Participatory Technology Development Working Paper 2

FARMER EXPERIMENTAL DESIGN WORKSHOP FOR THE LEINUTS PROJECT IN KENYA: A LOW-POTENTIAL AREA CASE

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At an internal workshop of ETC Ecoculture, some consultants in training and coaching Participatory Technology Development (PTD) exchanged their methods and experiences made with workshops to initiate a process of designing farmers' experiments. These workshops involved farmers interested in experimentation and PTD facilitators interested in supporting the farmers' experimentation.

This paper is written by Jean-Marie Diop[1] and Davis Onduru[2] and is based on their experiences with the LEINUTS project. The LEINUTS project studies the potentials of Low-External-Input and Sustainable Agriculture (LEISA) to attain productive and sustainable land use in Kenya and Uganda. Governmental and non-governmental organisations from Kenya, Uganda, Portugal and the Netherlands combine their expertise to assist and empower farmers in Sub-Saharan Africa (SSA) affected by soil degradation and soil nutrient depletion. The project covered a period of three years (1996-2000).

[1] ETC Netherlands
[2] Kenya Institute of Organic Farming

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1. BACKGROUND

The LEINUTS project studies the potentials of Low-External-Input and Sustainable Agriculture (LEISA) to attain productive and sustainable land use in Kenya and Uganda. Governmental and non-governmental organisations from Kenya, Uganda, Portugal and the Netherlands combine their expertise to assist and empower farmers in Sub-Saharan Africa (SSA) affected by soil degradation and soil nutrient depletion. The project covered a period of three years (1996-2000).

In SSA in general, the inherent soil fertility is being increasingly exploited to satisfy the growing need for agricultural products for farmers' own consumption as well as for the market. This exploitation process results in an increase in greater extraction than inputs of nutrients, leading to decreasing soil fertility. To reverse the present trend of soil depletion, land-use planning approaches are required that satisfy production and sustainability demands at the same time. Agricultural techniques have to be developed to address effectively the problem of soil nutrient depletion.

Most SSA farmers are well aware of the processes of nutrient mining, but they fail to invest in long-term soil fertility for reasons such as lacking land property rights, immediate cash needs, risk aversion and shortage of labour. Apart from the development of techniques, also the awareness of soil nutrient depletion as a major problem and a perception of the effectiveness of alternative management techniques needs to be raised at the level of farm households as well as that of policy makers.

The governmental and non-governmental organisations which are partners in the LEINUTS project (KIOF and KARI in Kenya and Environmental Alert and Makerere University in Uganda) aimed to realise the following objectives:

- To study the sustainability and economic performance of LEISA farming practices in low and high agricultural potential areas of Kenya and Uganda
- To determine potentials of LEISA in relation to Integrated Nutrient Management and to increase agricultural sustainability and productivity in Kenya and Uganda
- To formulate a strategy for adoption of LEISA techniques
- To disseminate and facilitate implementation of research results to relevant actors such as farmers, extension services, NGOs, research institutions and policy makers.

From these objectives, four main Working Packages were defined:

1. Measurement of nutrient balances and economic performance at farm household level under LEIA[3] and conventional agricultural management through monthly monitoring, measurements and application of frameworks for analysis.
2. Impact assessment of selected LEISA techniques through implementation of on-farm trials and farmers' assessment.
3. Formulation of development scenarios with participation of all relevant stakeholders.
4. Dissemination, training and implementation by organising workshops, seminars and training sessions for the stakeholders involved.

[3] Low-External-Input Agriculture

The Participatory Technology Development (PTD) activities (which started in Year 2) are included in the Working Package 2, which can be defined as follows:

- Collection of information on LEISA practices and effects of LEISA techniques in research areas by using interviews, discussion groups and secondary sources.
- More time for the development of farmers' criteria and indicators to assess LEISA practices, complementary to scientific indicators developed by more scientific monitoring and analysis of nutrient balances, nutrient flows and economic performance.
- PTD training of NGO staff and implementation of the PTD process with farming communities involved in the research project.

The research activities in each country are located in both high-potential areas (HPA) and low-potential areas (LPA). In each country and in each area, comparable LEIA farmers and conventional farmers were chosen according to the recommendation domain concept and their willingness to participate in the LEINUTS project. The recommendation domain concept involves defining representative smaller units or pockets of farms with limited internal variation, i.e., that are relatively uniform in terms of natural conditions (moisture availability, temperature regime, soil fertility, topography, soil conservation status) and socio-economic factors (Steiner 1987).

Before the implementation of the PTD process, a farmer experimental design workshop was conducted in each area (HPA and LPA). This paper deals with the process and results of the farmer experimental design workshop in LPA in Kenya.

2. OVERALL METHODOLOGY

2.1 Identification of priority problems

In each area, a participatory diagnosis (using PRA tools) had already been organised and had highlighted soil fertility management as the priority problem.

2.2 Looking for things to try out

2.2.1 Preparation of the farmer experimental design workshop

At the end of the PTD training, a session was organised to prepare field workers for a farmer experimental design workshop to be conducted in both LPA and HPA areas. The main objective of the workshop was to meet with farmers interested in trying out one or more technical options that would be jointly identified together with them, based on the priority problems identified by the community, and to discuss with these farmers how to design and implement the experiments.

The brainstorming with the field workers on how the farmer experimental design workshop could be organised and what could be the contents[4] yielded the following ideas:

- Sensitisation and negotiation
- Final choice of the technical topic to try out
- Selection of technical topic to try out (should be a group focus)
- Farmers' criteria (objectives) and indicators (to observed or measured) related to the technical topic chosen and what will be the criteria and indicators to evaluate the trials
- Defining trial objectives
- Determining the required environmental conditions
- Choice of the treatments, treatment levels and arrangement of the treatment (layout)
- Number of replications per treatment and per farm
- Choice of appropriate statistical design(s)
- Information to be gathered by who and when
- Planning and designing experiments:
- who will actually do the experiments?
  * what do farmers expect from the outsiders?
  * what do outsiders expect from the farmers?
  * do we need strict control or use farmer' practices as control?
  * how many time should the experiments be repeated and under which conditions?
  * how do we lay out the trials?
- Discussion of one or more case histories of experiments done by members of the groups, discussing how they did the experiment and why they did it in that way. This exercise was expected to make an inventory of farmers' experiences with conducting experiments and to highlight existing knowledge (innovations).
- What/when do we need to observe/measure/record?
- Systematically going through a series of "prompting questions" to stimulate farmers to discuss and decide upon the design, implementation and monitoring of the specific experiments they have in mind.

[4] Contents are not in order of priority.

- According to what criteria do we select the location?
- Providing additional insight into the technical topic farmers would like to experiment with and into the experimental design
- Selection of trial should be a group focus
- Inputs to be used and who will supply them
- Choice of the crops/animal of the trial should be a group focus
- Organisation and timing of the experiments
- Monitoring and evaluation:
  * what information do we need to collect?
  * how do we collect this?
  * who will do what, and when?

All these brainstorming ideas could not be solved in depth in a classroom exercise because of the direct influence of the technical topic which would be chosen jointly with farmers during the actual workshop. However, some questions could be discussed and agreed upon as follows:

- Final choice of the technical topic to try out: the technical topic should deal with soil fertility management and should be able to give results in one year, in view of the LEINUTS project timeframe of only three years.
- Selection of technical topic to try out: it should be a group focus - in each farmer group (LEIA and conventional) the technical topic chosen for experimentation should be common to all farmers within the same group.
- Selection of trial: it should be a group focus - in each farmer group (LEIA and conventional) the trial design should be the same for all farmers in the same group. If a test crop is chosen, it should be the same for all within the same group.
- How many time should the experiments be repeated: according to the defined time frame, the PTD experiments for LEINUTS will last only one year, i.e. a maximum of two growing seasons in 1998-1999.

2.2.2 Farmer experimental design workshop methodology

The workshops were attended by a total of 18 and 16 farmers in HPA and LPA, respectively. The main orientation was to draw upon the farmers' wealth of experience through facilitation in a number of discussion sessions. Approaches used include icebreakers, subgroup discussions, plenary presentations, visual tools and brainstorming.

The workshop proceeded in six sessions and workshop follow-up activities:

1. Sensitisation and inventory of expectations

An informal procedure of self-introduction was used as an icebreaker on the first day to set the `temperature' for the workshop. This was coupled with prayers (each day) in line with the local culture and beliefs. The expectations of the participants (LEIA and conventional farmers) were then listed and shared to help draw a common agenda for the workshop. To minimise dominance of previously trained farmers in the discussions and to enhance participation, the participants were divided into two subgroups; one comprising farmers who had been formally exposed to LEISA techniques (LEIA farmers) and one with farmers who had had no formal exposure (conventional farmers). A reporter was elected by the members of each subgroup to facilitate the discussions. The

outcome of these deliberations were presented in a plenary for further discussion and clarification.

2. Matching farmers' and outsiders' expectations

In order to marry farmers' and outsiders' expectations, the LEINUTS project team's expectations were presented for discussion in a plenary session. These were the following:

- To sensitise farmers (conventional farmers mainly) on principles and practices of LEISA techniques for soil fertility improvement that are of interest to them.
- To enhance farmers' knowledge and skills on systematic on-farm experimentation.
- To assess the impacts of jointly selected LEISA technologies (with a high potential to improve soil fertility) through on-farm research and to draw up an action plan for this.

In order to reach agreement on one technology for on-farm experimentation, the expectations of the farmers were married with the requirements of the project through the following process:

- Participatory identification of technologies which are of interest to both LEIA and conventional farmers for experimentation. The LEINUTS team facilitated the reaching of a consensus from this list of LEIA and conventional farmers' expectations.
- Based on the farmers' experiences, discussion facilitated by the LEINUTS team on jointly identify technologies with high potential to address soil fertility; these were proposed for on-farm experimentation.
- Selection of technologies with a good chance of showing an impact within one calendar year (two crop-growing seasons).
- Prioritisation (through pair-wise and matrix ranking tools) of technologies according to farmers' preference and their potential to show an impact within one calendar year.

Using this procedure, one technology was finally chosen for experimentation through group consensus.

3. Introduction and discussion of selected LEISA practices for on-farm experimentation

An introduction to LEISA principles and practices was made in order:

- to sensitise conventional farmers on LEISA principles and to put them on an equal footing with their colleagues (LEIA farmers)
- to refresh the memories of previously trained LEIA farmers
- to underscore the importance of improving soil fertility through various relevant LEISA practices
- to address participants' expectations which had no relation with soil fertility or which touched on technologies which cannot give results within one calendar year.

This session was followed by theory and practical sessions on selected LEISA technologies for experimentation.

4. Sensitisation and negotiation of on-farm experimentation

The importance and purpose of on-farm experimentation was underscored and explanations were given on how different stakeholders would benefit from the joint

experimentation. For instance, the discussions led to listing of the following areas where farmers would benefit:

- Improvement of soil fertility/current agricultural practices.
- Technical insight into the performance of the technology: economic performance, yields, etc.

The LEINUTS team would benefit by gaining an insight into the current agricultural practices and ways of adapting them.

After these discussions on benefits and beneficiaries, the farmers were stimulated to take an active part in implementing and managing trials to address the current site-specific soil fertility problems they were experiencing. These discussions led to an understanding of the role of the outsiders as that of facilitation and offering of relevant support. The negotiation on experimental design proceeded in seven steps:

Step 1: Inventory of farmers' experiences with conducting experiments related to soil fertility and outsiders' insights on possible things to try out.

Step 2: Formulation of hypothesis. The hypotheses for testing was formulated through group discussion facilitated by the outsiders.

These hypotheses are related to Step 1. A general framework used was:

- If we do this ... (this defines the treatment(s)).
- Then this will happen ... (this defines the expected results).
- Because ... (this gives the explanation of the phenomena).
- Under the condition that ... (this defines the conditions to be met).

Step 3: Choice of the test. One common test crop was chosen by both LEIA and conventional farmers. The procedure used to choose the test crop was as follows:

- Making a list of all test crops proposed by both LEIA and conventional farmers.
- Selecting test crops which can give results in one season and can be completely harvested.
- Selecting a single test crop, which is appropriate for all farmers, easy to manage, with seeds readily available and within the reach of all farmers.

Step 4: Farmers' criteria and indicators. The preference ranking or pair-wise ranking proved to be a good tool to rank different technical topics. Through the direct comparison of the technical topics using the semi-structured interview (SSI) technique, farmers' criteria are generated. The exercise consists of letting the farmer compare the technical topics, two by two, and it is up to him to define in which areas he will make the comparison. It is assumed that these areas of comparison are those which are most relevant for the farmer and can be considered as his own criteria. Criteria identified can be prioritised further at the level of each farmer and then at farmer-group level.

The indicators related to the criteria were likewise identified though SSI. These are what farmers think they will observe or measure, for instance, the effectiveness of a given technique. The following questions were relevant in the search for indicators:

- What indicates to the farmer that the technical topic is worth practising?
- What are the signs for the farmer that something has happened?, etc.

Step 5: Treatments. These are related to hypotheses, criteria and indicators. Farmers' experiences or/and outsiders' advice on possible treatments were listed. This helped to guide discussions so that the experimental designs could be made as simple as possible. The designs consisted of only one replication per treatment and per farm, and there was an identical layout in all farms of each group. Farmers' current practice was included in the design as control.

Plot sizes were discussed with farmers and agreed upon in each agro-ecological region. Quantities of inputs to be used in each treatment and local units for measuring them were agreed upon. Crop spacing was according to the farmer's own practice.

Step 6: Monitoring and data collection. Discussions on data collection centred on:

- Measuring all inputs (compost, manure, seeds, liquid manure, labour, etc.) and outputs (crop yield, crop residues, etc.)
- Monitoring crop development: stand count, plant height, crop vigour, weed infestation, disease/pest incidence, signs of nutrient deficiency, crop losses etc. for each treatment.
- Soil sampling.
- Farmers' observations: parameters to be observed during crop-growing seasons were discussed.
- Tools for monitoring and assessing of the experiments and for sharing of the results. Tools discussed included:
    * Farmer's record sheets/books
    * Monitoring forms for monthly monitoring of trials (project staff only)
    * End-of-season meetings/evaluation meetings.
    * Exchange visits.

Step 7: Joint planning/action plan for post-workshop activities. This was worked out by farmers and project staff and comprised the following items:

- A list of activities to be carried out.
- Persons responsible for each activity and choice of experimenting farmers.
- Time frame for each activity.

3. WORKSHOP RESULTS

3.1 Farmers' expectations

LPA farmers' expectations are shown in Table 1.

Table 1: Farmers' expectations in LPA area

Farmers' expectations	
LEIA farmers	**Conventional farmers**
- Easy ways of making double-dug beds. - Effectively organic methods to control pests, particularly weevils. - Recommendations for compost application rates. - Crop rotation techniques. - Soil conservation techniques that are easy to implement. - New methods of compost making. - Balancing of compost's plant nutrients. - Soil fertility management techniques. - Recommendations for land tillage practices. - Napier grass management. - Livestock management. - Advisability of using a combination of fertilisers and manure while planting. - Recommended organic techniques for planting crops. - How to stop chickens from eating their eggs.	- Fertiliser application rate when planting. - Whether it's a mistake to use fertilisers in combination with manure. - Whether one can use the same fertiliser for maize and beans. - How to use manure when planting food crops. - Why there is an increased incidence of Maize smut attack when we use manure in planting maize and why such attacks are more severe when manure is used as a top dressing. - Pesticides to use to control cutworms and maize stockborer. - How to improve status of phosphorus in the soil. - The difference and added advantages, if any, of organic farming over conventional farming practices. - How best to practise mixed cropping.

3.2 Identified issues for experimentation

Identified issues that were of interest to both groups of farmers were:

1. Manure and fertiliser application rates.
2. Can manure and inorganic fertilisers be used in combination?
3. Organic pest management techniques.
4. How to prepare and use organic fertilisers?

3.3 Identified issues of interest

The identified issues of interest with potential for improving soil fertility are:

1. Preparation and utilisation of organic fertilisers.
2. Use of a combination of organic and inorganic fertilisers.
3. Manure and fertiliser application rate.

3.4 Identified issues of soil fertility improvement potential

For the identification of issues of soil fertility improvement potential that can show impact within one cropping year, it was observed that all the three issues stated in 3.3 fulfil this criterion.

3.5 Technology jointly chosen for experimentation

By consensus, it was agreed that the experimentation would focus on the first issue: Preparation and utilisation of organic fertilisers (compost and liquid manure).

Later, Ton Rutten, a student from Wageningen Agricultural University who was trained in PRA by ETC, stayed in the Machakos area (LPA) of Kenya in order to do fieldwork for his thesis[5]. He confirmed the farmers' choice for experimentation as given above.

3.6 Choice of the test crop

List of possible test crops: maize, beans, snow peas, cassava, tomatoes, cabbages, kale, sorghum, finger millet, sweet potatoes. The group observed that, apart from cassava and kale, all the other crops could give results in one season and are harvested completely at the end of the season. However, maize is the only crop that is easy to manage and is grown by all the farmers (LEIA and conventional) in both the long and the short rainy seasons. Therefore, maize (an indigenous variety) was selected as the test crop.

3.7 Hypothesis for the experimentation

The hypothesis was defined as follows:

- If we apply compost and liquid manure when planting maize …
- Yields will increase ...
- Because liquid manure and compost improve soil-nutrient status and water-holding capacity, respectively ...
- Provided that there is enough rainfall.

3.8 Farmers' and scientific criteria/indicators

The farmers' criteria/indicators as identified in Machakos are shown in Tables 2 and 3. The methods used were preference ranking and a processing method derived from the non-parametric analysis method of Kruskul and Wallis (Siegel 1956).

[5] Rutten 1999.

Table 2: Preference ranking of criteria at each farmer level (total sum of the rankings given between brackets)

Farmers' Criteria	Conventional farmers										LEIA farmers								TOTAL
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	9	
Soil structure	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	2	**(21)**
Soil fertility	2	2	3	3	2	2	3	3	2	2	2	2	2	2	2	2	3	1	**(40)**
Labour quantity	3	4	2	2	3	5	1	1	3	3	3	3	3	4	5	3	2	7	**(57)**
Vigorous & strong crops	4	3	4	4	7	3	4	4	4	4	5	4	4	3	3	7	4	3	**(74)**
Yield/unit land	5	5	5	5	4	4	5	5	5	5	6	5	5	5	6	4	5	4	**(88)**
Money saving	6	6	6	6	5	6	7	6	7	6	8	6	6	6	7	5	6	5	**(110)**
Cash income	7	7	7	7	6	7	6	7	6	7	7	7	7	7	8	6	7	6	**(122)**
Pest control & crop protection	8	8	8	8	8	8	8	8	8	8	4	8	8	8	4	8	8	8	**(136)**

Irrespective of the farming systems, the first three choices of both groups of farmers were soil structure, soil fertility and labour quantity.

Table 3: Preference ranking of criteria between the groups of conventional and LEIA farmers

Criteria	Conventional farmers	LEIA farmers
Soil structure	12	9
Soil fertility	24	16
Labour quantity	27	30
Vigorous and strong crops	41	33
Yield/unit land	48	40
Money saving	61	49
Cash income	67	62
Pest control and crop protection	80	56

Even when the difference between farming systems is considered, soil structure, soil fertility and labour quantity still remain the first three choices for both farmer groups. It was notable that the LEIA farmers give less priority to labour than did the conventional farmers. This confirms a LEIA farmer' statement: "taking into account our poor situation, we are not afraid of the high labour demand of the LEISA techniques".

The major criteria for scientific analysis were: productivity, nutrient balance, nutrient use efficiency, and economic performance.

3.9 Treatments

Conventional farmers were interested in seeing the performance of a crop planted with compost alone, with a combination of manure + fertiliser, and with a combination of compost + liquid manure. The combination of manure + fertiliser (DAP) was chosen as farmers' practice (control).

LEIA farmers, on the other hand, were interested in investigating whether increasing the amount of compost they use in planting maize alone and /or top dressing with liquid manure would lead to increased yields. LEIA farmers' practice of usually applying 7 tons/acre of compost was chosen as control.

3.10 Plot size

For both groups, each trial plot measured 9 x 5 m. However, one woman (Mrs Veronicah Kalekie) had to scale down her plot size to 3 x 5 m, as she had already planted her farm and the portion she had left could accommodate only such plots.

3.11 Statistical and/or scientific rigour

For purposes of statistical and/or scientific rigor, the following was stressed by the project team:

- Maximum 3 treatments per farm (including farmers' practice). All treatments are to be found once in the farm of each experimenting farmer in each farmer group, so that each experimenting farmer's trial can be considered as one block representing one replication of a imaginative Randomised Complete Block (RCB) covering all farmer experimenters in the same farmer group.
- Identical layout in all farms in one group (LEIA and conventional).
- Clear differences between treatments.
- Every experiment contains a control, which consists of the current farming practice.
- Common test crop within each farmer group.
- One factor (possibly with different levels) to be considered.
- The plot size of the experiment is sufficiently large to enable proper recording of labour inputs for various operations; preferably the plot size will be equal to one primary production unit (PPU[6]).
- One replication per treatment and per farm experiment demarcated in the farm section unit (FSU[7])/PPU.

[6] PPU = cropping activities at the farm at a given period.
[7] FSU = part of the farm considered to be homogeneous for soil, slope, flooding and ownership characteristics.

4 WORKSHOP IMPACTS

In Zimbabwe (AGRITEX 1998), the extension workers' description of the difference between top-down and participatory extension approach was the following: "*in top-down extension, we use only one brain (the extensionists'), the farmers' brains remain dormant. In participatory extension, we use all brains together*".

In fact, our experience with the farmer experimental design workshop in Kenya has highlighted that all brains were used together in:

- considering farmers' and outsiders' expectations;
- identifying issues of common interest;
- eliciting farmers' priorities and preferences;
- identifying and prioritising farmers' and outsiders' criteria and indicators;
- choosing jointly technologies to experiment, and
- planning experiments together.

The farmer experimental design workshop had strengthened the capacity of farmers and the confidence of farmers in their own ability to find relevant solutions. The presentation of the options identified by the LEINUTS team, such as LEISA techniques, demonstrated to the farmers that outsiders can also play a role in providing alternative solutions. Through the farmer experimental design workshop, traditional ideas, knowledge and management capacities were accepted as possible strategies for reaching production improvements and natural resource management. This led to a change in attitudes. The LEINUTS team recognised that solutions can come from the farmers' side and they learned how their scientific designs could be adapted to the realities and the evaluation criteria of the farmers.

The LEINUTS team used to focus on their own knowledge, competence and interests when working with farmers. Hence, farmers' priorities were frequently overlooked. The Farmer Experimental Design Workshop helped in bringing farmers' priorities to light and thus re-orienting the approach and activities of the LEINUTS team.

5 BOTTLENECKS AND LIMITATIONS AND HOW THESE WERE/COULD BE MANAGED

5.1 Farmers' experiments

Farmers are continuously "experimenting". Farmers may carry out "experiments" on their own initiative and may conduct "experiments" for a number of reasons:

- out of curiosity, just to try out an idea that comes in mind;
- to solve a problem, to find solutions for currents pressing problems;
- to adopt technologies to local conditions and to the farmers' interests and preferences.

However, farmers' spontaneous "experimentation" faces a number of limitations to their ability and effectiveness in generating new technologies. Some of the limitations on farmers experiments are as follows:

- lack of analytical approach: there is danger of coming to false conclusions by attributing the success of the technique to the most obvious differences (e.g. success in double digging)
- poor design: lack of design of comparable units, etc.

To deal with these limitations, facilitation was oriented to strengthening farmers' experimentation through diverse aspects such as:

1. **Add-on option strategy**: improvement of farmer initiatives or availability of a wider choice/range of technologies with which to experiment.
2. **Improved-design strategy**: making farmers' experiments more systematic by taking into account:

- choice of control
- clear difference between treatments
- number of replications
- limitation of number of variables per treatment
- layout/trial format and size
- demarcating test plots
- number of experiments per farm, etc.

5.2 Generating new techniques versus "extending" local adaptation of known techniques

The participatory approach was not fully involved at the very beginning of the LEINUTS project; it was added later to the on-going project, after a recommendation to this effect was made at the first LEINUTS workshop. This did not give enough room (taking into account the three-year period of the LEINUTS project) to tackle what one can call "farmer innovation process", which consist of identifying farmers' innovations that can be taken as a starting point for the PTD process. This lack of consideration of farmers' innovations meant that the process of "looking for things to try out" focused mainly on (extending) local adaptation of already known or introduced techniques.

If local innovations are identified and analysed (as to what technical, ecological and socio-economic problems they are trying to address, or what opportunities they are trying to take advantage of), less attention need be paid to the first three steps of the classical PTD cycle. The local innovations can serve as a starting point for PTD experimentation.

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