Development of Agricultural Innovations in Organic Agriculture to adapt to Climate Change – Results from a Transdisciplinary R&D Project in North-eastern Germany

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Abstract

Based on concepts for innovation processes and co-production of knowledge, approaches are investigated that address the urgent and complex problems related to climate change, because especially the participation of, and close collaboration with, practice partners is needed. The paper presents the agricultural knowledge management approach in the organic agriculture module of the R&D project INKA BB (Innovation Network for Climate Change Adaptation Brandenburg Berlin) in north-eastern Germany (Knierim et al. 2009). The methodology for the science-practice collaboration follows an action research approach that supports the communication and cooperation of researchers and practitioners. The framework is the action research cycle with iterative stages of planning, action, and reflection. The organic agriculture module, which addresses individual research questions on several farms, is presented as a good practice example for close transdisciplinary network cooperation. The workshop contribution will provide reflections on the innovation development process over two project years.

1. Introduction

In addition to climate change mitigation, adaptation strategies are getting more and more important for handling the challenges of climate change. In general, adaptation measures constitute actions designed to adjust or cope with the consequences of climate change to decrease the vulnerability of people and ecosystems. In the field of agriculture, climate change adaptation activities are crucial to secure food production and livelihoods in the future (Wreford et al. 2010). Due to the big variety of farming systems, a broad portfolio of innovations for adaptation is required (Reyer et al. 2011). This is especially true for adaptation in organic agriculture because processes are more complex than in conventional agriculture, and management has to be organized over the long-term because of specific restrictions in organic farming systems such as the interdiction against applying mineral fertilizer as a short-term measure for nitrogen supply (Reyer et al. 2011). Close cooperation with practice partners is a precondition since regional and location-based knowledge is needed for the development of measures such as adapted cultivation methods.

In the R&D project Innovation Network for Climate Change Adaptation Brandenburg Berlin (INKA BB) in north-eastern Germany (Knierim et al. 2009), the process of innovation development is methodologically based on an action research approach. Hereby, practice partners participate in the design, testing, and evaluation of adaptation measures which are central to facilitating change and learning in a network of various stakeholders.

This paper first presents the theoretical and methodological background for the action research approach. It then provides reflections on the process of innovation development in the INKA BB's organic agriculture module with a focus on the methodological approach for process management.

This paper reflects two different actor views within the network: the perspective of social scientists who are responsible for providing the theoretical and methodological framework and concepts; and the views of natural scientists who present their experiences as a case study in this paper.

2. Theoretical and methodological frame

2.1 Principles of action research, co-production of knowledge, and innovation development

The methodological approach in the network is guided by principles of action research, transdisciplinary co-production of knowledge, and innovation processes. These concepts aim to support change and learning processes.

The theoretical-conceptual framework of INKA BB's action research approach corresponds to the challenges of working together with practice partners on real-life problems, developing innovative solutions for adapting to climate change, and incorporating them in new action strategies. One objective of the project is to integrate knowledge from different partners with different knowledge bases, such as scientific and practice knowledge, in the process of innovation generation and learning.

Tress et al. (2003:190) state that projects which are successful in reaching integration and production of new knowledge can make significant contributions toward solving complex problems. And since innovations are generated best by merging previously separate knowledge areas and technologies (Payer, 2002:6), multiple actors need to be involved. Thus, co-production of knowledge is a collaborative process of knowledge production that involves multiple disciplines and stakeholders from different sectors of society (Pohl, 2008).

Innovation development is a process of systemic change, rather than the introduction of single technologies or activities, and it involves numerous variables of social, technical, psychological, economic, cultural, and ecological concern. This process needs to be facilitated to initiate debate about desired changes and support cooperation to achieve them (Vasström, 2007).

In INKA BB, action research is conducted to systematically implement and assess the transdisciplinary cooperation and communication within innovation processes. Action research principles are based on a participatory research paradigm, so that practice partners are involved as emancipated co-researchers. The research has to be relevant in the life-world of practice partners, and the research process follows a cyclic and iterative approach to guide the joint learning and change process (Bortz & Döring, 2003).

INKA BB's action research approach seeks to stimulate research and generate knowledge through a joint learning process, and it is based on structural and methodical elements, which are conceptualized and guided by a social scientific module.

2.2 Structure and problem orientation of network modules

In order to create favorable conditions, the structure of the modules within the overall network is based on transdisciplinarity and requires representation of scientific partners as well as actors from the practice. In our context, we understand transdisciplinarity as the cooperation of scientists from various disciplines with non-scientists. The latter is comprised of stakeholders and especially practitioners in the proper sense, representing their own interests within the research and action process (Nagel et al. 2004). Thus, this research setting uses the strengths of the formal research system and the informal, sometimes tacit, knowledge of farmers and other practitioners. The transdisciplinary modules integrate diverse knowledge (societal and academic) to define the problem and develop innovative strategies.

In the case study of the organic agriculture module presented in this paper, the practitioners are farmers who are involved in on-farm research as well as representatives and advisors of organic farming associations.

2.3 Process design and methodological interventions

The INKA BB project course is designed in several phases (see Fig. 1). The design starts during the project application period: to make sure that research activities focus on relevant practice problems, stakeholders participate in the preparation phase by helping to define the problem and the objective within each of the innovation probing modules. After the preparation phase, the project runs through two iterative cycles of planning–implementation–evaluation, which are followed by a time period for the final consolidation of results. Each phase is characterized by specific objectives and methods: the planning step consists of problem definition, joint objective development, and agreement on appropriate measures, which are completed primarily through facilitated, transdisciplinary workshops. Implementation is carried out at the module level and primarily involves scientific and practice partners in several roles. The degree of practice partner participation differs and varies among the modules. Evaluation is again a joint activity of scientific and practice partners, and it serves as the basis for adjusting activities before the second implementation phase. It is important to repeatedly adjust objectives and activities, after each evaluation and reflection step.

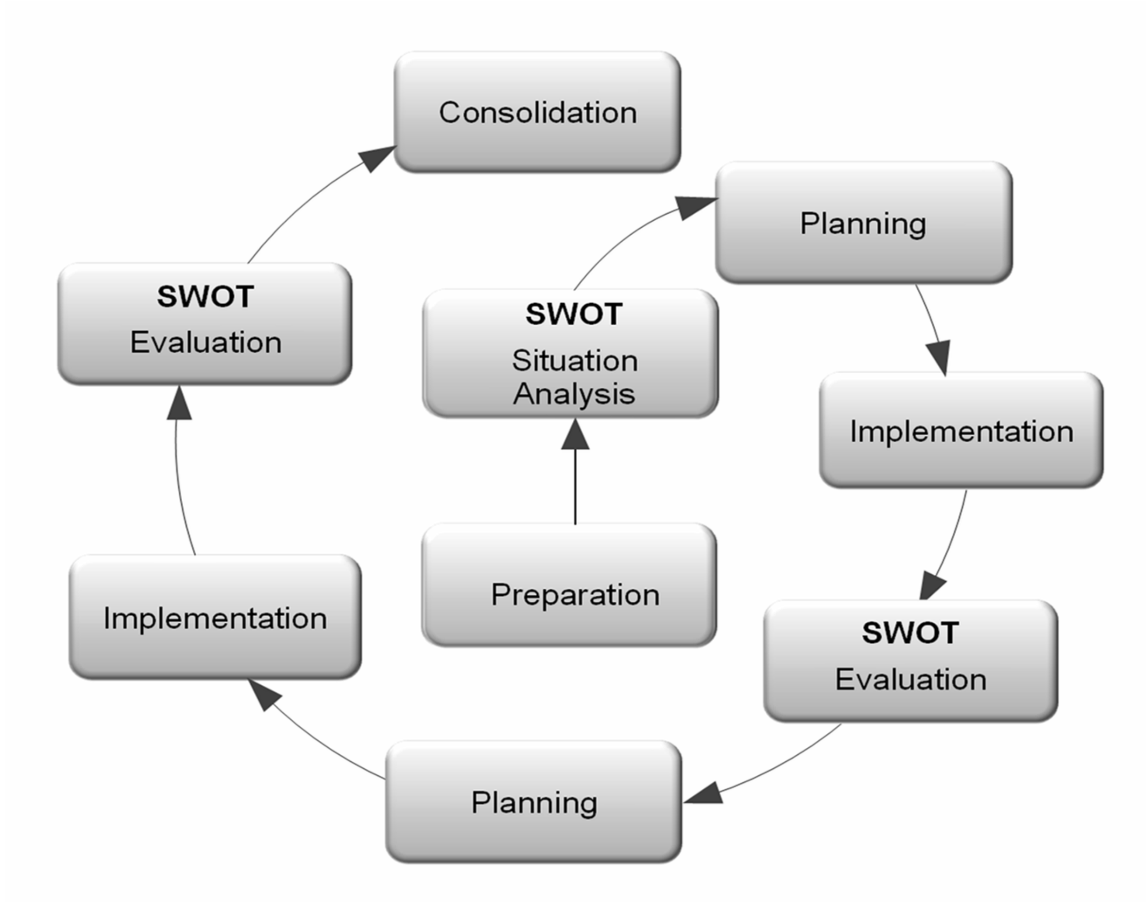

Figure 1: INKA BB's action research cycle with the analytical tool SWOT

The analytical steps of problem analysis and evaluation are methodologically backed up by the application of the SWOT (Strengths, Weaknesses, Opportunities, Threats) tool. The application of the SWOT-analysis is planned as a group process, e.g., during a workshop with practice partners, which gives the appropriate setting for cooperation and knowledge exchange, ideally supported by group moderation techniques.

To support the transdisciplinary modules in their methodological approach for cooperation with practice partners, scientists in INKA BB are trained in facilitation techniques for group processes and in workshop planning at the beginning of the project as well as before the first evaluation phase. The SWOT analytical tool was introduced for methodological support in the network, and experiences with its application are regularly analyzed.

3. Results from the module "Climate Adaptation in Organic Agriculture"

3.1 Preparation phase

Since 2004, the University of Sustainable Development Eberswalde (HNEE) has maintained numerous partnerships with organic farms in the Federal State of Brandenburg, Germany, through the network "Organic Farms as Education Partners". The partner farms contribute practice knowledge to the instruction and training of students in the Organic Farming and Marketing program (organizing internships, field trips, and teaching modules; providing topics for student projects and final theses). Through this cooperation, it became clear that adapting to climate change is currently a critical issue for the farms, but so far, there had been no research projects that specifically addressed their situation. In response, several partners took the initiative to plan such a research project (Climate Adaptation in Organic Agriculture), submit a proposal to the German Federal Ministry of Education and Research's (BMBF) funding program KLIMZUG (http://www.klimzug.de/en/160.php, 15.03.2012), and finally, carry it out as part of the joint project: Innovation Network Climate Change Adaptation Brandenburg Berlin. From the start, the topics and contents of the project were collaboratively developed by scientists and farmers in regular stakeholder meetings at the HNEE. In the meetings, participants decided on the project's conceptual framework, but did not define specific experiments in advance, i.e., research questions, experimental designs, and areas of focus were still open.

3.2 Situation analysis

As the first step, a SWOT analysis (see Fig. 2, Step 1) was conducted at a stakeholder meeting. Using this method, stakeholders first assessed the initial project situation and laid a foundation for a transparent, collaborative definition of objectives. Participants included organic farmers from the preparatory phase; additional regional organic farmers participating for the first time; representatives and advisors from the organic farming associations Bioland, Demeter, and Naturland; and scientists from the Leibniz-Centre for Agricultural Landscape Research (ZALF) and the HNEE. Using the problems and objectives defined by the original project proposal as a starting point, the stakeholders discussed in small groups the strengths and weaknesses of Brandenburg's organic farms in the face of climate change, and the opportunities and threats for organic agriculture presented by climate change and other external factors. In the SWOT analysis, the weaknesses identified by the stakeholders were largely in agreement with the problem statement and the goals defined previously in the project proposal (see Bloch and Bachinger 2010; REYER et al. 2011). The stakeholders also identified additional weaknesses, which had not been taken into account in the original problem definition and took those up for discussion after the analysis. Based on the results of the SWOT analysis, the participants then held a discussion about project goals, in which the strategic orientation of the project as well as the objectives and experimental approaches defined in the preparation phase were revised and updated.

3.3 Planning and implementation phase

During the planning phase, five individual meetings were held with organic farmers (Fig. 2, Step 2). Using a SWOT analysis framework, the specific, initial situation of each farm was analyzed (assessment of the current condition, identification of possible climate-related problems for cultivation methods), and the potential for carrying out on-farm experiments was assessed (identification of the experimental question, assessment of technical and personnel requirements). Based on these farm-specific analyses, hypotheses about climate-adapted cultivation methods were formulated, and on-farm experiments, specific to the individual farms, were developed accordingly.

The experiments were then implemented at four of the five farms (Fig. 2, Step 3); one farm lacked the technical and organizational resources needed for an experiment. The on-farm experiments were accompanied by comparable small-plot experiments carried out in parallel at the ZALF experimental station in Müncheberg (nested experimental design). The following combination of measures played a significant role in all the experiments: reduced tillage, adapted crops, catch crops, and adjusted sowing dates. In addition, following discussion with participating farmers, an innovative tillage device was procured and tested in experiments (HEKO ring cutter). The device allows overall shallow tillage in organic agriculture, severing roots while preserving soil structure.

Furthermore, one of the experiments tested a spring-loaded rotary hoe in comparison to the ring cutter. This was the first on-farm test of the hoe, used for weed control over large areas and within rows. Thus, INKA BB was able to carry out these first tests of both agricultural devices in the region.

3.4 Evaluation phase

In the first evaluation phase (2011), the results achieved so far through on-farm and small-plot experiments were presented to the public at the INKA BB Field Day in June 2011 (an on-site informational event). They were also evaluated and discussed intensively by a smaller group of stakeholders at the second stakeholder meeting. In contrast to the first stakeholder meeting (sector-specific SWOT analysis), this time discussion focused more on the strengths and weaknesses of specific farm systems and cultivation methods (Fig. 2, Step 4). Also, with the smaller size of the group at this meeting, a less formal approach was taken, allowing for open discussion. After discussing the results, the farmers participated in adjusting individual experiments and in some cases, expanding them for the second implementation phase (Fig. 2, Step 5). All of the farmers will continue to carry out on-farm experiments, and in addition, two new on-farm experiments are currently being developed for farms that have recently joined the network (spin-off effect). The ring cutter experiments indicated that further experiments are warranted, including tests combining the device with other methods. Thus, in the second implementation phase (2012-2013), farmers will test whether an innovative combination cultivator/seed-drill from HEKO can be used to further optimize the reduced-tillage cultivation methods developed thus far.

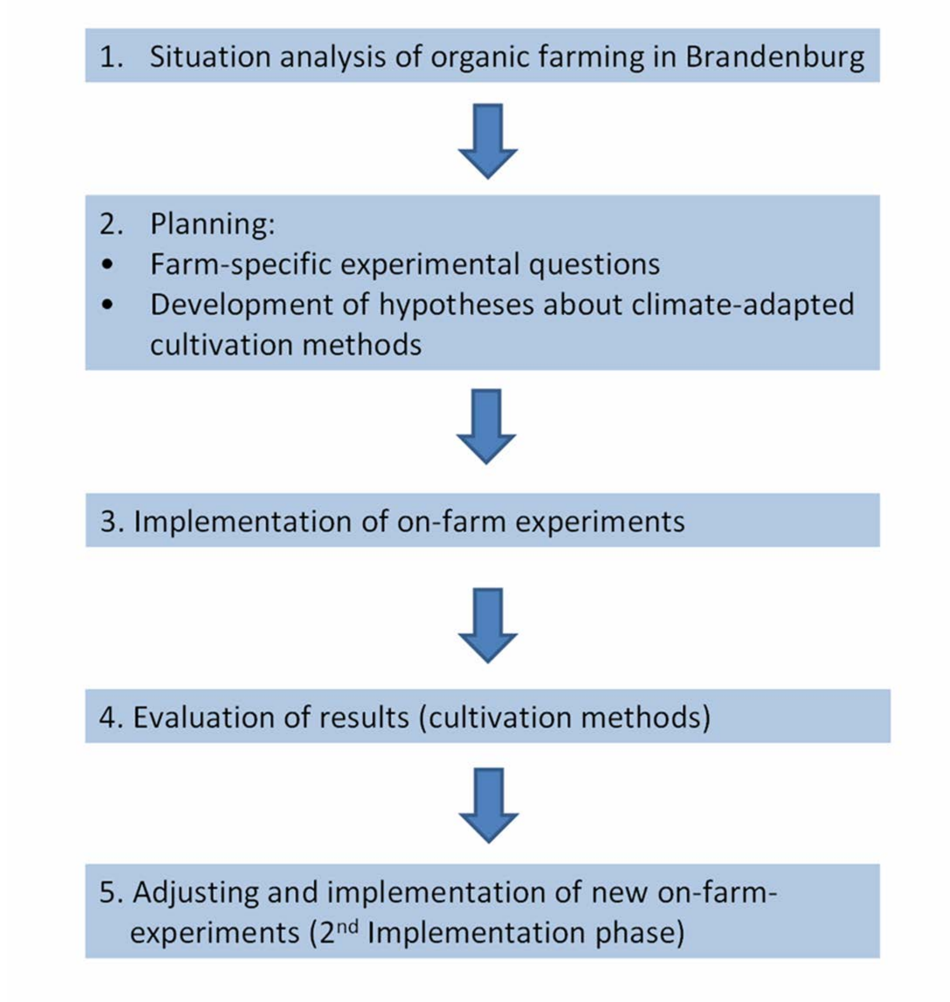

Figure 2: Action research process in the module "Climate Adaptation in Organic Agriculture"

4. Discussion

In line with the network's general methodological frame, the organic agriculture module follows the action research approach proposed in the network for development of their innovative cultivation methods. The scientists in the module made use of the research design's openness and used the evaluation and planning phases to focus and adjust their research to questions and needs arising from practice partners. The partners in the module were interacting on a regular basis, and concretization of the research orientation was always realized in group meetings. The application of SWOT analysis was recognized as a supportive instrument.

Among the factors that fostered the work's positive evolution was, without a doubt, the correspondence of the preconceived transdisciplinary structure to already-existing network structures. Because of this factor, communication routines and trust relationships were already established, and it was not difficult to include topics relevant to practice partners in research questions. However, it is remarkable that the primary network's preexisting structures did not close the network so that in the course of the project new partners were admitted and integrated.

Methodologically, the instrument SWOT analysis was applied in a flexible manner in the module. During the first meeting with the actors, it was used in working groups handling the topic of organic agriculture more generally in order to refine the problem definition and formulation of objectives. Secondly, SWOT was more informally used as a frame for the situation analysis in bilateral discussions on individual research questions on each farm, and in discussions about the experiments' potential and challenges. Thirdly, after the experiments' implementation, it was again used in a more informal way to structure the evaluation discussion for adjusting and reorienting the experiments. Thus, the methodological application as well as the partners' involvement was adjusted in relation to the respective requirements of each methodological step.

From a social scientist's perspective, the module can be judged to be a good practice example for a transdisciplinary network as it fulfills important criteria and preconditions for successful science-practice-cooperation, such as the active participation of stakeholders, an open attitude for interpersonal dealings, competencies for communication, and process facilitation in a challenging methodological approach. In the module, the personal capability and social skills of the participating partners facilitated the communication process, and the application of methodical tools further supported the analytical and decision-making steps.

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