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Bridging and Enriching Top-down and Participatory Learning
The Case of Smallholder, Organic Conservation Agriculture Farmers in Zimbabwe

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Abstract

This article discusses the combined use of top-down and participatory-learning approaches during the course of a 42-month organic conservation agriculture project that is being implemented in eight districts of Mashonaland East Province in Zimbabwe. The initial 18-month project was extended by a further 24 months in order to build on what had been achieved by deepening organic conservation agriculture practices, by increasing the understanding of, and access to, markets, and by expanding farmer agency. The top-down approach involves farmer representatives, known as 'access farmers' in the project, undergoing training at training centres and then returning to their respective farmer associations to train other farmers in what they have learnt. Participatory learning includes farmer-to-farmer learning within and among associations, and trainers learning from, and acting on, farmer experiences. Expansive learning, which combines, and goes beyond, both approaches and allows for joint learning, innovation and agency, has been used to support the associations to learn about, practise and benefit from organic conservation agriculture. This was stimulated by change laboratory workshops being conducted with each of the 32 farmer associations formed during the first 18 months of the project. The main argument in the present article is that combining these seemingly opposite approaches to learning is feasible and is essential for accelerating practice-oriented changes in agriculture. The concept that appears to enable this linkage is dialectics.

Introduction

Two main schools of thought have shaped how knowledge, values, skills and practices in agriculture are learnt and applied in Zimbabwe and southern Africa. One school of thought is generally called the 'top-down school' and is characterised by the Research-Design-Disseminate-Assimilate approach. In this approach, researchers are the more knowledgeable 'others' who generate knowledge, which is then passed on to farmers through extension workers. The farmers are supposed to assimilate the knowledge and use it to change their practices. The other, and more recent, approach, called 'participatory learning', emphasises joint learning among peers. In participatory learning, people learn about their needs and opportunities, preconceptions and biases about people's knowledge are challenged, knowledge is shared, and learning is interactive (Mukute, 2010).

This article discusses how these learning approaches have been bridged and enriched during a project, Livelihood Security in a Changing Environment: Organic Conservation Agriculture, that is being implemented in Mashonaland East Province in Zimbabwe (between

2010 and 2015). The bridging and enrichment of the two seemingly contradictory approaches to learning have been made possible by the conceptualisation of learning in a theory called 'cultural historical activity theory' (CHAT) after the work of Yjro Engeström (1999; 2007). The project goal is to facilitate smallholder farmer learning and the practice of organic horticultural production under irrigation, as well as organic conservation agriculture in rain-fed, dry-land farming, so that farmers are able to produce for household consumption and income generation. The initial 18-month phase of this research project involved establishing and supporting 32 organic-farmer associations in partnership with several non-governmental organisations (NGOs), the Zimbabwe government's Agricultural Training and Extension (AGRITEX) Department, and the present researcher, who has experience in working with CHAT. After 18 months, and as part of the initial scaling-out process, eight more associations were established with direct support from the more established and successful 'pioneer' associations.

The objectives of this article are to show:

- How CHAT has provided the necessary theoretical framework for combining the two seemingly contradictory approaches to learning; and
- How linking and enhancing top-down and participatory-learning approaches have accelerated the learning of, and changes introduced in, agricultural production and marketing practices by the farmer associations participating in the project.

Learning Approach for the Project

'Learning' refers to all processes leading to permanent capacity change, which could be physical, cognitive, emotional or social and are also not based exclusively on biological maturation (Illeris, 2003). There are two layers of interaction in learning: between the learner and the environment; and within the learner. The latter covers the inner mental processes of acquisition and elaboration through which impulses of interaction are linked to earlier learning. Learning results in within-the-person changes that modify the way in which the person interprets and modifies the world, that is, how the mind looks at the world, interprets it and acts on this (Edwards, 2005). Learning is therefore concerned with both internalisation and externalisation.

The project's approach to learning has three main aspects, namely:

1. Training of farmers by 'experts' in the different subjects for organic conservation agriculture and marketing (For purposes of the project, the farmers who are trained by experts are called 'access farmers'. One of the major roles of these access farmers is to acquire knowledge and skills from the more knowledgeable trainers in organic conservation agriculture and marketing, as well as to internalise and share these with fellow farmers in their respective associations using what may be described as a top-down approach. The need for farmers to learn and practise organic conservation agriculture created the knowledge gradient that made it essential to adopt this form of knowledge movement. Fambidzanai Permaculture Centre (FPC), which negotiated access to the districts and facilitated access-farmer selection, conducts centre-based and on-site

training in technical aspects of organic production and conservation agriculture. The Zimbabwe Organic Producers and Promoters Association (ZOPPA) trains farmers in organic standards and certification, and facilitates market links and the dissemination of information. Practical Action Southern Africa conducts farmer training in participatory markets systems development, while AGRITEX provides ongoing technical support services for farmers in their respective villages and wards. Through GardenAfrica, farmers included in the project have their organic pesticides tested for efficacy by Kew in the United Kingdom, and their soils tested by local research stations in order to determine what they lack.);

2. Participatory learning in which the farmers learn from one another's knowledge and experiences in what may be called 'farmer-to-farmer learning' or 'horizontal learning' (On their own, individual farmer associations periodically meet to identify and solve problems and to learn from one another's experiences. One of the main roles of access farmers and other farmer representatives from the associations is to take issues from the associations to the project partners for possible solution in what has been called 'bottom-up (or participatory) learning' in the development field (Chambers, 1997).); and
3. Participatory action research in which farmers take a leading role in the generation of knowledge, solutions and innovations to overcome obstacles to organic conservation agriculture and its associated benefits (The farmers draw on their knowledge and experiences, as well as on those of specialists and stakeholders, in order to change their agricultural practices and gain access to agricultural markets in the country. They also deal with challenges directly through their associations and wider district and provincial representation structures so as to improve the context in which their learning and agency takes place. A researcher (the present researcher) with experience in CHAT facilitates farmer association workshops so as to stimulate innovation and agency development among the farmers).

Theoretical Framework for Analysing the Project's Learning Approach

The study used CHAT-informed conceptualisations of learning and their hierarchical levels of interrelated human activity to illuminate and explain how the seemingly opposite approaches to learning – top-down and participatory – were combined and enhanced in the organic conservation agriculture project under review. The relevance of drawing on CHAT was inspired by the understanding that it offers a bridging theory for participatory and top-down learning and research methods (Mukute, 2010).

Conceptualisations of learning in CHAT

Scaffolding

Scaffolding supports the top-down learning approach in the project. In scaffolded learning, a more knowledgeable 'other' assists the learner to move to a new level of understanding and mastery (Tarulli & Cheyne, 2005). This learning is concerned with how knowledge is

acquired, internalised or appropriated by the learner. The main learners in this case are members of the organic-farmer associations in Mashonaland East Province in Zimbabwe. The 'more knowledgeable others' are trainers from the participating organisations. At another level, learners are the 16 government-employed agricultural extension workers (AEWs) who received organic conservation agriculture training, as their own college training had focused on high, external-input agriculture, which does not emphasise ecological sustainability. Farmer-to-farmer learning, if viewed as learning by means of which the more knowledgeable farmer teaches the less knowledgeable farmer about a specific topic or theme, can also qualify as scaffolded learning. However, in everyday language, it is called 'horizontal (participatory) learning'. The training methods that are used to support scaffolded learning include: lecturers, handouts, look and learn or exchange visits, and demonstrations.

Cultural interpretation of learning

Cultural interpretation of learning is concerned with linking everyday experiences and scientific concepts using instruction so that the learner can move from 'situated everyday understanding' to mature scientific concepts whose application is not limited to a specific situation. An important part of this form of learning is its linking of cognition (the mind), context and practice, thereby making the learning more relational and sociocultural (Simovska, 2008). Learning at this level is also concerned with acquisition, internalisation and appropriation of new concepts by the learner. In this project, this form of learning was largely supported by outreach and extension activities that were performed by trainers, as well as by linkages that farmers made with other potential sources of knowledge. Through learning methods such as observation, farmers identified variances between what they had been taught and had implemented, and the expected results, in areas such as compost-making, yields, and pricing of their produce. The trainers assisted the farmers to explain variations. Scientists, on the other hand, conducted soil testing and analysis. The testing of the efficacy of organic pesticides provided farmers with explanations regarding the successfulness or otherwise of their practices. The learning and training methods used in this approach included observation, testing, trials, bottom-up and top-down information flow, on-site teaching, and demonstration.

Collectivist/societal interpretation of learning

The collectivist interpretation of learning involves joint learning, joint action (agency) and the externalisation of the knowledge that the learner has acquired. Participation is manifested through which multiple voices as different points of view, interests and traditions of learners (Engeström, 1999), who also become agents, interact. Knowledge and experiences from different sources are valued and tapped into, including traditional, local, indigenous and scientific sources. The purpose of learning goes beyond mastery, which tends to be the focus of scaffolded and cultural learning, to include generation of new knowledge, new solutions, and innovations, thus shifting the focus from internalisation to externalisation. The collectivist interpretation of learning also allows for the utilisation of plural ways of knowing and learning, and provides for individual and joint research among farmers, and between farmers and their stakeholders. For the project, this meant drawing on the knowledge and experiences of:

- Farmers regarding their social and ecological context;
- Farmers as acquired through training provided by the project;
- Farmers resulting from practising organic conservation agriculture, conducting market surveys and interacting with agricultural suppliers and buyers of produce;
- Key stakeholders and specialists, who provided advice and solutions based on the farmers' needs; and
- Stakeholders, who participated in, and beyond, change laboratory workshops in which obstacles to association interests and objectives were identified and tackled.

Two key principles that were used to stimulate expansive learning were double stimulation and ascending from the abstract to the concrete. The learning methods used included focus-group discussions and plenary sessions in change laboratory workshops, empirical and historical analysis of emerging challenges, modelling of solutions to challenges being encountered by farmers in practising organic conservation agriculture and marketing agricultural produce, implementing, assessing and improving the solutions/innovations, and scaling them up through farmer-to-farmer extension.

Change laboratory workshops constitute an expansive-learning methodology developed by Engeström (2007) and his colleagues, and are designed to bring practitioners and researchers together to surface challenges and contradictions and to use distributed cognition to generate and implement solutions that transform practices. Such methodology is based on the two principles of ascending from the abstract to the concrete, and double stimulation (Virkkunen, 2013). Through abstraction, people make meaning from their experiences and use this as the basis of knowledge creation and of innovation. Double stimulation seeks to make subjects – in this case, farmers – the masters of their own lives. In double stimulation, the subjects are put in a structured environment in which the researcher provides active guidance towards the construction of a solution to a challenge and the development of agency (Virkkunen & Newnham, 2013). The first stimulus is the challenge that is being faced by the subject, and the second is a conceptual tool that the subjects (sometimes with the assistance of researchers and other interested actors) use to mediate their understanding of the challenge and to develop a solution (Engeström, 2007).

Hierarchical structure of human activity

Another useful conceptualisation associated with learning in CHAT is the hierarchical structure of human practice or activity. The hierarchical structure of human activity's dialectical linkages between goals and operations seemed to offer possibilities of extending the explanation as to why combining the mastery of techniques and tools used in organic conservation agriculture and the actions towards the attainment of the goals of organic farmers and their associations is proving successful. Virkkunen and Newnham (2013:37) describe the dialectical relationships between these layers of human activity as follows:

> The relationships between activity, action and operation are internal and dialectical. The joint activity is realised through individuals' actions but individuals' actions also form the

joint activity. In the same way the objective of the action determines what operations are needed, but on the other hand, the available operations affect what kind of objectives can be set and reached.

Object of an activity

Leont'ev (1978), one of the founding theorists of CHAT, described systemic levels of human activity that are hierarchical. At the highest level is the object of an activity or practice that carries the societal motive. The object of an activity is infinite and can never be fully achieved. For example, the object of sustainable agriculture as a human activity or practice is social justice, economic viability and ecological sustainability.

Goal of actions

At the middle level lies the goal of actions in the activity or practice as constructed by a specific individual or by groups of individuals. The intentional aspect of the goal covers 'what must be done', and actions towards a goal are finite and the goal can be achieved. The individual or groups of individuals could be farmers, marketers, researchers, conservationists, land planners, policymakers, and so on. The origin of an action is found in the individual or group's relations with others. For example, in order to make a profit, the farmer or his or her association should pursue this goal in relation to suppliers of inputs and to consumers of the produce. For instance, an agricultural activity or practice comprises agricultural actions such as saving seed, improving breeds, producing agrochemicals, tilling the land, planting seed, weeding, value addition, packaging, and so forth. In our case, the goal of the action is being viewed from the perspective of farmers who, and organic-farmer associations which, are intended to contribute to the societal motive and associated outcomes. The goals of farmers and farmer associations are to improve the agricultural resource base for the increased and sustainable production of healthy, safe and nutritious food for consumption and for sale at a profit. Such actions are oriented towards the conscious attainment of a goal in a particular place and at a particular time. In the present case, the place and time are defined by the project under review in Mashonaland East Province in Zimbabwe.

Operations (the how) under certain conditions

At the bottom of the hierarchy are operations that are concerned with how actions are to be performed under certain conditions. Operations are actions that become automated routines through repetition and rehearsal and that sometimes become embedded as, or in, tools and techniques. They enable the achievement of a goal but do not determine it. Compost-making, water-harvesting, making natural pesticides, double-digging, and transect walks to observe the ecological landscape are some of the examples in organic conservation agriculture that qualify as operations. These are essential for organic production and marketing, but mastering one or the other does not necessarily lead to the attainment of the farmers' goals. At the same time, the actions needed for organic certification under conditions where land has been subjected to agrochemicals before (or is surrounded by such land) are different from those necessary where the land and its surroundings are virgin or have been fallow for several years.

Research Process

Data generation

Data was generated by means of multiple methods and sources in order to enhance its robustness. The data-generation methods are summarised below:

Document analysis

The researcher analysed over 15 documents, which included: the Project Proposal; biannual and annual reports by implementing partners; implementing partners' quarterly reflection reports; workshop training reports; an end-of-project report; an article on action research involving farmers; a summary of proceedings at an end-of-project workshop that was attended by implementing partners, farmer association representatives, AGRITEX and other governmental officials, a United Nations Food and Agriculture Organization (FAO) official, and other organic producers; and a formative evaluation report on the project compiled in September 2012.

Implementing partner reflection and review meetings

The researcher attended some of the quarterly reflection and review meetings that were held by implementing partners. Each implementing partner, including the researcher, presented progress reports on any matters that needed the attention of others. As a result of the meetings, some replanning was done and some strategies were revised and improved as necessary. The meetings revealed the changing pace at which different levels of learning and agency development were taking place in the project.

Change laboratory workshops

The researcher facilitated change laboratory workshops with virtually all 32 farmer associations that were established at the beginning of the project. The change laboratory workshops were attended by members of the associations as well as by local AEWs. The first round of workshops was attended by 441 farmers and 26 AEWs, while the second round of workshops was attended by 249 farmers and 19 AEWs. Although there were some similarities between the challenges faced by each association, there were often different explanations for the challenges. The main challenges involved learning, production and marketing.

Data analysis

Drawing on Danermark, Ekstrom, Jakobsen and Karlsson (2002), the researcher used inductive, abductive and retroductive analysis to make sense of data. Inductive analysis allows one to make sense of the data generated by clustering it into categories. The main categories that the researcher used related to the project's learning approaches of top-down and horizontal (participatory) learning, as well as participatory action research (knowledge and innovation generation). Abductive analysis takes place when a researcher uses theoretical lenses to make sense of data by recontextualising the data using theory and/or contextual lenses to seek the best possible explanation. In this study, CHAT conceptualisations of learning and the hierarchy of human activity (see above) were used to make sense of data using an abductive approach,

alongside inductive analysis that allows for pattern-seeking in the data. Retroductive analysis, which entails determining the explanations of what must be the case for things to be the way they are, was used to draw conclusions about combining the learning approaches under review.

Contributions of the Different Approaches to Learning during the Project

This section of the article focuses on addressing the second objective of the article by showing how the project profited from framing the learning interventions in a manner that linked and enriched top-down and participatory-learning approaches.

Top-down learning

The access farmer, having been accepted on the project, then selected peers to form an association. The primary role of access farmers, or others identified within each association, was to receive training from the project 'experts', usually at a training centre away from their areas, and then convey that knowledge to fellow farmers in their respective associations. Such local training has largely been conducted in the horticultural gardens or the dry-land agricultural fields, and, occasionally, at local public facilities such as schools and community halls. As mentioned above, selected AEWs (16) from the eight participating districts also received training in the sustainability aspects of agricultural production. The eight farmer associations that were established after August 2012 have received organic conservation agriculture and associated marketing training from the more established associations and from AEWs in their respective wards, and by attending 'refresher' courses, and are now fully incorporated in the ongoing training and on-farm support.

Top-down farmer training by the more knowledgeable other

Much of the training of access farmers (and others who served in their place) has been conducted at the FPC training centre, which practises organic conservation agriculture on its premises and has the necessary board and lodging facilities. The initial training, which was conducted for a week per topic every month, covered the following practical and theoretical coursework: Training for Transformation and Introduction to Permaculture; Ecology; Water Management; Soil Management; Natural Pest and Disease Management; Agri-planner; Small Livestock Management; Nursery Management; Participatory Market Development; Beekeeping and Organic Honey Production; Integrated Pest Management; and Processing and Value Addition. Sixteen AEWS, who worked with the 32 organic-farmer associations, attended a one-week workshop at the same centre, which workshop was intended to help them learn about organic and conservation farming concepts and practices, as their own tertiary training was based on conventional, high external-input agriculture. Table 1 provides an example of how a one-week, centre-based training workshop was planned (and implemented), with access farmers as the trainees (FPC, 2011).

Table 1. One-week workshop plan on soil-improvement training by FPC

Workshop topic	Soil management
Aims and objectives	Aim: To work with natural systems and enhance biological cycles within the farming system involving micro-organisms, soil flora and fauna, plants and animals. Objectives: • To introduce the main components of soils and show how variations in these components influence soil properties and management; • To describe soil management operations and their implications for plant growth; • To encourage soil maintenance and increase its long-term fertility; • To provide farmers with the skills and associated knowledge necessary to plan an organic soil management regime and operate their production effectively; • To interpret and determine the role of manures and composts; and • To encourage soil protection from erosion, sun and wind and keep a good topsoil that is rich in moisture and soil biota which are essential for creating healthy, living soil.
Training methods	• Lecture; group work and presentations; group tutorials; demonstrations; practical assignments; question-and-answer sessions; and role play.
Practical (workplace) assignments	• Access farmers implement at least three soil-fertility amendments strategies in their horticultural gardens; • Access farmers support the construction of a thermal compost by each association member measuring 2.25m by 2.25m by 1.6m; and • Access farmers and association members plant mulching crops to encourage organic, nutrient-rich gardens.

ZOPPA conducts workshops on organic standards, certification, compliance monitoring and marketing for farmer associations in their respective wards. Each standards workshop lasts for three days. The training workshops are aimed at enabling farmers to acquire knowledge and skills concerning organic-production standards, compliance with international organic standards, and the setting up of local compliance systems, such as the Participatory Guarantees System (Nyakanda, 2013). ZOPPA also conducts inspections of farmers' gardens and assesses them for compliance. Associations that comply receive a Zimbabwe Organic Label from ZOPPA. By the end of 2011, four associations had qualified, thus allowing them to tap into the organic niche market in Zimbabwe, which is currently underdeveloped. ZOPPA Organic Label certification also opens up possibilities for marketing to eight neighbouring countries in which the label is recognised (Nyakanda, 2013). The other 28 associations meet all the certification requirements but are using land where agrochemicals have been used in the recent past. They are still going through the conversion period (three years). In order to recognise their efforts and motivate them, ZOPPA has introduced another category of certification called 'Zimbabwe Natural'. At the same time, the associations have begun seeking and using 'virgin' land after learning from others. Consequently, the next ZOPPA inspection, which will be conducted before the end of 2013, is likely to result in more associations being registered under the

Organic Label. One of the main challenges faced by ZOPPA in the project is how to increase the number of organic associations that can then become members when they comply and are certified (without additional funding). It is tackling this challenge by implementing a train-the-trainer course on organic standards.

The access farmers from the different associations approach the site-based training differently: some condense the one-week training into a whole day of training while others spread the training over several mornings. The decision on the timing and spread of on-site farmer-to-farmer training is made by each association. Some handouts, initially written in English, have been produced and distributed to those who attended centre-based training for use during subsequent field-based training by farmers. A common practice found within the project is that the farmer-to-farmer training is conducted within a week of receiving centre-based training, while the ideas are still fresh in the mind.

Some of the improvements that have been made to enhance local scaffolded learning are the following:

- Each training workshop summarising 'take home points' for access farmers to use in the on-site training;
- The production of handouts in the vernacular language, together with the necessary supportive visuals;
- Teaching more complex topics directly to the farmer associations and not through access farmers or association representatives (who attend centre-based training); and
- ZOPPA training two farmers in each district to become trainers in organic standards so that these trainers can help expand the membership by training interested groups of farmers in their respective districts, with little or no funds needed. (ZOPPA retains responsibility for compliance monitoring and formal certification.)

The trainers also conduct support visits in order to provide backup for association members, and give the necessary on-site technical support to members of each association. One of the most important benefits of these visits is that trainers are able to give more context-specific advice, thus augmenting generic, centre-based training.

Contributions of the top-down learning approach

An analysis of project outcomes suggests that the top-down learning approach is making an important contribution to farmers' knowledge and to their abilities to produce organically and to market their products effectively. The access farmers constitute an important link between centre-based training and site-based training. They have helped in the creation of a multiplier effect, as each access farmer or someone from his or her group trains as many as 30 other farmers. This has resulted in the training of about 800 farmers in organic conservation agriculture. There is considerable evidence to suggest that training farmers through other farmers is creating impact, with potential to increase local resilience. Project reports (McAllister, 2011; 2012; FPC, 2011) reveal that top-down training in organic conservation agriculture and associated marketing has increased farmers' technical knowledge and skills, especially with regard to:

- Improving soil fertility using locally available resources that do not harm the natural environment;
- Improving water availability under agro-ecological conditions in which water is seasonally a scarce resource that undermines production and productivity;
- Stimulating the cultivation of a diversity of crop species and raising a range of goat and chicken breeds, as well as with regard to crop rotation, soil enrichment using biological means, and balancing pest–predator relations;
- The production and application of biological pest control tools and techniques in relation to producing safe food in line with the provisions of organic farming; and
- The application of the Participatory Guarantee System in organic farming, which has made possible the organic certification of some farmer associations and has enabled them to label and market their produce as organic.

Bottom-up learning

A certain amount of learning and change has also been taking place from the farmers to the trainers. Much of this kind of learning occurs during support visits, when trainers hear and obtain explanations about some of the local knowledge and innovations. Trainers have reported that much of the learning has involved pest and disease control using local plants. Another interesting aspect of learning from farmers has been that relating to water resource management. For example, one association reported that, while swales and associated microwater-harvesting systems were helpful for increasing water supplies in specific gardens, they were inadequate for effective recharging of the water table. Related learning has been that, when some farmer associations generated income, they used it to buy water pumps for increasing the areas under irrigation. Consequently, the water tables began to fall and the irrigation could not be sustained. The lesson that was learnt from this was that it was critical for the associations and other members of the community to embark on watershed management. The trainers, through the implementing team, have responded to this emerging challenge by developing and implementing training on watershed management. This example shows how bottom-up and top-down learning are feeding into each other.

The main benefits of bottom-up learning has been the valuing of local knowledge systems by the trainers and the adjustment of training content to address new and emerging insights.

Horizontal learning

Learning among farmers continues to take place within each farmer association and between farmers associations, especially those that are physically close to each other. Farmers have periodically met in their associations to share experiences, to assess opportunities and challenges, and to plan together. During FPC training, access farmers and farmer representatives have also shared their experiences and challenges with a view to learning from one another.

Horizontal learning within and between associations

The contributions of farmer-to-farmer learning within their associations include the following:

- Passing on newly acquired knowledge, skills and techniques through talks and demonstrations on-farm;
- Sharing traditional, local and indigenous knowledge about how to manage crop and livestock diseases and pests;
- Conducting observations and assessments of their crops, livestock, fields and gardens, and identifying challenges and obstacles that need to be understood and overcome;
- Conducting informal transect walks and identifying land and water resources that can be tapped into for organic conservation agriculture; and
- Drawing lessons and insights from project experiences and sharing them with others for possible up-scaling.

Contributions of horizontal learning

Horizontal learning among farmers has been critical in creating a multiplier effect, which, in turn, has been important for the development of a critical mass of farmers practising organic conservation agriculture. Another important contribution of horizontal learning among farmers is that it has enabled the contextualised application of acquired, appropriated and internalised knowledge and skills. At the same time, it has fed back into the top-down training, especially when acquired knowledge has not produced the desired results. In this way, linkages between everyday experiences of farmers in the project and 'mature scientific concepts' have been made. For example, some farmer associations have had their soils tested for acidity and fertility in order to explain their performance as well as enable them to search for effective solutions. Similarly, some of the biological pest control tools have been tested for efficacy and potential harm to the environment and consumers. These two examples show how the interaction between top-down and horizontal learning has helped to both deepen and speed up the learning processes in the project.

Horizontal learning has been reported to have motivated fellow farmers to practise what had successfully worked in other farmer associations. Knowing that other farmers like themselves could do it created a positive attitude to practising organic conservation agriculture and helped build farmer confidence in themselves, thus contributing to the development of agency.

Participatory action research

The main tools that are being used for mediating the understanding of the challenges and the development and implementation of solutions are the expansive-learning cycle (after Engeström's work with CHAT) and the Farmer Learning and Innovation Forum (Mukute, 2010; Mukute & Lotz-Sisitka, 2012). The expansive-learning cycle provides a tool that shows how farmers in each association can jointly make meaning of their experiences, as well as jointly surface challenges that they face in learning and practising organic conservation agriculture, modelling and testing solutions, and improving the solutions and making progress towards their respective goals of more, nutritious and safe food, an improved agricultural resource base, and higher incomes from organic and conservation farming. The Farmer Learning and Innovation Forum tool provides guidelines on how to make space for joint learning, innovation and agency development among farmer groups such as associations.

Participatory action research by farmers and organic associations

Farmers and farmer associations in the project use change laboratory workshops as a space and process for initiating their joint learning, innovation and agency development. With the help of an interventionist researcher, each association identifies and prioritises major challenges in achieving its goal; models and implements solutions, and moves towards the attainment of its goals. In order to do this, each association draws on the knowledge and experience of its members and stakeholders, including the knowledge that is appropriated through top-down learning and horizontal learning. In addition, the farmer associations embark on solution-searching journeys to find new solutions that go beyond what they learnt in the past. They also exercise their individual, collective and relational agency in order to implement the developed solutions. Figure 1 shows the main actions that have been taken by each of the 32 organic farmer associations as part of the earlier participatory action research process.

Figure 1. Participatory action research process as implemented in the OCA project

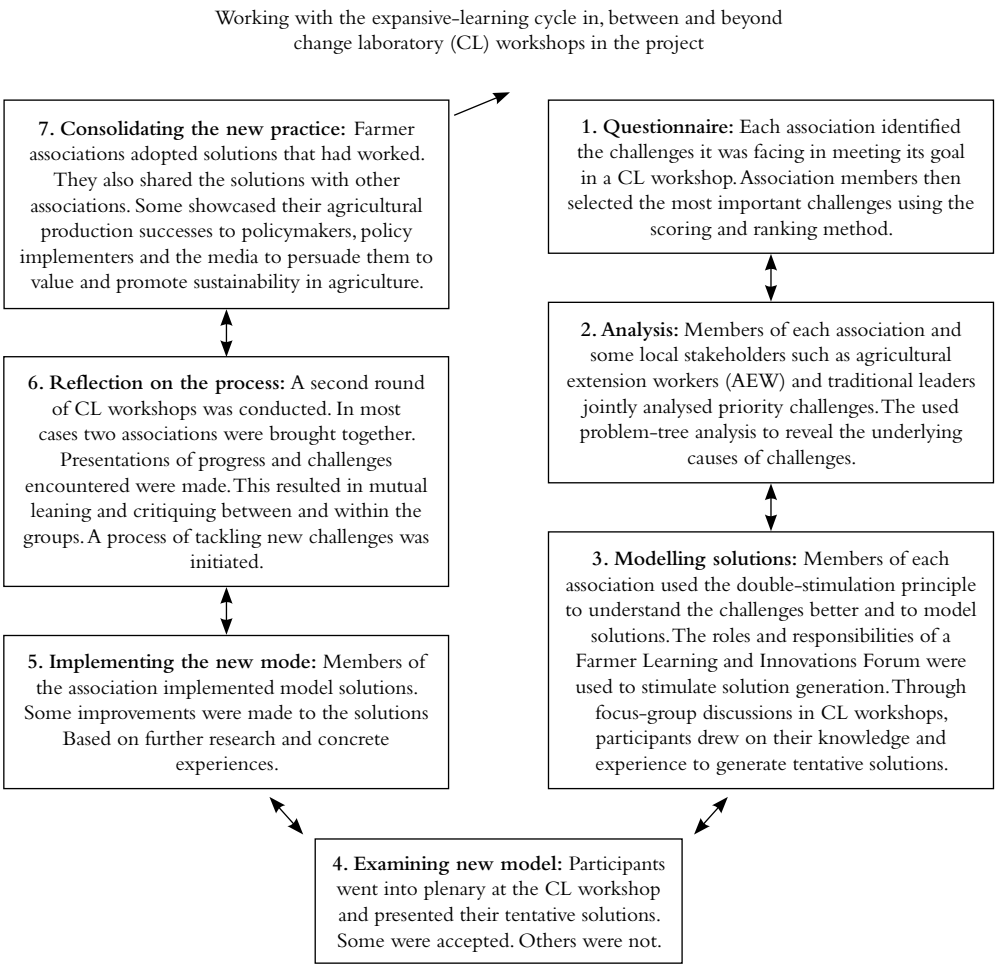

Table 2 is an example of how participatory action research (following the expansive-learning cycle) was facilitated for one association in the project.

Table 2. An example of how one farmer association moved along in the expansive-learning cycle

Stage	Results produced
Questioning in change laboratory (CL) workshop in order to reveal challenges	• Market and transport to the market; • Implements; • Prices; • Cheats at the market; • Seed; • Security of gardens from livestock; and • Transport.
Priority challenge analysis in CL workshop	Security of gardens from livestock: The challenge arises because villagers do look after cattle and goats in the dry season and there are no paddocks to help control livestock movement. Since the introduction of goats in the area, it has been nearly impossible to establish orchards. The community has no by-laws to compel herding cattle throughout the year.
Modelling solution in CL workshop	Persuade the headman to put in place by-laws that compel livestock herding throughout the year (including tethering of goats). The by-laws should include appropriate fines. Livestock owners should ensure that they keep their animals in kraals at night. Farmers should seek loans and build stronger structures to prevent livestock from breaking into their gardens. In the meantime, live fencing should be established.
Examination of model solution in and outside workshop	The main culprit is a powerful person, who historically assisted the people and whose help is needed for transporting produce at a favourable price. There were existing by-laws that actually provided for fines if livestock strayed into gardens at night. Livestock herding throughout the year is likely to be resisted in the community because of labour requirements. Multiple strategies were needed to tackle the challenge without straining community relationships.
Implementation of solution (actions)	• Protected gardens by using barbed wire and thorny bushes, and by erecting live fences; • Introduced the selling of troublesome cattle; • Implemented livestock management by-laws and fined some offenders US$ 25 per animal per case; and • Drafted a letter to the Member of Parliament (MP) whose goats were causing the most trouble. Delivered the letter through the associations' leadership, which included a traditional leader. Consequently, the MP hired personnel to look after the goats and repaired paddocks where his livestock were kept.
Review of solution and search for new, critical challenge	• The implemented solution resulted in increased horticultural production for consumption and for sale. It also resulted in increased self-confidence within the association, which had succeeded in negotiating with community members and leaders; and • The marketing challenge became more important and urgent.

Contributions of participatory action research

Drawing on Mukute (2012), the processes and outcomes of participatory action research – which research is strengthened by following the expansive-learning cycle and by the use of change laboratory workshops – have already made the following main contributions to the project under review:

- The farmer associations have been able to organise themselves, identify and address new challenges, tap into opportunities, and respond effectively together (Box 1). This includes the implementation of the Participatory Guarantee System1, and the search for solutions to major challenges during and between participatory action research/change laboratory workshops;
- Many farmer associations have been able to tap into system reserves by identifying idle (virgin or reverted) land and obtaining permission to utilise it in order to produce safe and nutritious food for consumption and sale, and by bypassing the three-year conversion period in order to become registered organic producers. Some associations have shared information on indigenous ways of treating certain livestock diseases;
- Nearly all farmer associations have used their collective capacities and have found new ways of dealing with production and marketing challenges that they have been confronted with. The learning that they generated through the project has inspired them to experiment; and
- Farmer associations have learnt from one another through horizontal learning, which has been achieved by way of joint meetings during some of the change laboratory workshops, exchange visits, and the mentoring of newly established associations by the older ones. One of the innovations that has been adopted to speed up the process of organic certification is the search for and use of virgin and 'reverted' land on which agrochemicals have not been applied for several years. Exchange visits and discussions facilitated between community leaders have led to improved access to such land for most of the associations.

CHAT-informed Analysis of the Values of the Learning Approaches

Table 3 uses abductive analysis by employing the CHAT lenses to try to reveal how the different learning approaches in the project complemented each other in the realisation of the project objectives. The focus is on how the learning approaches are enabling farmers and their associations to move towards the achievement of their goals, which are virtually identical.

Table 3. Learning approaches and some of their immediate results

Project's learning approach	Associated learning actions in the project	Interpretations of CHAT learning	Link to hierarchy of human activity
Farmer training by, or learning from, others	• Farmer acquisition of new knowledge on the following topics: Training for Transformation and Introduction to Permaculture; Ecology; Water Management; Soil Management; Natural Pest and Disease Management; Agri-planner; Small Livestock Management; Nursery Management; Participatory Market Development; Beekeeping and Organic Honey Production; Integrated Pest Management (IPM); and Processing and Value Addition; • Farmer application of new knowledge in agricultural production, value addition and marketing by farmers; and • Farmer search for explanations from the trainers and research institutes based on farmer application, observation and experiences in the project.	Primarily scaffolding and cultural interpretation of learning aimed at implementing pre-existing solutions	Mastering tools, techniques and operations of OCA – the how of practising organic and conservation agriculture Understanding why the operations work under certain conditions (e.g. why composts do better in shade or pesticide mixes are more effective when mixed with soap)
Participatory learning – learning among and from farmers	• Farmer observation of successes and failures arising from the application of newly acquired knowledge in agricultural production and marketing; • Farmer sharing of successes and failures as experienced during the project; • Farmer's search for specific answers to specific issues and challenges being experienced in the project (e.g. compost-making, record-keeping and pest management); • Farmer agricultural trials, experimentation and marketing studies in the field; and • Farmers sharing their knowledge and insights with trainers.	Primarily scaffolding and cultural interpretation of learning aimed at implementing pre-existing solutions Societal interpretation of learning associated with farmer generation and sharing of knowledge and insights	Using mastered techniques and tools to conduct actions that contribute to farmers' goals Using experiential learning to move towards farmers' goals
Participatory action research – farmer joint learning, innovation, and action with others	• Joint farmer, stakeholder and researcher identification and analysis of main obstacles to improving OCA practice and associated marketing of produce; • Joint farmer, stakeholder and researcher modelling of solutions to fundamental challenges in the OCA, and marketing practice solutions in CL workshops; and • Farmer examination, implementation and review of model solutions between and beyond CL workshops.	Primarily societal interpretation of learning aimed at tackling systemic causes of experienced challenges by creating new solutions – combining incremental improvements with a holistic and long-term development of the practice	Drawing on learnt and mastered operations, knowledge and skills derived from elsewhere and the energy arising from the goal to embark on actions towards a goal in the context of the object of the activity of sustainable agriculture

Conclusion

In conclusion, this article describes the emerging results of the project in relation to the three-dimensional object of the organic conservation agriculture project by drawing on several reports (FPC, 2011; McAllister, 2012; Mukute, 2012; Samhutsa, Sigauke & Zheke, 2012). The three (interrelated) dimensions of the object are social justice, economic viability and ecological sustainability.

Social justice: The project has promoted self-reliance and food security among members of the associations by providing and supporting the application of: technical knowledge on agricultural production and marketing and on the growing of a range of crop varieties, including vitamin-rich vegetables in a social context where nutritional security was highly necessary. It has also contributed to the development of group cohesion among association members and has stimulated the development of productive and constructive relations between the associations' members and AGRITEX, FPC, ZOPPA, traditional leaders and district leaders. These relations are important assets for joint learning and action. Social justice and self-reliance have been fostered when the learning and practice processes tapped into the local knowledge systems, as well as local relationships and resources.

Economic viability: From a starting point of below-subsistence-level productivity, the project has enabled the members of the associations to increase income from horticultural production. Association members interviewed in four of the eight districts revealed that their monthly income levels during the dry season (from April to November) ranged from US$ 40–60 in one district, to US$ 100–150, to US$ 200–400; and to over US$ 400. Incomes from the sale of agricultural produce have been used to improve the livelihoods of members of the associations. Those interviewed indicated that they had bought agricultural assets such as garden tools and livestock, had paid school fees and had built a house.

Ecological sustainability: Farmers have become better able to look after their agricultural resource base by increasing soil fertility and by managing pests and diseases using ecological means. This took place in their agricultural fields as well as on their rain-fed agricultural plots. They were also able to tap into and preserve indigenous crop varieties and small livestock breeds, which contributed to the conservation of agro-biodiversity. Small-water harvesting and the revival of derelict water infrastructure have been implemented in the context of worsening water scarcity in the dry season, as well as in the context of climate change. Using ecological solutions, farmers have significantly increased their yields despite 50% lower rainfall than expected.

Experiences during the course of the project suggest that combining learning approaches in a deliberate and carefully thought-through manner can in fact enrich the learning. It can also support practitioners such as farmers to innovate and to change their practices swiftly and comprehensively in moving towards their goals of prosperity and protection of the agricultural production base. The training of farmers in a top-down way has enabled them to acquire knowledge, skills and techniques that they have included in their operations, which, in turn, has helped them to achieve their goals. There has also been some bottom-up learning as the trainers learn from farmers, especially during field visits. This has sometimes resulted in changes to what

is taught and how it is taught (e.g. the introduction of watershed management). Horizontal learning has enabled farmers to identify obstacles and opportunities, some of which could be tackled using technical knowledge, with others being addressed by building appropriate social relations and by the facilitation and exercising of agency, which could not be taught during the project. Change laboratory workshops were particularly important in bringing together the different approaches to learning, thereby assisting farmers to move towards the achievement of their goals and a deliberate focus on creating new solutions and innovations associated with the achievement of the goals. Dialectics, the concept that underpins CHAT conceptualisations of learning and the hierarchical human activity, appears to have enabled the combination of seemingly contesting approaches.

Notes on the Contributor

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Endnote

1. The Participatory Guarantee System provides consumers with a credible guarantee that the produce is organic. It is participatory, in that the verification process involves the direct participation of representatives of farmers, consumers and other stakeholders.