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ENGAGING FARMERS IN A RESEARCH PROJECT. LESSONS LEARNED FROM IMPLEMENTING THE COMMUNITY OF PRACTICE CONCEPT IN INNOVATION PLATFORMS IN IRRIGATED SCHEMES IN TUNISIA, MOZAMBIQUE AND ETHIOPIA†

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ABSTRACT

The role of smallholder farmers in multi-stakeholder innovation platforms and thus in the innovation process that these platforms facilitate is typically limited. The EAU4Food project, aimed at increasing food production in irrigation schemes in Africa through improved farming strategies, used a platform design inspired by the community of practice (CoP) concept, which opened up space for farmers' interactive learning and enabled their active participation in the innovation process. In this article we present examples of how this approach has been implemented in Ethiopia, Mozambique and Tunisia. We analyse the level of farmers' participation that was achieved at different stages of the implementation process, namely: deciding how to set up the CoP, identifying innovation needs and conducting the experiment. Among different strategies deployed by EAU4Food researchers, working with dialogue groups, engaging farmers in data interpretation and passing the responsibility over elements of the research process to farmers, proved to be the most effective in strengthening farmers' involvement. The use of a simulation game to test innovations also showed promising results and should be explored further. The attitude of researchers proved to be an important factor in achieving a high level of farmers' engagement in the project. Copyright © 2018 John Wiley & Sons, Ltd.

KEY WORDS: community of practice; innovation platforms; farmers' participation; participatory methods; simulation game

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RÉSUMÉ

Le rôle des paysans dans les plates-formes d'innovation et en conséquence dans le processus d'innovation qui en émerge reste souvent limité. Le projet EAU4Food, dont l'objectif est d'améliorer la production alimentaire dans les périmètres irrigués africains par l'introduction de pratiques agraires innovantes, a proposé l'utilisation de plates-formes d'innovation inspirées par le concept de communauté de pratique (CoP), qui mettent l'accent sur l'apprentissage interactif des paysans et leur participation active dans le processus d'innovation. Dans cet article nous présentons les différentes stratégies d'implémentation de la méthodologie CoP en Ethiopie, au Mozambique et en Tunisie. Nous analysons le niveau de participation des paysans que nous avons pu obtenir à différentes étapes de l'implémentation: la construction des CoPs, le choix des pratiques innovantes à tester et le processus d'expérimentation. Parmi les différentes stratégies déployées, travailler avec les réseaux de dialogue de paysans,

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impliquer les paysans dans l'interprétation de données et leur donner la responsabilité de différents éléments du processus de recherche ont été les plus efficaces pour renforcer l'engagement des paysans. L'utilisation d'un jeu de simulation pour tester les innovations a montré des résultats prometteurs et devrait faire l'objet d'une étude approfondie. L'attitude de chercheurs s'est avérée être un facteur clé de l'engagement des paysans dans le projet. Copyright © 2018 John Wiley & Sons, Ltd.

MOTS CLÉS: communauté de pratique; plates-formes d'innovation; participation des paysans; méthodes participatives; simulation

INTRODUCTION

Over 25 years have passed since Robert Chambers and colleagues published their seminal book *Farmer First: Farmer Innovation and Agricultural Research* (Chambers *et al*., 1989) which contributed greatly to the recognition of the capacity of farmers to propose their own innovative farming solutions, paving the way for wider participation of farmers in agricultural research. Since then many approaches have developed to actively involve farmers in research and development activities, such as participatory rural appraisal (PRA), which incorporates the knowledge of rural stakeholders into the process of planning development interventions; participatory technology development (PTD) in which scientists and farmers jointly carry out experimentation to develop technologies appropriate to local conditions and which evolved into participatory innovation development (PID), to include broader understanding of innovation, beyond just technology. Co-production of knowledge with farmers was promoted through the group learning set-ups such as farmer field schools (FFSs), through different types of farmer experiments (Hocdé and Triomphe, 2006) or through a more participatory use of simulation-based decision support systems (DSSs) to enhance mutual learning between farmers and researchers (McCown *et al*., 2009).

In innovation studies, in the increasingly popular agricultural innovation systems approach (AIS), farmers are recognized as one of the actors who produce, exchange and use knowledge. And yet, there is still room for improvement when it comes to farmers' participation. Several authors have emphasized farmers' weak position in both innovation systems and value chains (Ngwenya and Hagmann, 2011), their lack of control over knowledge production and dissemination (Fløysand and Jakobsen, 2011) and their weak position relative to external actors in shaping innovation practices and processes (Friederichsen *et al*., 2013). This situation also concerns innovation platforms (IPs), multi-stakeholder set-ups which are orchestrated to catalyse innovation (Ergano *et al*., 2010; Adekunle and Fatunbi, 2012). Platforms can still be misinterpreted as dissemination tools, with farmers expected to participate in implementing but not designing innovation and playing no part in establishing the platform's agenda, while their knowledge is regarded as less legitimate than that of other actors (Cullen *et al*., 2014). It remains a challenge to organize effective participation of smallholder farmers in the IPs and to find out how to mobilize their individual and collective capacities and knowledge for innovation (Spielman *et al*., 2009).

An attempt to include farmers in initiating innovation processes was made in a trans-disciplinary research project called 'European Union and African Union cooperative research to increase Food production in irrigated farming systems in Africa' (EAU4Food), in which the authors of this article participated. EAU4Food was initiated in 2011 to tackle the challenge of food security in five countries of Africa: Tunisia, Ethiopia, South Africa, Mozambique and Mali. The objective of the project was to co-develop, test and implement improved farming strategies together with local actors, to increase food production in irrigated schemes (Froebrich *et al*., this issue), which are typically recognized as arenas of important innovation dynamics (Jamin *et al*., 2011). In each participating country the project established innovation platforms including local research partners, farmers and other key stakeholders. Partly overlapping, these platforms operated at two levels: regional/national and local. The platforms at the local level were named by the project team 'communities of practice' (CoPs), after the concept of Wenger (1999). For the purpose of this paper we will call them project CoPs (PCoPs). They were thought of as spaces where project researchers, farmers and other local-level actors (for example extension agents, value chain actors) could build a common understanding of problems, and then, drawing on local knowledge and innovations, together propose and test innovative solutions. Ideally, they would act as CoPs, generating a pool of knowledge and a set of practices that could be mobilized by local actors in the future.

The concept of community of practice, first used by Lave and Wenger (1991) and then developed by Wenger (1999), describes how people engaged in a similar activity effectively learn through shared practice. CoPs are defined by three criteria: mutual engagement, joint enterprise and shared repertoire of common resources, such as experiences, stories, tools and ways of addressing recurring problems.

The theoretical underpinnings of the CoP concept are compatible with the AIS approach. First, the positioning of the CoP concept within the learning theory is similar to the positioning of the AIS approach within innovation theory—as opposed to a linear model of transfer. In a CoP, knowledge is an emergent property of social interaction and not a commodity that can be 'transferred' (Ison *et al*.,

2014). Learning through a CoP is seen as a process of social construction of knowledge (Morgan, 2011). Second, the relation between knowledge and practice in a CoP makes it possible to mobilize tacit knowledge (Duguid, 2005). This is important in the context of farming, as a lot of local farmers' knowledge has a tacit character that cannot be captured in discussion (Barnaud, 2008).

Although the majority of CoPs evolve spontaneously, Wenger (1999) does not exclude situations when a CoP is created in a response to an outside mandate, stressing that the practice is always shaped as a response of the participants to their own conditions and in their own context. There is no condition of minimum duration of interaction for a group to become a CoP—Wenger is saying only that a community needs to last 'long enough for significant learning to take place' (Wenger, 1999).

CoPs are promoted as effective tools to support learning in organizations, and while their use in agricultural contexts is not widespread, their potential to be mobilized as tools in intervention is generally recognized. At the same time, Ison et al. (2014) remain sceptical about the possibility to design or engineer them, but they stay open for the possibility of creating conditions for CoPs to emerge.

In this study we analyse how the EAU4Food participatory methodology comprising the CoP concept was implemented in three different study areas: Ethiopia, Mozambique and Tunisia. We compare different strategies used for engaging farmers in knowledge co-production in the innovation platforms of the EAU4Food project. Our purpose is to gain an understanding of if and how, in the context of a research project, we can create conditions for a group of farmers to become a learning community engaged in innovation processes and in this way to increase the chances of the project of have lasting impact. Our study is focused on the process and not on the outcomes, and thus includes projects that were not completed at the time of writing this article.

MATERIALS AND METHODS

We conducted an *ex-post* study of how the project methodology was implemented in Ethiopia, Mozambique and Tunisia. The authors of the article were directly involved in the design of the methodology and/or in its implementation on one of the sites. Our study covers the period from the moment in which farmers entered the process until the experiment phase (which was still ongoing in Mozambique when the article was written). The entry point was common for each site: the first project workshops. The objective of these workshops was to identify with farmers constraints to agricultural production in their irrigation schemes and to jointly establish a research agenda that would address these constraints, drawing on local knowledge and practices. Innovative solutions were to be subsequently identified, co-designed and tested with farmers. The study follows the evolution of farmers' participation in the project over the period of 3 years, which had different modalities and followed a different calendar depending on the site, with no coordination between the sites.

Study sites

In Ethiopia, the project was implemented in the Gumsalasa irrigation scheme in Tigray region, located in the north of the country. The construction of the irrigation scheme was completed in 1995 and irrigation started in the area for the first time in 1997. The scheme, located in a drought-affected region, depends on flood water collected during the rainy season in an earthen micro-dam. The command area covered 110 ha at first, then shrank to 55 ha. About 368 smallholder farmers are engaged with irrigation in the scheme. Crops commonly grown in the irrigation season include maize, wheat, barley and vegetables such as onion and tomatoes.

In Mozambique, the project was implemented in the Chókwè irrigation scheme, located in the Mozambican part of the Limpopo River Basin, in Gaza Province. It is irrigated with the water from the Limpopo River. The scheme, built in the 1950s (with an extension in 1979), formally comprises a total area of 35 000 ha. Only 28 600 ha are actually equipped and only 10 000 ha are presently being cultivated with rice, maize and horticultural crops. Farmers (12 000), who occupy land in the scheme, are mostly smallholders.

In Tunisia, the project was implemented in the El-Brahmi irrigation scheme in the north-west of the country in the Jendouba region. The scheme, constructed in 1978, covers 5000 ha, is cultivated by around 500 farmers as well as two private companies, who jointly occupy 600 ha. The scheme is irrigated with water from the Medjerda River and from a mountain reservoir. The main crops are cereals, horticultural crops and forage crops, and dairy farming is an important activity in the scheme.

Data collection and analytical framework

In each location we followed the evolution of the project CoP methodology around one type of innovation with one group of farmers (there were several innovations tested in each site): irrigation scheduling in Ethiopia, composting in Mozambique and a virtual test of farmers' innovations in dairy farming in Tunisia (i.e. a simulation game). We chose to focus on three processes in the implementation of the methodology that we coupled with three processes defining a CoP in the sense of Wenger (1999):

- setting up project CoPs—mutual engagement;
- identifying innovations to work on—negotiating a joint enterprise;

- learning through innovation testing—building a shared repertoire of common resources.

We completed the framework for each location using qualitative data concerning different stages of the evolution of the project CoP process (Table I). Given our objectives, the data collected were focused on farmers: their participation and role at every stage of the process. We relied on secondary data from project reports, back to office reports, and minutes of meetings from the three locations. This information was complemented with our own participatory observations from different sites, as well as with information that we gathered through interviews with farmers at different stages of the process, depending on location.

We examined the data for cross-case patterns (Yin, 2013). For every stage in the three processes, farmers' participation was evaluated using a tool adapted from the work of Pretty (1995) on different types of participation (Table II). There are other tools to describe/assess the level of stakeholders' participation (Arnstein, 1969; Lynam *et al*., 2007), but the one we chose best describes the articulation between the objective of researchers and type of participation and makes it possible to clearly describe the role of farmers in the process.

FINDINGS

Stage 1—Setting up project CoPs

In our three cases, differences in implementation of the EAU4Food/CoP methodology occurred from the initial stage of the process—inviting farmers to the first project meetings (summarized in Table III). In Ethiopia, the participants in the first EAU4Food/CoP were chosen by the elected committee of the water users' association (WUA) among farmers actively participating in water management, to represent different locations of the scheme—upper, middle and lower, left and right banks, as well as different wealth groups, as per the consensus reached between the WUA leaders and the research team. In Mozambique the research team adopted another strategy—three farmers' associations were selected (among many existing in the scheme), representing farmers of different socio-economic and geographical situations. Participation in the meetings (separate for each association) was left open to all the members. On the Tunisian site, local WUAs are contested by most of the farmers who do not recognize appointed staff as legitimate and are dissatisfied with their services. Except for the dysfunctional WUAs there are no other farmer associations. The research team invited farmers that were either recommended by a local rural research institute, or

Table I. Data collection framework

(a) Setting up a Community of Practice	First CoP meeting (describe)	Next CoP meeting (describe)	Next CoP meeting (describe)
What kind of farmers participated?			
How were they selected (selection criteria)?			
How were they invited? (Invitation/open access/…)			
Did the participants know each other prior to the PCoPs?			
Did the participants have a chance to interact outside of the project?			
Did the participants have a history of collective action?			
Did they have a common discourse on topics discussed in PCoPs?			
(b) Identifying innovation need			
	First stage (describe)	Next stage (describe)	Next stage (describe)
Chosen theme			
Farmers' participation in this choice			
Elements of negotiation between farmers and research team			
Space for discussion between farmers			
Farmers' knowledge mobilized in the process			
(c) Learning through testing innovations			
	First stage (describe)	Next stage (describe)	Next stage (describe)
Modality			
Farmers' participation			
Farmers' input			
Elements of negotiation between farmers and research team			
Space for discussion between farmers			
Tacit knowledge mobilized in practice			

Table II. Typology of farmers' participation (adapted from Pretty 1995). The colour code from red to green represents the level of participation from the lowest to the highest

Level of participation	Farmers' role
Self-organization	The lessons from the participatory process are transformed into decisions by farmers themselves
Interactive participation	Farmers participate in joint analysis—new groups may be formed that participate in local decision-making process
Functional participation	Farmers form groups to meet objectives predetermined by researchers. These groups are important for the project's success
Participation by giving opinions	Researchers listen to farmers' views that may or may not be taken into account in decision-making
Participation by giving information	Farmers provide information to be analysed by researchers
Passive participation	Farmers receive information

identified through a series of preliminary interviews (Hanafi *et al*., this issue). This resulted in a rather random group of individual farmers, with underrepresentation of smallholders.

The methodology used in all three locations at this stage combined interactive workshops and field visits. The farmers identified and prioritized the main constraints to agricultural production in their schemes. This diagnosis was completed by representing problems on photographs taken by farmers directly in the field and then displayed and collectively discussed. The participants 'prioritized' problems, voting for the most important for them (Tunisia) or most critical for irrigated agriculture (Mozambique). In Ethiopia the problems were ranked according to the scale of impact that addressing them could have on the local population ('how many people would be positively affected by solving a given problem') and evaluated in terms of the possibility of addressing them through research. In Ethiopia and Mozambique farmers were engaged in problem analysis, using a method known as a 'problem tree' to identify causes and consequences of the main problems. In Tunisia, some elements of analysis were conducted at a later stage, albeit less systematically, during the multi-stakeholder platform meeting when diverse stakeholders worked in thematic groups.

An attempt was made to identify local innovations in all locations; however in Tunisia, the discussed solutions were mainly theoretical, while in Ethiopia, the focus was on existing practices which would benefit from, or could be

Table III. Main differences in the implementation of the project methodology in the three cases

		Ethiopia Irrigation scheduling	Mozambique Composting	Tunisia Dairy farming
1. Setting up a PCoP	Entry point (farmers invited)	Individual farmers for the first rounds, community of neighbours for the innovation test	Farmers' associations throughout the process	Individual farmers for the first round and informal dialogue groups of farmers for the innovation test
	Participation in meetings	Individual selection by a third party—selected by members of the WUA committee	Self-selection (inside a selected group)	Individual selection by a third party—personal invitation by a researcher/ spontaneous invitation by a peer
2. Identifying innovations to work on	Source of tested innovation	Research team, in response to priority issues identified by farmers	Research team, in response to priority issues identified by farmers and after negotiation with farmers	Each farmer individually/research team after a series of interviews
3. Innovation testing	Planning the test	Researchers, with input from farmers and other stakeholders	Researchers/farmers	Each farmer individually
	Elements of negotiations (farmers-researchers)	On whose plot the test will be conducted	Tested innovation, schedule, responsibilities, crops to apply the compost on	None. Farmers were free to introduce any changes
	Responsibility for conducting the test	Researchers and farmers	Farmers, with support from researchers	Farmers
	Test type	Test on individual plot	Test on a common plot	Virtual test individual/common
	Space for informal dialogue around the test	Neighbourhood of test plot	Association/common plot	Contacts within dialogue group

complemented by, the research. After completing the problem analysis with farmers, research teams elaborated research proposals for innovation testing (Ethiopia) and concept notes for future innovation development (Mozambique). In Tunisia, only general themes for research were identified with farmers, but no research proposals were made at this stage.

Stage 2 —Identifying innovation to work on

The process of engaging farmers around a joint enterprise was organized differently in the three locations. One of the problems identified by Ethiopian farmers —poor water management at plot level (which farmers related to other priority problems, such as salinity and waterlogging)—was addressed through a research proposal 'Comparative assessment of conventional and simplified practical approaches to irrigation scheduling'. The proposal, developed by researchers, was presented to farmers (and other stakeholders) in the second round of meetings, where it was enriched following their comments. Individual farmers who were willing to participate, and whose plots fulfilled the criteria for the test, were recruited. Their role was to provide plots for the experiment and to actively participate in the set-up and follow-up of the experiments, sample and data collection and interpretation of results.

In the case of Mozambique, the final choice of innovation to be tested was made during a participatory workshop organized specially for this purpose (Sanchez-Reparaz *et al*., this issue). The problem of high production costs prioritized by farmers was tackled in a concept note proposing to work on 'decreasing fertilization costs through alternative soil fertility conservation practices'. The research team interviewed farmers from 3 associations (10 per association) about their agrarian practices, perception of fertility and knowledge about soil fertility management and then used the synthesis of these interviews to trigger discussion. One workshop per association was organized on the topic of farmers' perception and practice of seven soil fertility conservation techniques: legume intercropping, manure, compost, crop residues, rotations, fallows and use of mineral (inorganic) fertilizers. Farmers were asked to analyse the advantages and disadvantages of each practice and the constraints in their adoption, and to express their preference for a practice to be tested. Farmers from one of the associations showed their interest in testing manure application, while recognizing the difficulty in accessing the necessary quantity of manure in the irrigation scheme, where animals are not allowed. In response, the research team proposed to instead experiment with compost, combining less quantity of manure with locally available rice residues, which would valorize local organic material and decrease fertilization costs. The proposition was accepted by the president of the association, who led other farmers to participate. Subsequent interviews with project participants revealed that this was the usual mode of functioning inside the association, where the president was a central and powerful figure.

In Tunisia, another attempt to establish a research agenda was made during the second round of project meetings. A thematic meeting on one of the problematic areas proposed and prioritized by farmers—dairy farming (alongside two other meetings on other identified themes)—was called. The local research team did not want to make it open to the wider public, instead the researchers, in consultation with local extension agents, invited individual farmers that they considered potentially interested. Participation was very low and most participants were new to the project (i.e. they had not been present in the previous round). The participants suggested two general topics for research—how to increase milk production and how to better plan cow nutrition, but again no specific innovative practice to be tested was proposed, as there were no experts on these topics in the research team.

Stage 3—Learning through innovation testing

The process of planning, organizing and conducting innovation tests also had a different course in all three cases. In Ethiopia, farmers and researchers agreed to jointly perform the test activities according to the research plan—farmers participated in taking measurements of the amount of water applied during each irrigation application, in collecting soil samples to measure soil salinity and in taking measurements of the biomass and grain yield at the harvest stage which would be used for measuring crop water productivity at the end of the season. Two irrigation scheduling methods were tested against farmers' own usual practices. At this stage a project CoP was created. On each test plot, the research team organized additional meetings for neighbouring farmers, at the vegetative and harvest stages of the test. Farmers observed and commented on the results, exchanging ideas with other farmers, researchers and local extension staff, and giving their own interpretations. The results of the test (along with the results of other similarly organized project experiments) were presented during another series of project meetings, this time gathering farmers participating in different learning communities.

In Mozambique, the test was planned on the common plot of the association. All the elements—the land made available for the test, the scheduling of the test, the crop on which the compost would be applied, the farmers responsible for each test activity—were negotiated between farmers and researchers during a participatory planning workshop.

Farmers took full responsibility for regularly turning the compost, measuring its temperature and humidity and reporting the results to the research team. They received the necessary training. It was decided that farmers would actively participate in the establishment of the field trial (when compost is applied), in its monitoring and evaluation, and that participatory workshops would be organized with farmers after the completion of each stage of the experiment, until the final participatory evaluation.

In Tunisia, a PhD researcher who was studying the scheme (the first author), and was aware of dairy farmers' interest in finding innovative practices to improve their cow-feeding practices and milk production without increasing the costs, proposed preparation of a virtual test of farmers' ideas in the form of a game. A role-playing game called LAITCONOMIE was designed around topics previously chosen by farmers (milk production and cow nutrition) in which participants, playing dairy farmers, aimed to improve milk production whilst simultaneously finding alternatives to the use of an expensive industrial concentrate in their feeding system. The game, designed according to the 'self design' principle (d'Aquino *et al.* 2002; d'Aquino and Bah, 2013), evolved around interactions between farmers about their individual practices and the impact of these practices on their milk production. The invited players came from two different informal dialogue groups (understood as a group of farmers who knew each other, work in similar conditions, regularly interact and discuss their practice) that the PhD researcher identified through interviews. An extension agent from the regional office served as an expert, providing technical advice when requested by farmers. The farmers were free to introduce their own rules and propose any improvements to their practice they wanted—new crops, new agricultural techniques, changes in the feeding system, new organization of work. They themselves evaluated and explained the impact of each new practice on milk production, but these evaluations had to be validated by the group (the other farmers and the local expert, but not the researcher). A simple computer-based tool calculated farmers' income from the milk collection centre. The ideas developed and virtually tested by farmers included introducing new crops such as alfalfa, introducing a ryegrass and berseem clover association, introducing silage techniques, combining milk and meat farming and forming a cooperative to produce their own concentrate feed, along with many small technical improvements in growing forage crops discussed in detail with their peers and the expert.

Different ways in which the participants were involved in practical action are itemized in Table IV.

When it comes to building a common repertoire, in Ethiopia, farmers and other local stakeholders participating in tests proposed that the researchers should produce a 'best practices' guide, gathering experiences from different experiments that could become a common reference in the scheme. In Mozambique, farmers interviewed at the stage of compost application were all confident in their capacity to produce compost without external guidance. They also reported that they taught the technique to others, both inside and outside the association, and emphasized that the project built a competent human resource that would be now available to guide compost preparation for the association in the future. There are signs that the group took ownership of the process—farmers contacted the research team before the rainy season, with suggestions on how to protect the compost heap from the coming rain, and before the planned field trial they conducted a spontaneous experiment applying compost on a garden crop (zucchini). In Tunisia, although the simulation experiment lasted only half a day, all participants reported learning in the evaluation interviews. Three months after the workshop half of the participants introduced some of the solutions tested during the simulation game on their farms and one designed and implemented a new production system, combining some of the ideas developed in the game with his own ideas and claiming that participating in the game inspired him to develop and follow his vision. In all three locations, the participants in the test groups had an opportunity to communicate on a daily basis. In all locations, participants admitted in the interviews that they spoke about the project experiences with other participants, but also with other people, for example family members in Tunisia, people at church or the market in Ethiopia, members of other associations in Mozambique.

Table V presents different types of participation that farmers experienced at different stages of the process in the three cases.

DISCUSSION

Importance of the context

In the cases that we have presented different elements of the context provide a canvas for building locally adapted strategies to implement project methodology. These elements are of various kinds; however, they can be placed in one of three areas: local institutional landscape, composition of the research team, and working culture (Table VI). While analysing the local institutional landscape is part of preliminary analysis in a project, it could be beneficial to make a more explicit link between the results of this analysis (the situation in place) and the future participatory research strategy. It seems advisable that the elements belonging to the other two categories are also made explicit at an early stage of the project, in order to identify as soon as possible the elements that could enable or hamper implementation of participatory methods.

Table IV. Different characteristics of learning through practice in different strategies

	Experiment with farmers (Ethiopia)	Collective experimentation (Mozambique)	Simulation (Tunisia)
Relation farmer/researcher	Alongside researchers	Independently after being trained by researchers	Independently of researchers
Relation farmer/farmer	Individual experiment but observed by other farmers	Collective experiment (task division)	Individual experiments but discussed with other farmers. One collective experiment (decided by farmers)
Relation to practice	Hands-on and observation	Hands-on and observation	Verbal explanation of techniques and their effects.
Feedback on results	Comparison of effects of experimented practices and usual practice—control group	Results delayed in time. Observation of effects of self-initiated experiment (different crop—faster results)	Immediate—simulation
Responsibility for results	Researchers	Farmers	Farmers (but no real consequences)
Innovation tested	Two irrigation scheduling methods (against farmers' usual scheduling method)	One composting technique	Different techniques and forms of organization—virtually

Table V. Different types of participation at different stages of the process in the three locations. The colour code used is the same as in Table I and represents the level of participation, with dark green corresponding to the highest level

	Ethiopia	Mozambique	Tunisia
First round of meetings—the diagnosis	Interactive participation	Giving opinions	Giving opinions
Definition of research agenda	Giving opinions	Giving opinions	Giving opinions
Identifying innovation to be tested	Interactive participation	Interactive participation	Giving opinions (decision about the game)
			Self-organization (decisions in the game)
Planning innovation test	Giving opinions	Interactive participation	Self-organization (in the game)
Conducting innovation test	Interactive participation	Interactive participation/ Self-organization	Self-organization (in the game)
Sharing and interpreting results	Interactive participation	Self-organization (self-initiated test)	Self-organization (in the game)

Table VI. Context areas and elements

Areas of the context	Elements of the context
Local institutional landscape	• situation of water users' associations in research area • existence of farmers' organizations • local networks
Composition of the research team	• local research team's preferences regarding work with farmers • preferences of workshop facilitators regarding facilitation tools • prior knowledge of the research area by the research team • type of expertise available in the research team • access to local networks
Culture and working culture	• cultural expectations regarding interactions between farmers and researchers • mutual perceptions of farmers and researchers • the ideas, experiences and attitudes of external researchers

Engaging a community around a joint enterprise—working with existing dialogue groups

Creating a learning community around a jointly negotiated topic is, as Ison et al. (2014) suggested, difficult to engineer. Ideally, both should emerge together. In real life, a project team needs to start somewhere. As our results show, starting with identifying a group that already exists and has a history of dialogue is more promising than trying to engage random individuals around a topic. It is easier when there are formal groups in place that can be assumed to be dialogue groups (as in Mozambique), otherwise an effort needs to be made to identify informal dialogue groups. Targeting neighbouring farmers is a strategy that may pay off—the farmers work in the proximity of each other, in similar conditions, facing similar problems. When spatial organization of the research area makes it difficult, further efforts may be needed to identify dialogue groups. In Tunisia, a number of interviews had to be conducted to identify informal dialogue groups of dairy farmers in the irrigation scheme after working with a random group of individual farmers failed to bring expected results. The strategy to work with existing dialogue groups, rather than with random groups of farmers, is backed up in the literature on learning and innovation among farmers. Darré (Darré *et al*., 1989; Darré, 1991, 1993) in his extensive body of work emphasized the central role of dialogue in informal localized groups of farmers in shaping and changing their farming practice. Morgan (2011) in his study of farmers converting to organic farming concluded that regular contact in dialogue groups is crucial to engaging in learning communities. Goulet (2013) pointed out that learning in dialogue groups is of key importance especially for farmers practising new or alternative farming methods. Choosing to work with groups of farmers who have the opportunity to communicate outside of the project has the advantage of making use of existing dialogue spaces, where project activities can become a topic of everyday informal conversations, recognized as crucial for innovation (Leeuwis and Aarts, 2011).

At the same time, as pointed out by Layadi *et al*. (2011), it is not easy to take dialogue groups into account in a project, due to their informality. Another possible drawback is that engaging with an existing group means dealing with existing power relations and with the existing group decision-making patterns. These elements can be exploited for the benefit of the project, as it was in Mozambique, but wrong understanding of existing patterns could just as easily hamper the project's success.

Learning by doing or by simulating

The importance of learning through shared practice is emphasized in many studies (Schad *et al*., 2011; Cristóvão *et al*., 2009). In all the cases presented, the strategies to create conditions for experiential learning (Kolb, 1984) were different: farmer experiment in Ethiopia, collective experiment in Mozambique and simulation in Tunisia.

However, involving farmers in agricultural experiments may also have some disadvantages. First, farmers take a risk engaging their time and resources in experimentation that may not bring expected results (i.e. increased yield). Second, there are time constraints related to the agricultural or irrigation calendars—the timing is not always compatible with the timing of a participatory process. In Mozambique, the moment when the group agreed to engage in the compost experimentation was not in line with the farming calendar and the whole process had to be delayed. Both these constraints can be avoided through the use of simulation. As Isaacs and Senge (1992) put it, simulation creates a learning environment where time can be slowed down or speeded up and the risks of experimentation eliminated. It can also engage farmers' tacit knowledge in similar ways that practice does. The experience from Tunisia shows that simulation can be considered a useful tool in some cases. Here, it allowed participants to identify, share and test their own ideas for innovative practices in a risk-free setting, and to test many different practices in a short time (during one game session), creating a condensed project CoP.

Passing the baton to farmers

In the light of our findings, sharing responsibility for the results with farmers is important at different stages of the process. Involving farmers in analysing and not just producing data, seems to be a good strategy for identifying a possible joint enterprise. In Tunisia, where participatory analysis was not conducted, identified topics were perhaps too general to provoke farmers' engagement.

When farmers not only provide but also analyse information, the activity traditionally reserved for researchers, it brings both parties closer to 'co-construction' of knowledge and allows us to go past the logic of 'transfer' (Barnaud, 2008), increasing farmers' ownership of the process.

Another strategy was to make farmers responsible for the experiment phase. The Mozambican and Tunisian examples show that this strategy can produce a sense of competence and encourage farmers to lead their own experiments outside of the intervention.

While most of the project in all locations was based on interactive participation, the level of participation was generally lower in the phase of establishing the research agenda or sometimes planning the innovation test. This is in line with previous findings (Nederlof *et al*., 2011; Cullen *et al*., 2014). Through the lenses of CoP theory, this stage is key—it is around common objectives decided at this stage that the learning community is formed—they become the joint enterprise, what brings the community of practice together.

It may be more strategic to push farmers' participation at this stage even more.

As for the experiment stage, it was the withdrawal of the researchers that assured further ongoing participation in Mozambique and Tunisia. In Mozambique they were simply absent from the field after ceding the conduct of the experimentation to the farmers, while in Tunisia, the self-design principle used to design a game assumes the leading role of the participants in proposing and testing solutions.

CONCLUDING REMARKS

Although we speak of farmers' participation, it is the readiness of researchers to work in a participatory manner that is crucial to the success of any participatory approach. While the position of a researcher in a linear model of technology transfer is comfortable and familiar, sharing power over the research process with farmers is not. In our project, the local researchers who had little previous experience in working in participatory ways had to rethink, at least for the project's duration, their role in the innovation process. As our experience suggests, for a research project that has participatory ambitions, the choice of consortium partners, and further, the individuals who will actually implement the project in the field, is key. Individuals' attitudes to their own role in the research process should be discussed in advance; commitment to participatory principles is vital. This should also be reflected in the way that the project's impact is evaluated, as limiting evaluation to measurable scientific output (number of papers, h-index, etc.) does not encourage investment in participatory work.

Another lesson learnt is to take advantage of those elements of the context that can facilitate participatory process implementation, for example, to use existing group dynamics (formal or informal), as this is a factor that can enhance the presence of the project between and beyond the moments of direct intervention, creating more space for learning and engagement of the participants.

Increasing ownership of the project by local actors by involving them early and as much as possible in the process (for example in establishing a research agenda) can be suggested as a way to increase chances of better integration of research results, as they could be considered a commonly developed resource. This can be further strengthened, for example by giving the participants a role not only in generating data, but also in their analysis and interpretation, or by giving them full responsibility for some parts of the experimentation process.

Simulation and gaming can be recommended as a participatory research strategy when dealing with innovation. It creates a space to explore and test different solutions that is safe both for participants and for researchers.

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REFERENCES

Adekunle A, Fatunbi A. 2012. Approaches for setting-up multi-stakeholder platforms for agricultural research and development. *World Applied Sciences Journal* **16**(7): 981–988.

Arnstein SR. 1969. A ladder of citizen participation. *Journal of the American Institute of Planners* **35**(4): 216–224.

Barnaud C. 2008. Equité, jeux de pouvoir et légitimité: les dilemmes d'une gestion concertée des ressources renouvelables. Mise à l'épreuve d'une posture d'accompagnement critique dans deux systèmes agraires des hautes terres du Nord de la Thaïlande. Université de Nanterre-Paris X, Nanterre, France.

Chambers R, Pacey A, Thrupp LA. 1989. *Farmer First: Farmer Innovation and Agricultural Research*. Intermediate Technology Publications: London, UK.

Cristóvão A, Ferrão P, Madeira R, Tibério ML, Raínho MJ, Teixeira MS. 2009. Circles and communities, sharing practices and learning: looking at new extension education approaches. *Journal of Agricultural Education and Extension* **15**(2): 191–203.

Cullen B, Tucker J, Snyder K, Lema Z, Duncan A. 2014. An analysis of power dynamics within innovation platforms for natural resource management. *Innovation and Development* **4**(2): 259–275.

D'Aquino P, Bah A. 2013. Land Policies for Climate Change Adaptation in West Africa A Multilevel Companion Modeling Approach. *Simulation & Gaming* **44**: 391–408.

D'Aquino P, Le Page C, Bousquet F, Bah A. 2002. A novel mediating participatory modelling: the 'self-design' process to accompany collective decision making. *International Journal of Agricultural Resources, Governance and Ecology* **12**: 59–74.

Darré J-P. 1991. Les hommes sont des réseaux pensants. *Sociétés contemporaines* **5**(1): 55–66.

Darré J-P. 1993. Production des connaissances dans les groupes locaux d'agriculteurs. *Agriscope* **7**: 24–36.

Darré J-P, Le Guen R, Lémery B. 1989. Changement technique et structure professionnelle locale en agriculture. *Economie rurale* **192**(1): 115–122.

Duguid P. 2005. 'The art of knowing': social and tacit dimensions of knowledge and the limits of the community of practice. *The Information Society* **21**(2): 109–118.

Ergano K, Duncan A, Adie A, Tedla A, Woldewahid G, Ayele Z, Berhanu G, Alemayehu N. 2010. *Multi-stakeholder Platforms Strengthening Selection and Use of Fodder Options in Ethiopia: Lessons and Challenges*. Cirad-Inra-SupAgro: Montpellier, France; 12.

Fløysand A, Jakobsen S-E. 2011. The complexity of innovation: a relational turn. *Progress in Human Geography* **35**(3): 328–344.

Friederichsen R, Minh TT, Neef A, Hoffmann V. 2013. Adapting the innovation systems approach to agricultural development in Vietnam: challenges to the public extension service. *Agriculture and Human Values* **30**(4): 555–568.

Goulet F. 2013. Narratives of experience and production of knowledge within farmers' groups. *Journal of Rural Studies* **32**: 439–447.

Hocdé H, Triomphe B. 2006. *L'expérimentation en milieu paysan*. In CIRAD-GRET (Ed.), Memento de l'agronome; p. 511–530.

Isaacs W, Senge P. 1992. Overcoming limits to learning in computer-based learning environments. *European Journal of Operational Research* **59**(1): 183–196.

Ison R, Blackmore C, Collins K, Holwell S, Iaquinto B. 2014. Insights into operationalizing communities of practice from SSM-based inquiry processes. *Systemic Practice and Action Research* **27**(2): 91–113.

Jamin J-Y, Bouarfa S, Poussin J-C, Garin P. 2011. Les agricultures irriguées face à de nouveaux défis. *Cahiers Agricultures* **20**(1): 10–15.

Kolb DA. 1984. *Experiential learning: experience as the source of learning and development*. Prentice-Hall: Englewood Cliffs, N.J.

Lave J, Wenger E. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press: Cambridge, UK.

Layadi A, Faysse N, Dumora C. 2011. Les organisations professionnelles agricoles locales, partenaires pour renforcer le dialogue technique? *Cahiers Agricultures* **20**(5): 428–433.

Leeuwis C, Aarts N. 2011. Rethinking communication in innovation processes: creating space for change in complex systems. *Journal of Agricultural Education and Extension* **17**(1): 21–36.

Lynam T, de Jong W, Shell D, Kusumanto T, Evans K. 2007. A review of tools for incorporating community knowledge, preferences, and values into decision making in natural resources management. *Ecology and Society* **12**.

McCown RL, Carberry PS, Hochman Z, Dalgliesh NP, Foale MA. 2009. Re-Inventing Model-Based Decision Support with Australian Dryland Farmers. 1. Changing Intervention Concepts during 17 Years of Action Research. *Crop and Pasture Science* **60**: 1017–1030.

Morgan SL. 2011. Social learning among organic farmers and the application of the communities of practice framework. *Journal of Agricultural Education and Extension* **17**(1): 99–112.

Nederlof S, Wongtschowski M, van der Lee F. (Eds) 2011. Putting Heads Together. *Agricultural Innovation Platform in Practice*. Amsterdam, the Netherlands: KIT Publishers.

Ngwenya H, Hagmann J. 2011. Making innovation systems work in practice: experiences in integrating innovation, social learning and knowledge in innovation platforms. *Knowledge Management for Development Journal* **7**(1): 109–124.

Pretty J. 1995. *Regenerating agriculture: policies and practice for sustainability and self-reliance*. Earthscan; National Academy Press: London, UK; Washington, DC; p. 320.

Schad I, Roessler R, Neef A, Valle Zarate A, Hoffmann V. 2011. Group-based learning in an authoritarian setting? Novel extension approaches in Vietnam's northern uplands. *Journal of Agricultural Education and Extension* **17**(1): 85–98.

Spielman DJ, Ekboir J, Davis K. 2009. The art and science of innovation systems inquiry: applications to sub-Saharan African agriculture. *Technology in Society* **31**(4): 399–405.

Wenger E. 1999. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press: Cambridge, UK.

Yin RK. 2013. *Case Study Research: Design and Methods*. Sage Publications: London, UK.