Exchanges among farmers' collectives in support of sustainable agriculture: From review to reconceptualization

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Abstract

Successful sustainable transitions require an understanding of the drivers and resources needed to support the required changes. While the importance of farmers' collectives in these transitions is underlined by various scientific studies and public policies, we lack an overview of how scholars are dealing with this topic. This paper has two main objectives: i) a review of the studies that explore the interplay between exchanges among collectives and the farmers' transition pathways to sustainable agriculture, and ii) a conceptual framework to analyze this interplay. Drawing on a review of 43 scientific articles, it highlights a variety of possible theoretical and methodological approaches and interpretations to inform our understanding. Based on the literature, we have distinguished four perspectives in this field: i) the way farmers rely on collectives during their transition process; ii) the collectives as complex organizations; iii) the collectives as loci for knowing; and iv) learning processes among collectives. We also show that these studies fail to provide insights on the interplay between the farmers' dynamics of transitioning towards sustainable agriculture and those of the collectives, and the way it contributes to supporting professional transition. To illuminate this interplay, we introduce a conceptual framework based on Deweyian pragmatism and developmental approaches that allows us to analyze the transition process as one of farmer empowerment. We focus on the farmers' experience, on the way they are affected by their working situations, and on how support for inquiry can help them rebuild meaning and continuity in their transitions. This work should contribute to informing the circulation of agroecological knowledge issues and enable stakeholders who support these processes to find the most appropriate levers for a diversity of farmers and farming systems.

Keywords

Sustainable agriculture, transition, collectives, farmers, support, exchanges, experience

Highlights

- We study the possible interplays between farmers' collectives and farmers' transition towards sustainable agriculture.
- Four perspectives of the interplay studied have been distinguished through a literature review
- This article supports the inquiry theory as key to understand the interplay studied.

1 Introduction

Sustainable agriculture seems to be an alternative model to the green revolution paradigm which limits have been long pointed out. Defining sustainable agriculture remains a challenge and is controversial. For the present paper, we define it according to the FAO contribution: "the management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of

continued satisfaction of human needs for present and future generations. Sustainable agriculture conserves land, water, and plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable" (FAO, 1988). Thus, sustainable agriculture can embed several agricultural approaches and practices (soil conservation, agroforestry, agroecology, mixed crop-livestock systems, rotational grazing, organic farming, etc.). Nevertheless, sustainable agriculture does not establish by maintaining existing systems: the entire agri-food system has to be transformed (Elzen et al., 2012). Researchers have invested this issue referring to transition processes which they explore from multiple perspectives raising how complex this phenomenon is. Some scholars addressed transitions as social processes: they acknowledged the transformation of the knowledge production and flow within local networks (Compagnone et al., 2018), or from addressing the regime configuration taking place within the wider socio-technical systems (Ingram, 2015; Bui et al., 2016), or the way such transition is related to a process of social movement building (Anderson et al., 2018). Researchers also addressed transition at farm level. They studied practice change and redesign of farming systems through farmers' trajectories (Lamine et al., 2009; Chantre and Cardona, 2014), and pointed the learning processes during such trajectories (Chantre et al., 2015; Brédart and Stassart, 2017) and the transformation of the farmer's professional world (Coquil et al., 2017).

These last studies invite us to reconsider the support provided to farmers in order to achieve a transition process at the on-farm level. As highlighted by Coquil et al. (2018), facilitating farmers' transition towards a more sustainable agriculture requires a transformation of the agricultural community, e.g., the farmers but also the AKIS (Agriculture Knowledge Innovation System) players (Klerkx et al., 2012). AKIS players have to reconsider their organization and service provision in order to deal with site-specific processes and to better contribute to the farmer's experience development, both being key in the transition process at farmers' level. In order to contribute to this issue, we choose to focus on the link between the way exchanges take place in farmers' collectives and the transition process farmers experienced in their move towards a more sustainable agriculture.

Indeed, public policies and AKIS players propose new support schemes which emphasize the role of farmers' collectives (e.g., Economic and Environmental Interest Grouping in France) and "*the paramount importance of experience sharing as a key factor for success"* during transition to sustainable agriculture[1]. This has also been recently emphasized through stakeholders' mobilization for the establishment of a new Common Agricultural Policy (CAP) for 2020, which calls for more financial support for farmers' collectives and cooperative dynamics, for the "greening of agriculture"[2]. Recent studies have highlighted the fact that transitions towards more ecological based farming systems often take place through collectively constituted peer or multi-actor networks (Proost and Weperen, 2006; Chantre, 2011; Curry et al., 2012; Lucas et al., 2019). Considering peer-to-peer exchanges may be a way of better valuing the various ways of doing and thinking about agriculture, and thus moving away from the duality between specific and generic knowledge (Girard and Magda, 2018) and moving towards what Coolsaet (2016) calls an "agroecology of knowledge". Accordingly,

Blesh and Wolf (2014) describe farmers' networks as spaces where farmers "*generated site-specific knowledge, and [recognize that] in the process of sharing this knowledge they forged connections to the wider sustainable agriculture movement and established an alternative knowledge system*." Such claims relate to previous studies which showed the social dimension of the construction of knowledge (Darré, 1984; Roling and Jiggins, 1998, p. 295; Šūmane et al., 2018) and the role of collectives to develop shared values and a vision of sustainable agriculture norms (Kilpatrick et al., 2003).

Farmers' collectives are investigated through multiple approaches: from social network analysis (Isaac et al., 2007; Bodin and Crona, 2009; Spielman et al., 2011; Isaac, 2012; Wood et al., 2014; Compagnone and Hellec, 2015) to a more comprehensive approach (Goulet, 2013; Prost et al., 2017). Nevertheless, although policy-makers and scholars point out the potential contribution of farmers' collectives in the farmers' transition towards sustainable agriculture, there is a lack of knowledge about the way the exchanges within farmers' collectives influence, in a way or another, the farmers in the flow of their work. Therefore, this article aims to address the question of the interplay between farmers' collective exchanges, and the process of farmers' sustainable agriculture transition, with a wish to explore more specifically how experience-based-exchanges contribute to such transition. To do so, we propose: i) a review of the literature, to set light on how scholars have studied the interplay between farmers' exchanges among collectives and their transition pathways, and ii) a conceptual framework to address this interplay based on the inquiry theory (Dewey, 1938). After presenting our research strategy (Section 2), we describe four perspectives identified through an inductive approach, about how scholars address our question (Section 3). We then discuss the limits of the way the interplay is addressed in the review and the relevance of considering farmers' transition as dynamics for the study of the interplay (Section 4.1) and propose a conceptual framework (Section 4.2) for analyzing the interplay between experience-based exchanges among farmers' collectives and farmer's transitions.

2 Research strategy

Our research strategy was twofold. First, we reviewed the literature to capture scholars' approaches to understanding the interplay between farmers' exchanges among collectives and farmers' transition process towards more sustainable agriculture. Second, we proposed a conceptual framework to fill the gaps that our review identified in the literature with regard to our research question.

For our review process, we followed a procedure that consists of: 1) building a search request in line with our research question; 2) selecting a bibliographic database; and 3) synthesizing the main findings regarding our research question through an inductive and qualitative analysis. The request was built through an iterative protocol to explore multiple possibilities and combinations, and to find a set of papers that matched our research question. Through this iterative process, we used some papers as indicators of the relevance of the term combination. The articles were selected from the Web of Science and CABI databases limited in the time span

(1955–2019) and by their availability. The combination of two databases allowed us to have a wide range of sources, as CABI enabled us to catch more papers from Southern countries. The request below was designed to explore six main themes: agriculture, sustainability, transition, exchanges and collectives, knowledge, and the "empirical" nature of knowledge. Each theme was then specified with words often associated with it (e.g. sustainability with ecology and innovation). The words were put in their root form (e.g. sustain) to capture all possible forms (e.g. sustaining, sustainable)

Title= (farm* OR agro* OR agri*) AND Topics= (*ecolog* OR sustain* OR innov*) AND Topics= (transit* OR learn* OR pathway* OR trajector* OR road*) AND Title= (*group* OR network* OR exchang* OR dialog* OR cooperat* OR shar* OR social) AND Topics= (experi* or know* or practice*) AND Topics= (indigen* OR local* OR empiri* OR tradition* OR peer* OR peasant* OR farm* OR tacit)

The first author proceeded to the selection of relevant papers over 227 references. The table below sums up the procedure used to obtain the final corpus. We thus eliminated articles that:

- did not focus on agricultural activities (climate change, food chains, forestry, policy, and economics) from a sustainability perspective as defined by the FAO, and on the aim of supporting on-farm transition (e.g. support the design of a decision-support system)
- more theoretical papers and papers that lacked methodological transparency or clarity in the presentation of the results.

The analysis was based only on the request results; we did not look for other papers.

The first author performed a qualitative analysis of the selected papers with the grid presented and illustrated in Table 3 in the appendix. It describes the papers through indicators such as: the scope of the research, considerations about farmers' collectives and exchanges, the case study, the conceptual framework, the methodology, the main results and the "take-home message" of the paper. To organize this literature review, we looked at the papers from our own point of view, that is, the ways in which they contribute to understand the literature on farmers' transition process, their collectives and exchanges, and the potential links between these two topics. We thus identified four main perspectives discussed in the next section of this article. Each paper does not necessarily fall into a single category as the authors' investigation was not always directly related to our research question, and could therefore show findings in more than one category. But to simplify the reading, we assigned a paper to a category by considering the "take-home" message of the papers.

The second step was then to build a conceptual framework to address one of the gaps we point out in our literature review: the lack of knowledge to analyze experience-based sharing and to understand its potential contribution to on-farm transitions. We built on the educational literature based on the work of John Dewey (1938) to develop this framework. This theory constitutes an important contribution to the conceptualization of "experience" and how experience transforms and evolves over time and action. We found it fruitful to consider the interplay between farmers' experience-based exchanges among collectives, and their experiences of transition processes towards sustainability.

Step 1: Broad paper search	***Step 2: Merge and eliminate duplications and thematically irrelevant articles by reading titles***	***Step 3: Eliminate articles which do not correspond to the thematic focus, by reading abstracts***	***Step 4: Eliminate articles after a first reading (or the ones not available)***
Web Of Science: 128 **CABI: 220**	227	88	43

Table 1. Selection procedure of papers for the review analysis

3 Four perspectives to address the interplay between farmers' collective dynamics and farmers' transition towards more sustainable agriculture

Our literature review allowed us to identify four perspectives according to the ways the articles address the interplay between farmers' collective dynamics and farmers' transition towards more sustainable agriculture. While in the first perspective, the possible interplay is identified through the analysis of the resources mobilized by farmers during their transition, in the second one the collective dynamics are at the core of the research and less attention is paid to its influence on individuals, and in the third and fourth ones, the attention is clearly on the way knowing and learning developed inside the collectives. In Table 2 below, we identify the various papers that contribute to these perspectives.

Authors' perspective	Description	References from the request results
1/ The farmers rely on collectives during their transition	Analysis of the social environment of farmers engaged in processes of transition towards sustainable agriculture.	(Kroma, 2006; Warner, 2006; Ingram, 2010; Ryschawy et al., 2015; Hayden et al., 2018; Mawois et al., 2019; Wypler, 2019)
2/ The collectives as complex organizations	Analysis of the collectives' characteristics as potentially supporting farmers' transition towards sustainable agriculture.	(Vaarst et al., 2007; David, 2007; Matuschke, 2008; David and Asamoah, 2011; Michael Rosset et al., 2011; Schneider et al., 2012; Lubell et al., 2014; Mashavave et al., 2013; Charatsari et al., 2016; Diaz-José et al., 2016; Manson et al., 2016; Aguilar-Gallegos et al., 2016)
3/ The collectives as loci for knowing	Analysis of farmer-to-farmer interaction or multi-actor one to understand the knowing process of farmers when they transition towards sustainable agriculture	(Millar and Curtis, 1997; Ridley, 2005; Lubell and Fulton, 2007; Faysse et al., 2012; Ingram, 2008; Murphy, 2012; Benyishay and Mobarak, 2013; Kalra et al., 2013; Curry and Kirwan, 2014; Bruce, 2016; Burbi and Hartless Rose, 2016; Girard and Magda, 2018; Phillips et al., 2018; Lucas et al., 2019)
4/ Leaning process among collectives	Analysis of how collectives contribute to learning processes of farmers and under which condition it does in the context of transition towards sustainable agriculture	(Quiroz, 1988; Millar and Curtis, 1997; Collins et al., 2001; Nerbonne and Lentz, 2003; Schneider et al., 2009; Morgan, 2011; Anil et al., 2015; Kraaijvanger et al., 2016; Phuong et al., 2018; Restrepo et al., 2018)

Table 2. The papers which we attributed to one or more perspectives on the interplay between individuals' transition and farmers' collectives dynamics.

3.1 The farmers rely on collectives during their transition

This first perspective aggregates studies which focus on the farmers' environment and the resources that farmers mobilize to learn about innovative practices or face challenges in relation to their transition towards more sustainable agriculture. The role of farmers' collectives is not directly observed or addressed: it is inferred through close examination of the social dimension of farmer's work and the place given by farmers to experience sharing and experimentation, etc. Some authors begin by studying farmers' practices or strategies when they set up sustainable farming (Warner, 2006; Kroma, 2006; Ingram, 2010; Ryschawy et al., 2015; Mawois et al., 2019), before exploring a more social dimension of the farmer's work. For instance, Mawois et al. (2019), through their study of the diversification strategies of farmers introducing legumes, have deduced from interviews that the farmers with the most robust and radical transitions were the ones involved in collectives for experience sharing and in building local references through experimentations. Kroma (2006) went a step further by questioning farmers' opinions about the collectives' benefits and by participating in some collectives' activities for complementing her analysis. She describes these collectives as inclusive and flexible places where farmers can validate their experiences and find mutual support, motivation, reflection, trust.

Kroma also argues that organic farming, as a form of agriculture that triggers an active involvement of farmers in experimentation, steers farmers towards collectives because access to ecological knowledge is less facilitated by research and extension institutions. Ingram (2010) describes the social dimension at stake for farmers practicing tillage reduction. She argues that some individuals value learning by discussing problems when some others are reluctant to share knowledge and to interact with peers because of a fear of criticism, unwillingness to share information with a possible competitor, or a purist approach to reduced tillage technics. Hayden et al. (2018) address the challenges and opportunities that farmers experience when integrating crops and livestock on an organic farm. They consider collectives as communities of practices (CoP) and find they are an opportunity for the mitigation of the dominant farming system with providing an alternative normative environment and aid for management planning. CoP is described as "*critical when deciding to try an integrated system, and vital for ongoing success in such systems*". However, they also note that farmers are embedded in complex learning systems (Oreszczyn et al., 2010) that make it difficult for farmers' collectives alone to meet all the challenges inherent in the transition process, such as financing and insurance, long-term horizons for returns, and county and farm infrastructure. Wypler (2019) also qualifies the influence of support collectives in terms of the effect of its inner dynamics, such as gender domination (e.g., heteropatriarchal discourses that deter LGBT farmers from participating). These authors thus provide a first glimpse of the interplay studied from the point of view of farmers' experiencing transition as they recognize support on addressing problems, accessing to alternative knowledge and norms, and motivation. However, these studies do not deal with the form of the collectives nor how they become part of the farmer's activity over time.

3.2 The collectives as complex Organizations

The second perspective encompasses research studies that specifically analyze the collectives and their characteristics that could influence the interplay between farmers' collectives and their transition to more sustainable agriculture. While some (3.2.1) focus more on the structure of the ties within the collectives to infer the way practices and knowledge spread within and out the collectives, others (3.2.2) pay attention to the methodologies built for the collectives to support the learning processes and then infer the interplay with farmers' transition. None of these approaches pays much attention to the processes taking place at individual level to achieve a transition towards more sustainable agriculture.

3.2.1 3.2.1 A focus on collectives' structure

Some papers (Matuschke, 2008; Lubell et al., 2014; Mashavave et al., 2013; Diaz-José et al., 2016; Manson et al., 2016; Aguilar-Gallegos et al., 2016) draw on an analysis of the collectives' structure to inform the diffusion and adoption of sustainable practices. Most highlight the collectives' structure by the types of relations and the centrality of some clusters within the collectives and within the social landscape to infer its effect on farmers' decision-making and on innovation dissemination. Manson et al. (2016) found that the widespread adoption of

rotational grazing practices reflects existing social and spatial considerations: the number of dairy households in the area, the initial mix of farmers, the sharing of strong ties between neighboring farmers, and the role of space in how collectives are formed. Schneider et al. (2012) adopts an actor-network theory approach (Callon and Latour, 1992) to highlight the fact that the no-tillage concept is a result of a network built between human (farmers, experts, scientists, etc.) and non-human actors (herbicides, earthworms, etc.). In this study, the collectives include a wide range of actors with specific activities that influence the evolution of the no-tillage concept over time and space, and transform each of the actors themselves. Nevertheless, such approaches give little empirical evidence of how the exchanges within the collectives contribute to the farmers' transition process towards more sustainable agriculture.

3.2.2 3.2.2. A focus on methodologies which support collectives

Some studies focus on the methodology of learning and diffusion that supports the collectives and they build correlations to infer the extent to which the collectives participate in the adoption of some practices or concepts related to agroecology. For instance, Rosset et al. (2011) study the Campesino a Campesino movement in Cuba, based on Freire horizontal communication. The collective is built on "farmer-promoters" who devise new solutions or revive traditional ones, and who use popular education methodology to share them with their peers who have the same problems. In Cuba, this movement is led by a local association that structures collectives including farmer-promoters, communication facilitators, collectives' coordinators, etc. Rosset et al. (2011) study the influence of these collectives from a quantitative point of view (i.e., the number of family farmers engaged in the process of agroecological farming) and describe the evolution of farming practices in Cuba since 1959. Other scholars studied Farmer Field School (FFS) cases (David, 2007; Vaarst et al., 2007; David and Asamoah, 2011; Charatsari et al., 2016) to understand the effects of the program methodology on the social capital, knowledge adoption, experimentation and group formation. Based on a survey among FFS and non-FSS farmers about practices and knowledge acquired, David (2007) finds positive results on the effectiveness of the Cameroonian FFS for facilitating discovery learning. She also highlights participants' failure to retain or diffuse concepts and principles (i.e., agroecosystem analysis). On the other hand, Charatsari et al. (2016) find that bonding social capital is the most important aspect affecting farmers' engagement in the learning process. These papers contribute to highlight some organizational characteristics of the collectives and how it influences the interplay with the farmers' transition through the diffusion of sustainable practices and knowledge. Though, these studies lack empirical elements to describe how farmers' interactions do contribute to farmers' transition pathway.

3.3 The collectives as loci for knowing

The third perspective encompasses research studies that address the way some practices or concepts or knowledge are discussed among collectives (Ridley, 2005; Lubell and Fulton, 2007; Faysse et al., 2012; Girard

and Magda, 2018; Lucas et al., 2019). For instance, in their study of the Pâtur'Ajuste collectives, Girard and Magda (2018) analyze the situated interactions between farmers and the development agent during collectives meetings in the field. They ground their approach in Dewey's pragmatism theory and used the experience categories of Rogalski and Leplat (2011) to highlight how farmers' exchanges refer to their local knowledge to infer the appropriate grazing practices and how the agents use this knowledge to argue their expertise. Furthermore, Lucas et al. (2019) considered the arrangements that take place in inter-farm co-operation collectives to understand their contribution to sustainable transition processes. She analyses several French machinery co-ops (CUMA) through an analytical framework in which she identifies the multidimensional nature of the co-operation, its processual nature (e.g., technical dialogues, sharing arrangements, etc.) and its positive or negative effects. She specifies five ways in which local inter-farm co-operation helps farmers in the development of sustainable agriculture: the satisfaction of new material needs induced by diversification, the facilitation of self-provisioning, and the reorganization of work patterns, the management of uncertainty and risk, and the emergence of technical dialogues that encourage the coproduction of local knowledge. Some scholars also studied the contribution of digital collectives to the farmer-to-farmer communication or the farmer-to-extension services one (Bruce, 2016; Burbi and Hartless Rose, 2016; Phillips et al., 2018). Phillips et al. (2018) analyzed the content of Facebook groups and interpreted the use of publishing and commenting as a supportive and positive contribution to the validation of knowledge, the on-farm decision-making, changes in farm management thinking, modes of operation, and strategic management. They argue that personal storytelling occurring in the conversations is a powerful and effective without necessarily having existing social relationships. Other scholars focus more specifically on some variables which can explain the differences they identify between the ways such processes take place within collectives (Ingram, 2008; Murphy, 2012; Benyishay and Mobarak, 2013; Kalra et al., 2013; Curry and Kirwan, 2014). Benyishay and Mobarak (2013) studied the effect of the position of the spokesperson (e.g., farmer leader, farmer peer) and found that peer farmers who faced conditions most comparable to those of the target farmers are the most persuasive about practice adoption. Ingram (2008) found evidence that farmer-agronomist interaction can be effective for knowledge exchange and practice transformation when it is built on a willingness to learn from each other, on an understanding of the farmer's situation, and on an accommodation of each other's knowledge. These papers address the interplay studied from the multiple functions and conditions that influence interaction and cooperation among farmers alone or with other stakeholders. However, the studies do not account for the way these elements process the farmers' transition.

3.4 Learning processes among collectives

Others analyzed the way the collectives contribute to foster learning processes among collectives (Quiroz, 1988; Millar and Curtis, 1997; Collins et al., 2001; Nerbonne and Lentz, 2003; Schneider et al., 2009; Morgan, 2011; Anil et al., 2015; Kraaijvanger et al., 2016; Phuong et al., 2018; Restrepo et al., 2018). For instance,

Restrepo et al. (2018) evaluated a two-year collaborative learning process for finding sustainable pathways to reduce milk losses, with two dairy farmer groups in Kenya. They used the evaluation framework of Kilpatrick (1998) to highlight: farmers' reactions about the process; learning in theory and practice, the change of action on the basis of the new knowledge; and the benefits from these changes. Based on farmers' answers, they showed that farmers learned by: (1) implementing corrective actions based on known cause–effect relations (single-loop learning); (2) discovering new cause–effect relations and testing their effect (double-loop learning); and (3) further questioning and changing their aims (triple-loop learning). Other authors used the Community of Practice (CoP) framework (Lave and Wenger, 1991) to study the role of collectives in the dissemination of knowledge and their effectiveness in social learning (Anil et al., 2015; Morgan, 2011). For instance, Morgan (2011) developed an understanding of the emergence, evolution and role of the groups in terms of social learning by describing: the "mutual engagement" of members through interaction and norms negotiated around their activity; "joint enterprises" that bind farmers together through a sense of mutual accountability; and "shared repertoire" of practices adopted by the members involved in the community. Through the description of these dimensions for three groups of farmers converting to organic, Morgan (2011)concluded that social learning is influenced by the working style of farmers, as the interactions and degree of collaboration are differentiated on the basis of the perceived identity of peers as for instance the understanding of the organic agriculture concept. These papers address the interplay studied from the learning process that takes place among farmers' collectives whether it is an experiment or social-based process. However, they do not enlighten how the learning process among collectives contribute to on-farm activity and how the farmers manage their learning process when facing so diverse working environments.

To sum up, this review highlights four perspectives from which scholars addressed the possible interplays between farmers' transition and the participation to collectives' exchanges (Figure 1). These four perspectives mobilize a wide range of theoretical and methodological approaches, leading to a non-unified vision. The interplays highlighted vary widely, thus revealing the complexity of the relationships that can exist between the farmers' transition and the participation of farmers in collectives or in groups of stakeholders who, to a greater or lesser degree, share the challenge of transitioning towards sustainability at the farm level.

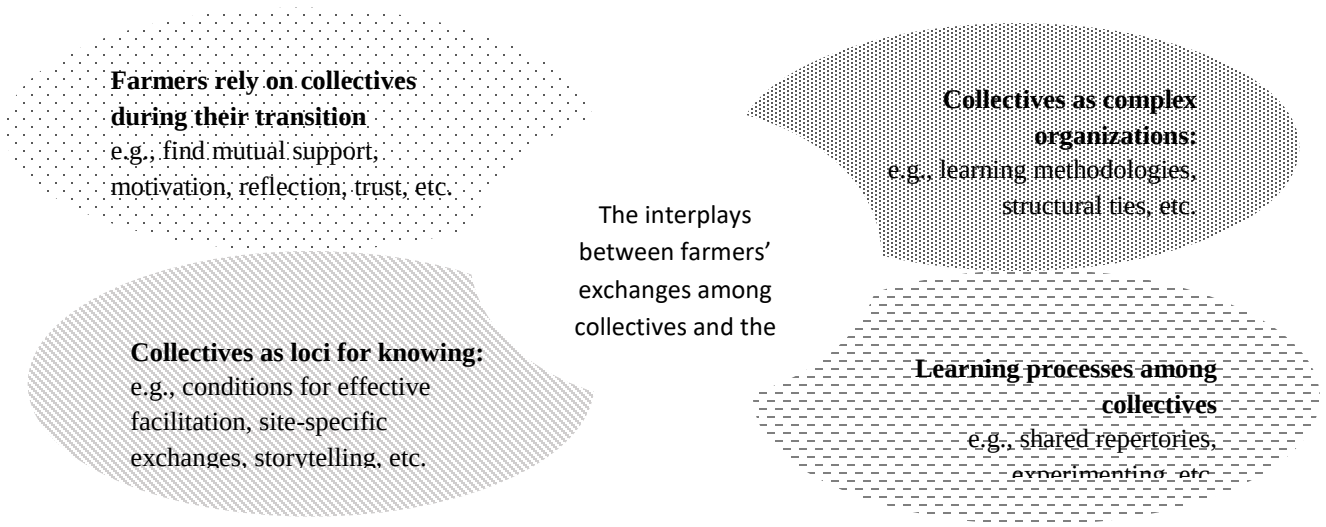

Figure 1. Organizing the literature review to see the way authors address farmers' transition processes, exchanges in the collectives and the links between the two in relation to sustainable agriculture.

4 Towards an integrative framework to explore the interplay between farmers' exchanges and transition towards sustainable transition

4.1 From an analysis of the review to the conceptual framework

In Section 3, we show that the studies which discuss the interplays between farmers' collectives and the transition to sustainability are far from providing a unified vision of how collectives and exchanges contribute to facilitating farmers' development of sustainable practices and knowledge. We lack information about how farmers' transition towards sustainable agriculture as a dynamic process in which collectives contribute to farmers' activity, and not only as a process of adopting farming practices considered to be more sustainable. As our review has highlighted, transitioning involves many technical, social and educational dimensions; it makes it difficult to grasp how collectives actually contribute to this dynamic. We argue that an investigation of transition dynamics would afford some insight into the compromises constantly facing farmers within their process of transition and adaptation. It would also improve our understanding of the collectives' contribution to learning, guiding and rethinking the farmers' activity and their relationship to their working situations. To illustrate this claim, we could seek to understand how the collectives can support farmers in improving their capacity for critical analysis and action when they are faced with a specific problem, as Kroma (2008) has suggested.

Adopting such a perspective means understanding how exchanges match farmers' challenges and working environment, and how they influence their transition process. Beyond the question of adopting or changing

agricultural practices, various studies have shown that transitions towards more sustainable farming systems actually lead to transformations of the farmers themselves: their worldview, their values, their work organization, and so on (Lamine, 2011; Chantre et al., 2013; Barbier et al., 2015; Coquil et al., 2017; Cristofari et al., 2017; Dupré et al., 2017; Chizallet et al., 2018; Toffolini et al., 2019). Although such studies were conducted for various purposes and through different approaches, they all point out that the transition process towards sustainability is much more complex than just filling knowledge gaps or adopting new recommended practices (Coquil et al., 2018). They show that the farmers experiencing such transition have to reconsider the entire relationship built with their human and non-human environment. They highlight the constant tensions between past experiences, organization and work routines, and the new knowledge, experiences, ways of thinking and expectations. To highlight this, most of these authors proceed by a retrospective long-term analysis of the transition process (Lamine et al., 2009; Chantre et al., 2013; Coquil et al., 2017), based on farmers' narratives. Only a few undertake a longitudinal approach to transition in the making, as Chizallet et al. (2020) have done.

So how can we understand this interplay between the dynamics of exchanges within the farmers' collectives, and the transition in which a farmer is engaged? How can we capture the way in which such collectives support farmers in overcoming the discontinuities that have been pointed out by some authors (Beghuin et al., 2019) during the transition towards sustainability? The concept of experience as developed by Dewey (1938) is key to our proposal, as it enables us to capture the diverse dimensions of the farmers' professional socio-ecosystem, including the contribution of collectives to transforming farmers' experience of their working environment.

4.2 A conceptual framework to analyze the processual interplay between farmers' collectives and their professional transition

4.2.1 Defining professional transition

As highlighted in the review, studying the interplays between collectives and farmers' transition goes along with studying their knowing and learning processes, not only what they are learning, but how they do so and what triggers it. Our conceptual framework is a continuation of these approaches intended to show how learning and change can occur in the flow of a farmer's activities. As there is no unified definition of transition in the papers that we reviewed, We considered studies that consider sustainable transition as professional transformation (Chantre et al., 2015; Coquil et al., 2017; Chizallet et al., 2020). Following Masdonati and Zittoun (2012), we suggest that such transitions are characterized by three interdependent processes:

- *Identity remodelling* induced by the change of position in a given social field, and by the dynamics of peer recognition or lack of recognition;
- *Acquisition of new social, professional, cognitive and technical skills* to act on new work situations through engagement in learning or adjustment;

- *Construction of meaning in the individual's experience*. This involves standing back from a lived experience and reframing it, as compared to previous experiences. The emotional experience of these transitions, as well as evaluations of situations of past experiences, can then be integrated, thus contributing to the reconstruction of continuity in the individual's pathway.

Although this type of description is usually used in psycho-sociology to describe phenomena such as professional conversion, we found it relevant to the changes that underlie transition towards more sustainable agriculture at an individual level. It allows us to explore such transitions by considering changes in the praxis, identity, cognitive, social and experiential dimensions of individuals. Our framework is thus designed to identify how exchanges among collectives support the three interdependent processes. It is nevertheless difficult not to get lost in the complexity of these processes due to their personal nature, which is why we mobilize pragmatist theory to partially overcome these pitfalls, as explained below.

4.2.2 Experience as a fruitful concept

We postulate that farmers' professional transitions are processes in which their experiences are reframed in order to transform not only their farming activities but also themselves. As Dewey (1887) described and Bourgeois (2013) later emphasized, experience includes interdependent dimensions (cognitive, affective, conative, and body) that together contribute to individual coherence and continuity in the flow of one's activity. Although experience is far from being a simple concept to work with, given its polysemic nature (Rogalski and Leplat, 2011; Beaujouan et al., 2013; Osty, 2013; Barbier and Thievenaz, 2013; Maillot, 2013), we think it is a fruitful direction for understanding how the links are woven between the farmers' activity and the multiple resources they act with. In particular, in the context of sustainable agriculture where some scholars are calling for a profound redesign of farming systems, considering farmers' experience seems an interesting way to understand how they manage discontinuity and continuity on their pathways. Yet the transformation of farmers' experience can go unseen (Jullien, 2009), especially when the focus is only on long trajectories and critical events on their pathway. It is therefore necessary to look at the lived situations affecting the individuals in the flow of their activities, and not only the technical ones but more broadly also those which they consider as crucial for being effective and efficient in their lives, at least from a professional point of view. As experience transforms, individuals review their previous experiences from a new perspective, develop useful resources to act on and with the environment, and put their experience into words to create a common understanding with others (Thievenaz, 2019). Dewey argued that experience emerges from reflexively linking one's action with the consequences: "When an activity is continued into the undergoing of its consequences, when the change made by action is reflected upon into a change made into us, the flux is loaded with significance" (Dewey, 1916; cited in McDermott, 1973: 495)

4.2.3 The experiential environment transformation

To further understand the processes of experience reframing, the pragmatist perspective leads us to focus on farmers' work situations. These situations are considered not as contexts, but as "**experiential environments**" (Dewey, 1938). They are not only environments in which individuals live, but environments that offer the means through which and on which the individuals have to act and build compromises. In their environments, farmers must act on or with the agroecosystem and with many technical, material, economic and social dimensions. Moreover, the farmers as subjects are not neutral, they influence their environment through their way of acting, thinking, valuing, being affected, and so on, which make the "experiential environment" singular. We introduce this notion because we believe that we could improve our understanding farmers' transition by investigating not only the structures of their farming activities but also the significance of every relationship they built in working with their environment, whether it is conflictual, binding or facilitating. So how is the experiential environment transformed? Dewey argued that not every working situation encountered by individuals is equivalent in its ability to reframe their experience.

He pointed out that specific situations trigger the transformation of experiential environments: the indeterminate situations which arise from an individual's ability to be surprised, embarrassed, doubtful, and so on. In these situations, the individual experiences a tension caused by a rupture between the known means to deal with a situation and the actual consequences. To resolve this tension and go back to a balanced experiential environment, the individual has to be involved in building and experimenting new means of action. Dewey thus put forward a learning theory, the inquiry (1938), to describe how individuals shift from an indeterminate situation to a well-balanced experiential environment. The inquiry process helps not only to understand the links between action and its consequences, but also to understand them in a way that supports new means of action to restore the flow of their activity. The inquiry is an iterative process through which individuals identify and formulate what composes the problem in the situation, suggest possible solutions, use deductive reasoning to identify the most feasible and effective solution, and finally experiment with the solutions temporarily chosen. The inquiry process ultimately makes it possible to produce intelligibility in the situation and new means, which make it possible to re-establish continuity in action and consequently the continuity of the individual's experience and meaning. This process is not linear; it unfolds over time and through diverse work and personal situations. We therefore propose to rethink the learning of farmers in transition as a process of inquiry embedded in their experiential environment.

4.2.4 Inducing inquiry to support farmers' transition

Seeing how the experiential environment is transformed through inquiry leads us to an interesting path to understand the interplay we want to explore. In fact, we believe that the interplay is about collectives supporting the inquiry process of farmers transforming their experiential environment. To analyze this support, we draw on studies from the educational field, such as that of Fabre and Musquer (2009) about inducing

problematization behaviors, Wood et al. (1976) and Vial and Caparros-Mencacci (2007) about scaffolding as a support to problem-solving, and Mayen (2002, 2014, 2018) about learning from working situations. Supporting inquiry is about fostering some inducers of the inquiry by taking into account the experiential environment, whether by problematizing a situation experienced by a farmer or by introducing new inferences built on cognitive, affective, conative and body-part dimensions, to build new means. Figure 2 summarizes these theoretical propositions.

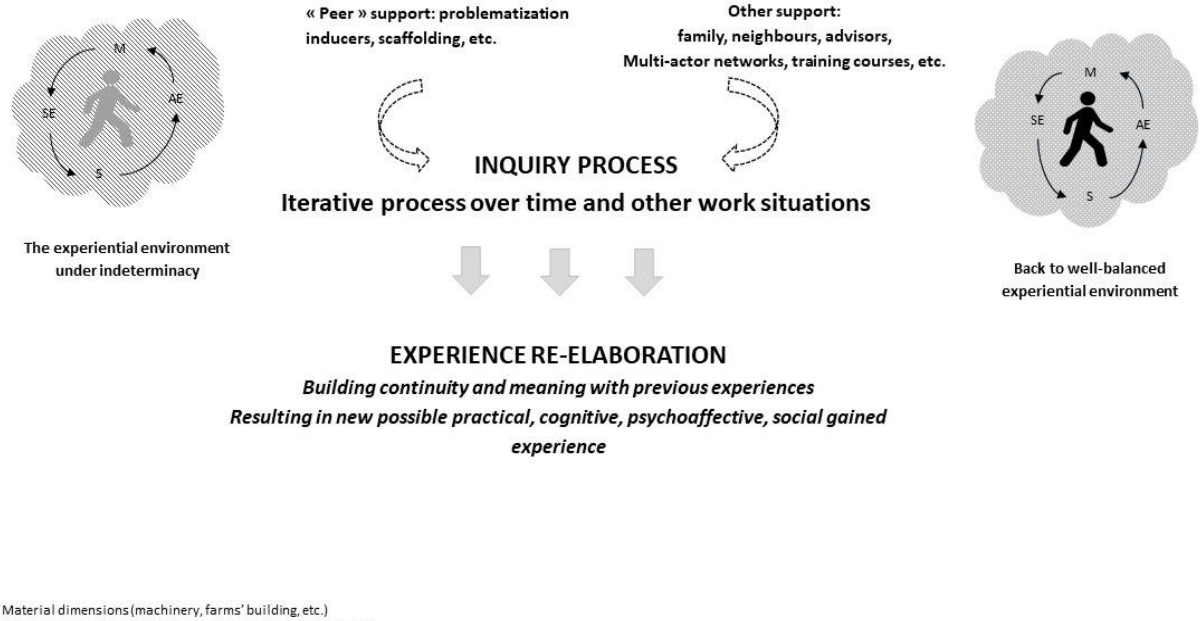

Figure 2. The conceptual framework describing the processual interplay between farmers' experiential environment and the peer collectives support for the inquiry process

As Dewey argued in his judgment theory (1938), not all suggestions are to become ideas for the one experiencing indeterminacy: "The suggestion becomes an idea when we wonder whether it is functionally appropriate; if it can be a way to solve a given situation" (1938: 175). Thus, supporting the inquiry process cannot be disconnected from knowing the farmers' experiential environments to understand their point of view on the problems they face. This is why we think that "peer" collectives are a most relevant space (Ruault and Lemery, 2009) to address and support the inquiry. Darré (1984) showed that "peers" are the ones who share professional norms and common concerns about their activities to develop concrete solutions. Guiding the AKIS players and multi-actor collectives towards the support of inquiry that arises from individuals and their

own concerns can therefore be an interesting avenue to address sustainable agriculture challenges. As Ruault and Lemery (2009) put it, building "relevant collectives" suggests the need to "adapt the configuration of the group and the scale of work according to the nature and progress of the problems."

4.2.5 Some methodological considerations

From a methodological point of view, this is a matter of building a framework to study, over time, both the exchanges in collectives and the experiential environment of farmers who are actively involved in transition. Longitudinal follow-up of farmers' collectives engaged in transition towards more sustainable agriculture will make it possible to collect the content exchanged, that is, data on the exchange situation, and to analyze it through the lens of whatever induces and supports inquiry. At the same time, based on elicitation methodology (Vermersch, 1994), interviews with the farmers participating in the collectives will make it possible to examine their overall experiential environments at a given point in time, and to look at how the exchanges are or are not transforming them. To capture this transformation, it is also necessary to look at the way in which the farmers are affected — what disturbs, contradicts, pleases, or frightens them — to highlight a potential process of inquiry. We can thus investigate the element of the experiential environment that is indeterminate.

5 Conclusion

In this article, we highlighted the interplay between exchanges among farmers' collectives and farmers' transition towards more sustainable agriculture, by first conducting a comprehensive literature review and then proposing a conceptual framework. Our analysis of the literature points to a variety of possible approaches and interpretations for understanding the contribution of collectives to farmers' transition to sustainable agriculture, as perceived from multiple angles. But our review also reveals that the way the collectives affect a farmer's transition process (his/her way of farming, thinking and being a farmer) remains a blind spot. We therefore propose a conceptual framework based on Dewey's pragmatism and the developmental approaches inspired by it. The framework suggests considering the transformation of farmers' experiential environment through peer collectives' support of their inquiry process. Such an approach could lend more substance to an exploration of "the power of collectives", so often put forward as a key factor in the dynamics of supporting transitions to sustainability.

Our work led us to consider farmers' transitions as professional transitions, in particular through the concept of the experiential environment. Brédart and Stassart (2017) seem to go in a similar direction, highlighting the fact that farmers learn through "dialog" with their practices, as they give meaning to events and link them to the course of action. This concept of dialog does not however explain the structural obstacles and opportunities in the transformation of farming systems (Rodriguez et al., 2009). It supports the idea that farmers construct a singular meaning of them, through a point of view on the situation. The concept of experiential environment makes it possible to investigate the farmers' perception of the problems to be addressed in their working

situations. It thereby enables us to recognize that farmers' working situations are singular and that not all individuals have the same ability and means to address their problematic situations. It suggest that experiential learning among farmers' as addressed by Chantre (2011) and Catalogna et al. (2018) is to be addressed through critical thinking of the functional balance of new inferences in the situation. As Heinrich et al. (2015) emphasized, to operationalize experiential learning we have to consider farmers' zone of proximal development (Vygotsky, 1978), to help them connect new knowledge and situations with their familiar work situations they already understand.

This work is in line with previous studies that highlight the necessity to break away from the diffusion of innovation paradigm (Cerf et al., 2017) and to focus more on horizontal experience-based exchanges which can afford new perspectives for innovative training strategies for rural extensionists (Landini et al., 2017). It argues for a renewed vision of farming transitions which transforms not only technical dimensions but also farmers themselves as subjects and workers, as Coquil et al. (2017) have already highlighted. It also describes an iterative process of constant readjustment (Brédart and Stassart, 2017) of farmers' experiential environment, and emphasizes the transformation of farmers' work as an interesting entry to address farmers' transition. This opens up the question of the ability of advisory services to provide support based on the involvement of farmers in their own problematization of their experiential environment. Our work suggests that support is not only about sharing innovative practices among collectives, whether composed of peers or other stakeholders as in PEI-AGRI focus groups, and should rather consider inducing and facilitating inquiry among relevant collectives that share common concerns. In managing innovation processes (Klerkx et al., 2012) one has to consider using experiments or generic knowledge when it can nourish the farmer's perception of the problem and its resolution. Developing skills that support farmers' inquiry process can be considered as an intermediation skill to help on-farm redesign (Cerf et al., 2017) to overcome cognitive and psycho-affective barriers. We also suggest that such skills could benefit from professional discussions among advisers on their own work situations (Cerf et al., 2011) to help them become more aware of how they think about their work and interact with farmers (Cerf and Hemidy, 2007; Coquil et al., 2018). The role of AKIS players is crucial as it has to support inducing inquiry, through dialog, and provide farmers with relevant information, according to the problem to be solved.

6 Footnotes

[1] Minister of Agriculture, Agri-Food and Forestry (2014). First International Symposium on Agro-ecology at FAO: Food Security and Nutrition as Major Issues. Press release.

[2] Supporting collectives and the next CAP, a proposed framework from three organizations participating in Another Common Agricultural Policy (CAP) platform: CIVAM, TRAME and CUMA.

7 Acknowledgement

We would like to thank the CASDAR project Agor@gro, AgroParisTech and the department ACT of INRAE for the financial support. We also thank the reviewers for their precious and helpful advice and Liz Carey Libbrecht for language editing the English version of this paper.

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9 Appendix

Reference	Subject(s) studied	Questions	Considerations about farmers' collectives and exchanges	Case study	Conceptual framework	Methods	Results	Take home message of the paper
Hayden, J., S. Rocker, H. Phillips, B. Heins, A. Smith, et K. Delate. « The importance of social support and communities of practice: farmer perceptions of the challenges and opportunities of integrated crop-livestock systems on organically managed farms in the northern U.S. » Sustainability 10, no 12 (2018): 4606.	Challenges and opportunities experienced by farmers interested in integrating crops and livestock on organically managed farms.	What challenges and opportunities do farmers experience, or perceive, regarding integrating crops and livestock that are relevant to organically managed farms? In what instances do the opportunities of integration mitigate the challenges? Which challenges of integration are perceived, or experienced, as being unmitigated or beyond the control of farmers?	Most impacted variable for adoption is "access to and quality of information, financial capacity, and being connected to agency or local collectives' of farmers or watershed groups". They question the influence of micro variables as farmer experience, and the influence of some macro and meso level factors such as information collectives. They question the influence of collectives on building farmers' identity.	Iowa, Pennsylvania or Minnesota Livestock farmers and organic prioritised The total number of participation incidences was 51 over two years: 21 focus group participants and 30 interviewees Three farmer focus groups (21 farmers total) were conducted between July and August 2016 for observation.	Some CoP theoretical background but not used as a theoretical framework	Interview questions: understand a farmer's current system, experience with integrating crops and livestock, challenges and opportunities regarding integration, how research could support their work, and preferred outreach methods and channels The resulting transcriptions were analyzed using traditional qualitative coding techniques aided by the Dedoose web app. Two broad categories of "parent" codes: challenges and opportunities. The emergent child codes like: farmer partnerships or stocking density.	- Identification of four challenges (farming norms, complexity of management, biophysical conditions, financial costs) and four opportunities (increasing support for ICLS, financial & labor advantages, biophysical improvements), animal welfare) - They show how the challenges are mitigated by the opportunities as intensive management by growing communities of practice where peer knowledge exchange and peer support aid management planning, and/or through novel farmer partnerships connecting graziers with crop growers. Or cover crop challenges by growing communities of practice where peer knowledge exchange and peer support aid cover crop troubleshooting.	This study supports evidence from these integrative approaches, suggesting that farmers' social collectives' and communities of practice play an important role in enabling farmer agency within the structural constraints of a global food system that reifies the dominant conventional model of agriculture. They underscore the importance of external resources that are beyond the control of farmers, such as policy and county-level infrastructure.

Table 3. Excerpt of the analysis framework of the reviewed papers.