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1 Exchanges among farmers' collectives in support of 2 sustainable agriculture: from review to 3 reconceptualization 4

5 **Abstract**

6 Successful sustainable transitions require an understanding of the drivers and resources needed to support the
7 required changes. While the importance of farmers' collectives in these transitions is underlined by various
8 scientific studies and public policies, we lack an overview of how scholars are dealing with this topic. This
9 paper has two main objectives: i) a review of the studies that explore the interplay between exchanges among
10 collectives and the farmers' transition pathways to sustainable agriculture, and ii) a conceptual framework to
11 analyze this interplay. Drawing on a review of 43 scientific articles, it highlights a variety of possible theoretical
12 and methodological approaches and interpretations to inform our understanding. Based on the literature, we
13 have distinguished four perspectives in this field: i) the way farmers rely on collectives during their transition
14 process; ii) the collectives as complex organizations; iii) the collectives as loci for knowing; and iv) learning
15 processes among collectives. We also show that these studies fail to provide insights on the interplay between
16 the farmers' dynamics of transitioning towards sustainable agriculture and those of the collectives, and the way
17 it contributes to supporting professional transition. To illuminate this interplay, we introduce a conceptual
18 framework based on Deweyian pragmatism and developmental approaches that allows us to analyze the
19 transition process as one of farmer empowerment. We focus on the farmers' experience, on the way they are
20 affected by their working situations, and on how support for inquiry can help them rebuild meaning and
21 continuity in their transitions. This work should contribute to informing the circulation of agroecological
22 knowledge issues and enable stakeholders who support these processes to find the most appropriate levers for
23 a diversity of farmers and farming systems.
24
25

26 **Keywords**

27 Sustainable agriculture, transition, collectives, farmers, support, exchanges, experience
28

29 **Highlights**

- 30 • We study the possible interplays between farmers' collectives and farmers' transition towards
31 sustainable agriculture.
- 32 • Four perspectives of the interplay studied have been distinguished through a literature review
- 33 • This article supports the inquiry theory as key to understand the interplay studied.
34

35 **1 Introduction**

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

40 continued satisfaction of human needs for present and future generations. Sustainable agriculture conserves
41 land, water, and plant and animal genetic resources, and is environmentally non-degrading, technically
42 appropriate, economically viable and socially acceptable” (FAO, 1988). Thus, sustainable agriculture can
43 embed several agricultural approaches and practices (soil conservation, agroforestry, agroecology, mixed crop-
44 livestock systems, rotational grazing, organic farming, etc.). Nevertheless, sustainable agriculture does not
45 establish by maintaining existing systems: the entire agri-food system has to be transformed (Elzen et al., 2012).
46 Researchers have invested this issue referring to transition processes which they explore from multiple
47 perspectives raising how complex this phenomenon is. Some scholars addressed transitions as social processes:
48 they acknowledged the transformation of the knowledge production and flow within local networks
49 (Compagnone et al., 2018), or from addressing the regime configuration taking place within the wider socio-
50 technical systems (Ingram, 2015; Bui et al., 2016), or the way such transition is related to a process of social
51 movement building (Anderson et al., 2018). Researchers also addressed transition at farm level. They studied
52 practice change and redesign of farming systems through farmers’ trajectories (Lamine et al., 2009; Chantre
53 and Cardona, 2014), and pointed the learning processes during such trajectories (Chantre et al., 2015; Brédart
54 and Stassart, 2017) and the transformation of the farmer’s professional world (Coquil et al., 2017).
55 These last studies invite us to reconsider the support provided to farmers in order to achieve a transition process
56 at the on-farm level. As highlighted by Coquil et al. (2018), facilitating farmers’ transition towards a more
57 sustainable agriculture requires a transformation of the agricultural community, e.g., the farmers but also the
58 AKIS (Agriculture Knowledge Innovation System) players (Klerkx et al., 2012). AKIS players have to
59 reconsider their organization and service provision in order to deal with site-specific processes and to better
60 contribute to the farmer’s experience development, both being key in the transition process at farmers’ level.
61 In order to contribute to this issue, we choose to focus on the link between the way exchanges take place in
62 farmers’ collectives and the transition process farmers experienced in their move towards a more sustainable
63 agriculture.

64 Indeed, public policies and AKIS players propose new support schemes which emphasize the role of farmers’
65 collectives (e.g., Economic and Environmental Interest Grouping in France) and “*the paramount importance*
66 *of experience sharing as a key factor for success*” during transition to sustainable agriculture¹. This has also
67 been recently emphasized through stakeholders’ mobilization for the establishment of a new Common
68 Agricultural Policy (CAP) for 2020, which calls for more financial support for farmers’ collectives and
69 cooperative dynamics, for the “greening of agriculture”². Recent studies have highlighted the fact that
70 transitions towards more ecological based farming systems often take place through collectively constituted
71 peer or multi-actor networks (Proost and Weperen, 2006; Chantre, 2011; Curry et al., 2012; Lucas et al., 2019).
72 Considering peer-to-peer exchanges may be a way of better valuing the various ways of doing and thinking
73 about agriculture, and thus moving away from the duality between specific and generic knowledge (Girard and
74 Magda, 2018) and moving towards what Coolsaet (2016) calls an “agroecology of knowledge”. Accordingly,

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

81 Farmers' collectives are investigated through multiple approaches: from social network analysis (Isaac et al.,
82 2007; Bodin and Crona, 2009; Spielman et al., 2011; Isaac, 2012; Wood et al., 2014; Compagnone and Hellec,
83 2015) to a more comprehensive approach (Goulet, 2013; Prost et al., 2017). Nevertheless, although policy-
84 makers and scholars point out the potential contribution of farmers' collectives in the farmers' transition
85 towards sustainable agriculture, there is a lack of knowledge about the way the exchanges within farmers'
86 collectives influence, in a way or another, the farmers in the flow of their work. Therefore, this article aims to
87 address the question of the interplay between farmers' collective exchanges, and the process of farmers'
88 sustainable agriculture transition, with a wish to explore more specifically how experience-based-exchanges
89 contribute to such transition. To do so, we propose: i) a review of the literature, to set light on how scholars
90 have studied the interplay between farmers' exchanges among collectives and their transition pathways, and ii)
91 a conceptual framework to address this interplay based on the inquiry theory (Dewey, 1938). After presenting
92 our research strategy (Section 2), we describe four perspectives identified through an inductive approach, about
93 how scholars address our question (Section 3). We then discuss the limits of the way the interplay is addressed
94 in the review and the relevance of considering farmers' transition as dynamics for the study of the interplay
95 (Section 4.1) and propose a conceptual framework (Section 4.2) for analyzing the interplay between
96 experience-based exchanges among farmers' collectives and farmer's transitions.

97

98

99 **2 Research strategy**

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

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

110 (1955–2019) and by their availability. The combination of two databases allowed us to have a wide range of
111 sources, as CABI enabled us to catch more papers from Southern countries. The request below was designed
112 to explore six main themes: agriculture, sustainability, transition, exchanges and collectives, knowledge, and
113 the “empirical” nature of knowledge. Each theme was then specified with words often associated with it (e.g.
114 sustainability with ecology and innovation). The words were put in their root form (e.g. sustain) to capture all
115 possible forms (e.g. sustaining, sustainable)

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

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

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

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

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

138 The second step was then to build a conceptual framework to address one of the gaps we point out in our
 139 literature review: the lack of knowledge to analyze experience-based sharing and to understand its potential
 140 contribution to on-farm transitions. We built on the educational literature based on the work of John Dewey
 141 (1938) to develop this framework. This theory constitutes an important contribution to the conceptualization of
 142 “experience” and how experience transforms and evolves over time and action. We found it fruitful to consider
 143 the interplay between farmers’ experience-based exchanges among collectives, and their experiences of
 144 transition processes towards sustainability.

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

145 *Table 1. Selection procedure of papers for the review analysis*

146

147 **3 Four perspectives to address the interplay between farmers’ collective**
 148 **dynamics and farmers’ transition towards more sustainable agriculture**

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

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

158

159 **3.1 The farmers rely on collectives during their transition**

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

173 Kroma also argues that organic farming, as a form of agriculture that triggers an active involvement of farmers
174 in experimentation, steers farmers towards collectives because access to ecological knowledge is less facilitated
175 by research and extension institutions. Ingram (2010) describes the social dimension at stake for farmers
176 practicing tillage reduction. She argues that some individuals value learning by discussing problems when some
177 others are reluctant to share knowledge and to interact with peers because of a fear of criticism, unwillingness
178 to share information with a possible competitor, or a purist approach to reduced tillage technics. Hayden et al.
179 (2018) address the challenges and opportunities that farmers experience when integrating crops and livestock
180 on an organic farm. They consider collectives as communities of practices (CoP) and find they are an
181 opportunity for the mitigation of the dominant farming system with providing an alternative normative
182 environment and aid for management planning. CoP is described as “*critical when deciding to try an integrated*
183 *system, and vital for ongoing success in such systems*”. However, they also note that farmers are embedded in
184 complex learning systems (Oreszczyn et al., 2010) that make it difficult for farmers’ collectives alone to meet
185 all the challenges inherent in the transition process, such as financing and insurance, long-term horizons for
186 returns, and county and farm infrastructure. Wypler (2019) also qualifies the influence of support collectives
187 in terms of the effect of its inner dynamics, such as gender domination (e.g., heteropatriarchal discourses that
188 deter LGBT farmers from participating). These authors thus provide a first glimpse of the interplay studied
189 from the point of view of farmers’ experiencing transition as they recognize support on addressing problems,
190 accessing to alternative knowledge and norms, and motivation. However, these studies do not deal with the
191 form of the collectives nor how they become part of the farmer’s activity over time.

192

193 **3.2 The collectives as complex Organizations**

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

201

202 *3.2.1 3.2.1 A focus on collectives’ structure*

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

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

217

218 3.2.2 3.2.2. *A focus on methodologies which support collectives*

219 Some studies focus on the methodology of learning and diffusion that supports the collectives and they build
220 correlations to infer the extent to which the collectives participate in the adoption of some practices or concepts
221 related to agroecology. For instance, Rosset et al. (2011) study the Campesino a Campesino movement in Cuba,
222 based on Freire horizontal communication. The collective is built on "farmer-promoters" who devise new
223 solutions or revive traditional ones, and who use popular education methodology to share them with their peers
224 who have the same problems. In Cuba, this movement is led by a local association that structures collectives
225 including farmer-promoters, communication facilitators, collectives' coordinators, etc. Rosset et al. (2011)
226 study the influence of these collectives from a quantitative point of view (i.e., the number of family farmers
227 engaged in the process of agroecological farming) and describe the evolution of farming practices in Cuba since
228 1959. Other scholars studied Farmer Field School (FFS) cases (David, 2007; Vaarst et al., 2007; David and
229 Asamoah, 2011; Charatsari et al., 2016) to understand the effects of the program methodology on the social
230 capital, knowledge adoption, experimentation and group formation. Based on a survey among FFS and non-
231 FFS farmers about practices and knowledge acquired, David (2007) finds positive results on the effectiveness
232 of the Cameroonian FFS for facilitating discovery learning. She also highlights participants' failure to retain or
233 diffuse concepts and principles (i.e., agroecosystem analysis). On the other hand, Charatsari et al. (2016) find
234 that bonding social capital is the most important aspect affecting farmers' engagement in the learning process.
235 These papers contribute to highlight some organizational characteristics of the collectives and how it influences
236 the interplay with the farmers' transition through the diffusion of sustainable practices and knowledge. Though,
237 these studies lack empirical elements to describe how farmers' interactions do contribute to farmers' transition
238 pathway.

239

240 **3.3 The collectives as loci for knowing**

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

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

273

274 **3.4 Learning processes among collectives**

275 Others analyzed the way the collectives contribute to foster learning processes among collectives (Quiroz,
276 1988; Millar and Curtis, 1997; Collins et al., 2001; Nerbonne and Lentz, 2003; Schneider et al., 2009; Morgan,
277 2011; Anil et al., 2015; Kraaijvanger et al., 2016; Phuong et al., 2018; Restrepo et al., 2018). For instance,

278 Restrepo et al. (2018) evaluated a two-year collaborative learning process for finding sustainable pathways to
279 reduce milk losses, with two dairy farmer groups in Kenya. They used the evaluation framework of Kilpatrick
280 (1998) to highlight: farmers' reactions about the process; learning in theory and practice, the change of action
281 on the basis of the new knowledge; and the benefits from these changes. Based on farmers' answers, they
282 showed that farmers learned by: (1) implementing corrective actions based on known cause–effect relations
283 (single-loop learning); (2) discovering new cause–effect relations and testing their effect (double-loop
284 learning); and (3) further questioning and changing their aims (triple-loop learning). Other authors used the
285 Community of Practice (CoP) framework (Lave and Wenger, 1991) to study the role of collectives in the
286 dissemination of knowledge and their effectiveness in social learning (Anil et al., 2015; Morgan, 2011). For
287 instance, Morgan (2011) developed an understanding of the emergence, evolution and role of the groups in
288 terms of social learning by describing: the “mutual engagement” of members through interaction and norms
289 negotiated around their activity; “joint enterprises” that bind farmers together through a sense of mutual
290 accountability; and “shared repertoire” of practices adopted by the members involved in the community.
291 Through the description of these dimensions for three groups of farmers converting to organic, Morgan
292 (2011) concluded that social learning is influenced by the working style of farmers, as the interactions and
293 degree of collaboration are differentiated on the basis of the perceived identity of peers as for instance the
294 understanding of the organic agriculture concept. These papers address the interplay studied from the learning
295 process that takes place among farmers' collectives whether it is an experiment or social-based process.
296 However, they do not enlighten how the learning process among collectives contribute to on-farm activity and
297 how the farmers manage their learning process when facing so diverse working environments.

298

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

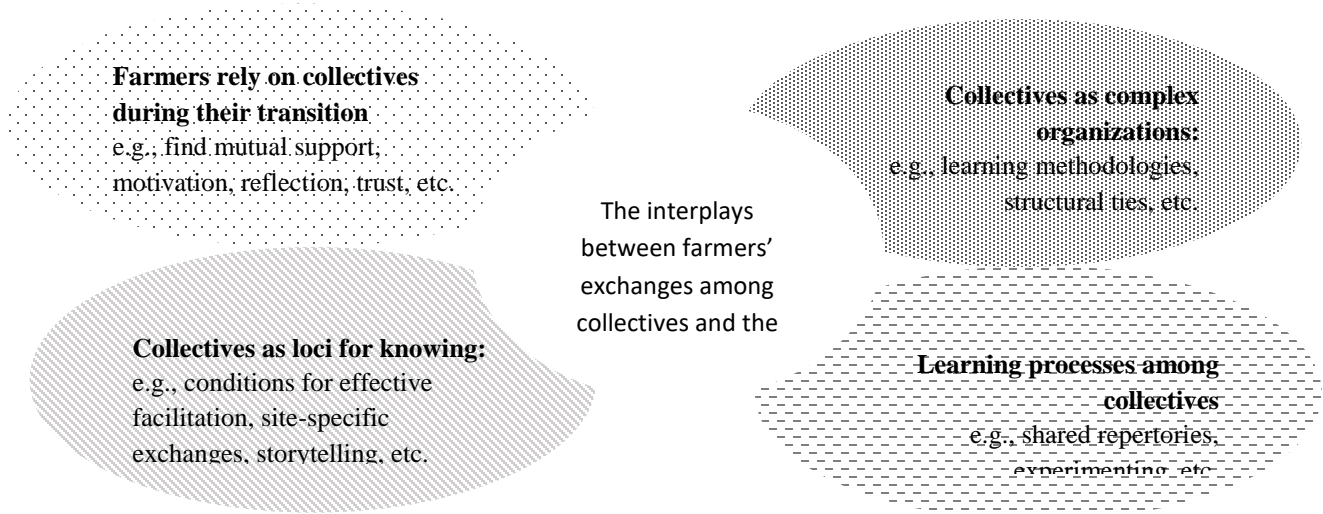


Figure 1. Organizing the literature review to see the way authors address farmers' transition processes, exchanges in the collectives and the links between the two in relation to sustainable agriculture.

305

306 **4 Towards an integrative framework to explore the interplay between farmers'** 307 **exchanges and transition towards sustainable transition**

308

309 **4.1 From an analysis of the review to the conceptual framework**

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

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

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

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

344

345 **4.2 A conceptual framework to analyze the processual interplay between farmers' collectives and their** 346 **professional transition**

347 *4.2.1 Defining professional transition*

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

355 - *Identity remodelling* induced by the change of position in a given social field, and by the dynamics of
356 peer recognition or lack of recognition;

357 - *Acquisition of new social, professional, cognitive and technical skills* to act on new work situations
358 through engagement in learning or adjustment;

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

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

370

371 4.2.2 *Experience as a fruitful concept*

372 We postulate that farmers' professional transitions are processes in which their experiences are reframed in
373 order to transform not only their farming activities but also themselves. As Dewey (1887) described and
374 Bourgeois (2013) later emphasized, experience includes interdependent dimensions (cognitive, affective,
375 conative, and body) that together contribute to individual coherence and continuity in the flow of one's activity.
376 Although experience is far from being a simple concept to work with, given its polysemic nature (Rogalski and
377 Leplat, 2011; Beaujouan et al., 2013; Osty, 2013; Barbier and Thievenaz, 2013; Maillot, 2013), we think it is
378 a fruitful direction for understanding how the links are woven between the farmers' activity and the multiple
379 resources they act with. In particular, in the context of sustainable agriculture where some scholars are calling
380 for a profound redesign of farming systems, considering farmers' experience seems an interesting way to
381 understand how they manage discontinuity and continuity on their pathways. Yet the transformation of farmers'
382 experience can go unseen (Jullien, 2009), especially when the focus is only on long trajectories and critical
383 events on their pathway. It is therefore necessary to look at the lived situations affecting the individuals in the
384 flow of their activities, and not only the technical ones but more broadly also those which they consider as
385 crucial for being effective and efficient in their lives, at least from a professional point of view. As experience
386 transforms, individuals review their previous experiences from a new perspective, develop useful resources to
387 act on and with the environment, and put their experience into words to create a common understanding with
388 others (Thievenaz, 2019). Dewey argued that experience emerges from reflexively linking one's action with
389 the consequences: "When an activity is continued into the undergoing of its consequences, when the change
390 made by action is reflected upon into a change made into us, the flux is loaded with significance" (Dewey,
391 1916; cited in McDermott, 1973: 495)

392

393

394 4.2.3 *The experiential environment transformation*

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

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

423

424 4.2.4 *Inducing inquiry to support farmers’ transition*

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

429 problematization behaviors, Wood et al. (1976) and Vial and Caparros-Mencacci (2007) about scaffolding as
 430 a support to problem-solving, and Mayen (2002, 2014, 2018) about learning from working situations.
 431 Supporting inquiry is about fostering some inducers of the inquiry by taking into account the experiential
 432 environment, whether by problematizing a situation experienced by a farmer or by introducing new inferences
 433 built on cognitive, affective, conative and body-part dimensions, to build new means. Figure 2 summarizes
 434 these theoretical propositions.
 435

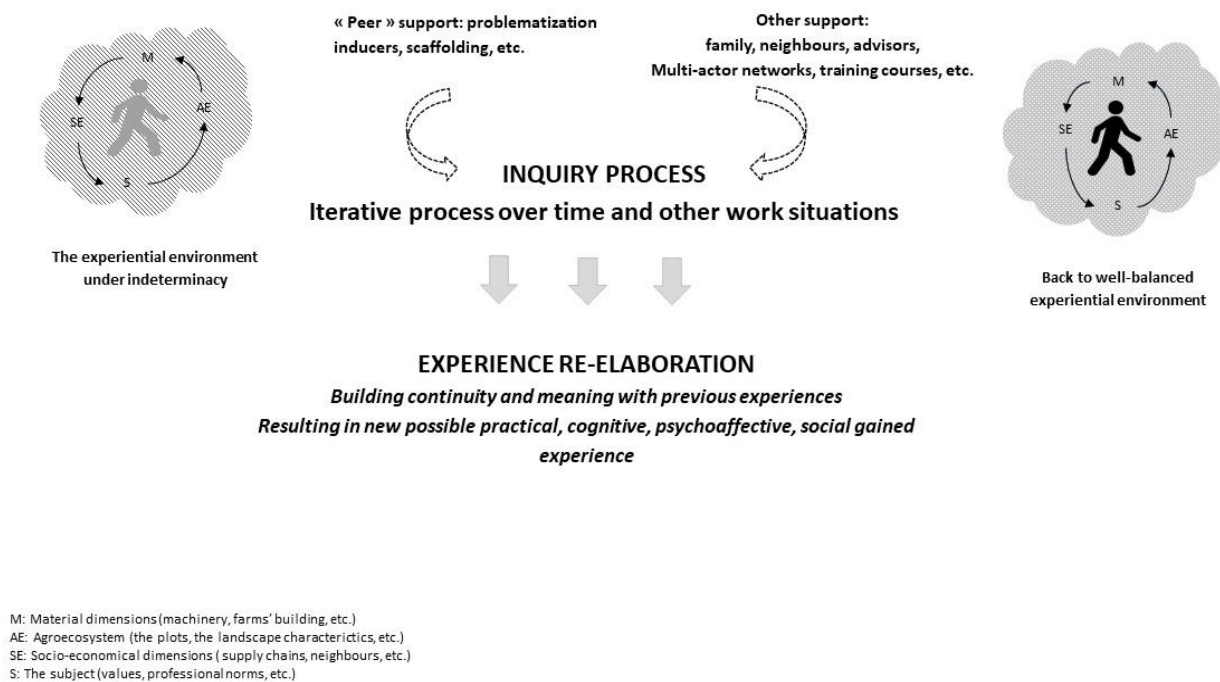


Figure 2. The conceptual framework describing the processual interplay between farmers' experiential environment and the peer collectives support for the inquiry process

436
 437
 438 As Dewey argued in his judgment theory (1938), not all suggestions are to become ideas for the one
 439 experiencing indeterminacy: "The suggestion becomes an idea when we wonder whether it is functionally
 440 appropriate; if it can be a way to solve a given situation" (1938: 175). Thus, supporting the inquiry process
 441 cannot be disconnected from knowing the farmers' experiential environments to understand their point of view
 442 on the problems they face. This is why we think that "peer" collectives are a most relevant space (Ruault and
 443 Lemery, 2009) to address and support the inquiry. Darré (1984) showed that "peers" are the ones who share
 444 professional norms and common concerns about their activities to develop concrete solutions. Guiding the
 445 AKIS players and multi-actor collectives towards the support of inquiry that arises from individuals and their

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

449

450 4.2.5 *Some methodological considerations*

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

461

462 **5 Conclusion**

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

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

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

488

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

509

510 **6 Footnotes**

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

513
514 ² Supporting collectives and the next CAP, a proposed framework from three organizations participating in
515 Another Common Agricultural Policy (CAP) platform: CIVAM, TRAME and CUMA.
516

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8 References

- Aguilar-Gallegos, N., Genaro Martinez-Gonzalez, E., Aguilar-Avila, J., Santoyo-Cortes, H., Munoz-Rodriguez, M., Ivan Garcia-Sanchez, E., 2016. Social network analysis for catalysing agricultural innovation: From direct ties to integration and radiality. *ESTUDIOS GERENCIALES* 32, 197–207. <https://doi.org/10.1016/j.estger.2016.06.006>
- Anderson, C.R., Maughan, C., Pimbert, M.P., 2018. Transformative agroecology learning in Europe: building consciousness, skills and collective capacity for food sovereignty. *Agriculture and Human Values* 36, 531–547.
- Anil, B., Tonts, M., Siddique, K.H.M., 2015. Strengthening the performance of farming system groups: perspectives from a Communities of Practice framework application. *International Journal of Sustainable Development and World Ecology* 22, 219–230.
- Barbier, C., Cerf, M., Lusson, J.-M., 2015. Cours de vie d’agriculteurs allant vers l’économie en intrants : les plaisirs associés aux changements de pratiques. *Activités* 12. <https://doi.org/10.4000/activites.1081>
- Barbier, J.-M., Thievenaz, J., 2013. Le Travail de l’expérience. *L’Harmattan*.
- Beaujouan, J., Coutarel, F., Daniellou, F., 2013. Quelle place tient l’expérience des autres dans la formation d’un professionnel ? Apport et limite du récit professionnel. *Éducation permanente* 25–38.
- Beghuin, F., Bourgeois, É., Merhan, F., 2019. Dynamique identitaire, trajectoire biographique et apprentissage dans le processus de conversion d’agriculteurs « conventionnels » vers l’agriculture bio. *Le sujet dans la cite Actuels* n° 8, 85–103.
- Benyishay, A., Mobarak, A.M., 2013. Communicating with farmers through social networks. Center Discussion Paper - Economic Growth Center, Yale University N, 61 pp.
- Blesh, J., Wolf, S.A., 2014. Transitions to agroecological farming systems in the Mississippi River Basin: toward an integrated socioecological analysis. *Agric Hum Values* 31, 621–635. <https://doi.org/10.1007/s10460-014-9517-3>
- Bodin, Ö., Crona, B.I., 2009. The role of social networks in natural resource governance: What relational patterns make a difference? *Global environmental change* 19, 366–374.
- Bourgeois, E., 2013. Expérience et apprentissage. La contribution de John Dewey. *Expérience, activité, apprentissage* 13–38.
- Brédart, D., Stassart, P.M., 2017. When farmers learn through dialog with their practices: a proposal for a theory of action for agricultural trajectories. *Journal of Rural Studies* 53, 1–13.
- Bruce, T.J.A., 2016. The CROPROTECT project and wider opportunities to improve farm productivity through web-based knowledge exchange. *FOOD AND ENERGY SECURITY* 5, 89–96. <https://doi.org/10.1002/fes3.80>
- Bui, S., Cardona, A., Lamine, C., Cerf, M., 2016. Sustainability transitions: Insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. *Journal of Rural Studies* 48, 92–103. <https://doi.org/10.1016/j.jrurstud.2016.10.003>
- Burbi, S., Hartless Rose, K., 2016. The role of internet and social media in the diffusion of knowledge and innovation among farmers. *International Farming Systems Association (IFSA) Europe*, Newport, UK, pp. 1–10.
- Callon, M., Latour, B., 1992. Don’t throw the baby out with the bath school! A reply to Collins and Yearley. *Science as practice and culture* 343, 368.
- Catalogna, M., Dubois, M., Navarrete, M., 2018. Diversity of experimentation by farmers engaged in agroecology. *Agron. Sustain. Dev.* 38, 50. <https://doi.org/10.1007/s13593-018-0526-2>
- Cerf, M., Bail, L., Lusson, J.M., Omon, B., 2017. Contrasting intermediation practices in various advisory service networks in the case of the French Ecophyto plan. *The Journal of Agricultural Education and Extension* 23, 231–244. <https://doi.org/10.1080/1389224X.2017.1320641>
- Cerf, M., Guillot, M.N., Olry, P., 2011. Acting as a Change Agent in Supporting Sustainable Agriculture: How to Cope with New Professional Situations? *The Journal of Agricultural Education and Extension* 17, 7–19. <https://doi.org/10.1080/1389224X.2011.536340>
- Cerf, M., Hemidy, L., 2007. Designing support to enhance co-operation between farmers and advisors in solving farm-management problems. *The Journal of Agricultural Education and Extension* 6, 157–170. <https://doi.org/10.1080/13892249985300301>

- Chantre, E., 2011. Apprentissages des agriculteurs vers la réduction d'intrants en grandes cultures : Cas de la Champagne Berrichonne dans les années 1985-2010.
- Chantre, E., Cardona, A., 2014. Trajectories of French Field Crop Farmers Moving Toward Sustainable Farming Practices: Change, Learning, and Links with the Advisory Services. *Agroecology and Sustainable Food Systems* 38, 573–602. <https://doi.org/10.1080/21683565.2013.876483>
- Chantre, E., Cerf, M., Bail, M.L., 2015. Transitional pathways towards input reduction on French field crop farms. *International Journal of Agricultural Sustainability* 13, 69–86. <https://doi.org/10.1080/14735903.2014.945316>
- Chantre, E., Le Bail, M., Cerf, M., 2013. Comment évolue l'expérience des agriculteurs engagés dans l'écologisation de leurs pratiques. *Education Permanente, Travail et développement professionnel. Construire l'expérience* 2, 71–82.
- Charatsari, C., Koutsouris, A., Lioutas, E.D., Kalivas, A., 2016. Building social capital and promoting participatory development of agricultural innovations through Farmer Field Schools: the Greek experience. *International Farming Systems Association (IFSA) Europe, Newport, UK*, pp. 1–16.
- Chizallet, M., Barcellini, F., Prost, L., 2018. Supporting farmers' management of change towards agroecological practices by focusing on their work: A contribution of ergonomics. *Cahiers Agricultures* 27. <https://doi.org/10.1051/cagri/2018023>
- Chizallet, M., Prost, L., Barcellini, F., 2020. Supporting the Design Activity of Farmers in Transition to Agroecology: Towards an Understanding. *Trav. Hum.* 83, 33–59.
- Collins, R., Kelly, R., McCosker, K., Buck, S., Lambert, G., Sparkes, D., 2001. Experiences from using Action Learning Groups to develop Sustainable Farming Systems for Central Queensland., in: Rowe, B., Donaghy, D., Mendham, N. (Eds.), . Australian Society of Agronomy Inc, Warragul, Australia.
- Compagnone, C., Hellec, F., 2015. Farmers' Professional Dialogue Networks and Dynamics of Change: The Case of ICP and No-Tillage Adoption in Burgundy (France). *Rural Sociology* 80, 248–273. <https://doi.org/10.1111/ruso.12058>
- Compagnone, C., Lamine, C., Dupré, L., 2018. La production et la circulation des connaissances en agriculture interrogées par l'agro-écologie. *Revue d'anthropologie des connaissances* Vol. 12, N°2, 111–138.
- Coolsaet, B., 2016. Towards an agroecology of knowledges: Recognition, cognitive justice and farmers' autonomy in France. *Journal of Rural Studies* 47, 165–171. <https://doi.org/10.1016/j.jrurstud.2016.07.012>
- Coquil, X., Cerf, M., Auricoste, C., Joannon, A., Barcellini, F., Cayre, P., Chizallet, M., Dedieu, B., Hostiou, N., Hellec, F., Lusson, J.-M., Olry, P., Omon, B., Prost, L., 2018. Questioning the work of farmers, advisors, teachers and researchers in agro-ecological transition. A review. *Agronomy for Sustainable Development* 38. <https://doi.org/10.1007/s13593-018-0524-4>
- Coquil, X., Dedieu, B., Béguin, P., 2017. Professional transitions towards sustainable farming systems: The development of farmers' professional worlds. *Work* 57, 325–337. <https://doi.org/10.3233/WOR-172565>
- Cristofari, H., Girard, N., Magda, D., 2017. Supporting transition toward conservation agriculture: A framework to analyze the learning processes of farmers. *Hungarian Geographical Bulletin* 66, 65–76. <https://doi.org/10.15201/hungeobull.66.1.7>
- Curry, N., Ingram, J., Kirwan, J., Maye, D., 2012. Knowledge networks for sustainable agriculture in England. *Outlook on Agriculture* 41, 243–248.
- Curry, N., Kirwan, J., 2014. The role of tacit knowledge in developing networks for sustainable agriculture. *Sociologia Ruralis* 54, 341–361.
- Darré, J.-P., 1984. La production des normes au sein d'un réseau professionnel L'exemple d'un groupe d'élèves. *Sociologie du Travail* 26, 141–156.
- David, S., 2007. Learning to think for ourselves: knowledge improvement and social benefits among farmer field school participants in Cameroon. *Journal of International Agricultural and Extension Education* 14, 35–49.
- David, S., Asamoah, C., 2011. The impact of farmer field schools on human and social capital: a case study from Ghana. *Journal of Agricultural Education and Extension* 17, 239–252.
- Dewey, J., 1938. *Logique: la théorie de l'enquête*.

- Dewey, J., 1916. *Democracy and education: An introduction to the philosophy of education.*
- Dewey, J., 1887. Illusory psychology. *Mind* 12, 83–88.
- Diaz-José, J., Rendón-Medel, R., Govaerts, B., Aguilar-Ávila, J., Muñoz-Rodríguez, M., 2016. Innovation diffusion in conservation agriculture: a network approach. *European Journal of Development Research* 28, 314–329.
- Dupré, M., Michels, T., Le Gal, P.-Y., 2017. Diverse dynamics in agroecological transitions on fruit tree farms. *European Journal of Agronomy* 90, 23–33. <https://doi.org/10.1016/j.eja.2017.07.002>
- Elzen, B., Barbier, M., Cerf, M., Grin, J., 2012. Stimulating transitions towards sustainable farming systems, in: Darnhofer, I., Gibbon, D., Dedieu, B. (Eds.), *Farming Systems Research into the 21st Century: The New Dynamic.* Springer Netherlands, Dordrecht, pp. 431–455. https://doi.org/10.1007/978-94-007-4503-2_19
- Fabre, M., Musquer, A., 2009. Les inducteurs de problématisation. *Les Sciences de l'éducation - Pour l'Ere nouvelle* Vol. 42, 111–129.
- FAO, 1988. Report of the FAO Council, 94th Session, Rome.
- Faysse, N., Sraïri, M.T., Errahj, M., 2012. Local farmers' organisations: a space for peer-to-peer learning? The case of milk collection cooperatives in Morocco. *Journal of Agricultural Education and Extension* 18, 285–299.
- Girard, N., Magda, D., 2018. The interplays between singularity and genericity of agroecological knowledge in a network of livestock farmers. *Revue D'Anthropologie Des Connaissances* 12, 199–228. <https://doi.org/10.3917/rac.039.0199>
- Goulet, F., 2013. Narratives of experience and production of knowledge within farmers' groups. *Journal of Rural Studies* 32, 439–447.
- Hayden, J., Rucker, S., Phillips, H., Heins, B., Smith, A., Delate, K., 2018. 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, 4606.
- Heinrich, W.F., Habron, G.B., Johnson, H.L., Goralnik, L., 2015. Critical thinking assessment across four sustainability-related experiential learning settings. *Journal of Experiential Education* 38, 373–393.
- Ingram, J., 2015. Framing niche-regime linkage as adaptation: An analysis of learning and innovation networks for sustainable agriculture across Europe. *Journal of Rural Studies* 40, 59–75. <https://doi.org/10.1016/j.jrurstud.2015.06.003>
- Ingram, J., 2010. Technical and social dimensions of farmer learning: an analysis of the emergence of reduced tillage systems in England. *Journal of Sustainable Agriculture* 34, 183–201.
- Ingram, J., 2008. Agronomist-farmer knowledge encounters: an analysis of knowledge exchange in the context of best management practices in England. *AGRICULTURE AND HUMAN VALUES* 25, 405–418. <https://doi.org/10.1007/s10460-008-9134-0>
- Isaac, M.E., 2012. Agricultural information exchange and organizational ties: the effect of network topology on managing agrodiversity. *Agricultural Systems* 109, 9–15.
- Isaac, M.E., Erickson, B.H., Quashie-Sam, S.J., Timmer, V.R., 2007. Transfer of knowledge on agroforestry management practices: the structure of farmer advice networks. *Ecology and society* 12.
- Jullien, F., 2009. *Les transformations silencieuses.* Grasset.
- Kalra, R.K., Anil, B., Tonts, M., Siddique, K.H.M., 2013. Self-help groups in Indian agriculture: a case study of farmer groups in Punjab, Northern India. *Agroecology and Sustainable Food Systems* 37, 509–530.
- Kilpatrick, S., Bond, L., Bell, R., Knee, J., Pickard, G., 2003. Effective farmer groups for defining best practices for sustainable agriculture.
- Klerkx, L., Van Mierlo, B., Leeuwis, C., 2012. Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions, in: *Farming Systems Research into the 21st Century: The New Dynamic.* Springer, pp. 457–483.
- Kraaijvanger, R., Veldkamp, T., Almekinders, C., 2016. Considering change: Evaluating four years of participatory experimentation with farmers in Tigray (Ethiopia) highlighting both functional and human-social aspects. *AGRICULTURAL SYSTEMS* 147, 38–50. <https://doi.org/10.1016/j.agry.2016.05.001>

- Kroma, M.A., 2006. Organic farmer networks: Facilitating learning and innovation for sustainable agriculture. *JOURNAL OF SUSTAINABLE AGRICULTURE* 28, 5–28. https://doi.org/10.1300/J064v28n04_03
- Lamine, C., 2011. Transition pathways towards a robust ecologization of agriculture and the need for system redesign. Cases from organic farming and IPM. *Journal of Rural Studies* 27, 209–219. <https://doi.org/10.1016/j.jrurstud.2011.02.001>
- Lamine, C., Jean-Marc, M., Perrot, N., Bellon, S., 2009. Analyse des formes de transition vers des agricultures plus écologiques: Les cas de l’Agriculture Biologique et de la Protection Intégrée. *Innovations Agronomiques* 4, 499–511.
- Landini, F., Brites, W., Mathot y Rebolé, M.I., 2017. Towards a new paradigm for rural extensionists’ in-service training. *Journal of Rural Studies* 51, 158–167. <https://doi.org/10.1016/j.jrurstud.2017.02.010>
- Lave, J., Wenger, E., 1991. *Situated learning: Legitimate peripheral participation*. Cambridge university press.
- Lubell, M., Fulton, A., 2007. Local diffusion networks act as pathways to sustainable agriculture in the Sacramento River Valley. *CALIFORNIA AGRICULTURE* 61, 131–137. <https://doi.org/10.3733/ca.v061n03p131>
- Lubell, M., Niles, M., Hoffman, M., 2014. Extension 3.0: managing agricultural knowledge systems in the network age. *Society & Natural Resources* 27, 1089–1103.
- Lucas, V., Gasselin, P., Van der Ploeg, J.D., 2019. Local inter-farm cooperation: A hidden potential for the agroecological transition in northern agricultures. *AGROECOLOGY AND SUSTAINABLE FOOD SYSTEMS* 43, 145–179. <https://doi.org/10.1080/21683565.2018.1509168>
- Maillot, S., 2013. La transition professionnelle, “expérience de soi” face au changement. *EDUCATION PERMANENTE* 197, 41–50.
- Manson, S.M., Jordan, N.R., Nelson, K.C., Brummel, R.F., 2016. Modeling the effect of social networks on adoption of multifunctional agriculture. *ENVIRONMENTAL MODELLING & SOFTWARE* 75, 388–401. <https://doi.org/10.1016/j.envsoft.2014.09.015>
- Mashavave, T., Mapfumo, P., Mtambanengwe, F., Gwandu, T., Siziba, S., 2013. Interaction patterns determining improved information and knowledge sharing among smallholder farmers. *African Journal of Agricultural and Resource Economics* 8, 1–12.
- Matuschke, I., 2008. Evaluating the impact of social networks in rural innovation systems: An overview. *Intl Food Policy Res Inst.*
- Mawois, M., Vidal, A., Revoyron, E., Casagrande, M., Jeuffroy, M.H., Bail, M. le, 2019. Transition to legume-based farming systems requires stable outlets, learning, and peer-networking. *Agronomy for Sustainable Development* 39, 14.
- Mayen, P., 2018. S’écarter du travail pour mieux l’apprendre: Une réflexion pour l’ingénierie de formation en situation de travail et pour la conception d’organisations apprenantes. *Éducation permanente* 216, 141–158.
- Mayen, P., 2014. Apprendre à travailler avec le vivant: développement durable et didactique professionnelle. Ed. Raison et Passions.
- Mayen, P., 2002. Le rôle des autres dans le développement de l’expérience: Apprendre des autres. *Education permanente* 87–107.
- McDermott, J.J., 1973. *The philosophy of John Dewey: the structure of experience* 1. The structure of experience. Putnam.
- Michael Rosset, P., Machin Sosa, B., Roque Jaime, A.M., Avila Lozano, D.R., 2011. The Campesino-to-Campesino agroecology movement of ANAP in Cuba: social process methodology in the construction of sustainable peasant agriculture and food sovereignty. *JOURNAL OF PEASANT STUDIES* 38, 161–191. <https://doi.org/10.1080/03066150.2010.538584>
- Millar, J., Curtis, A., 1997. Moving farmer knowledge beyond the farm gate: an Australian study of farmer knowledge in group learning. *European Journal of Agricultural Education and Extension* 4, 133–142.
- Morgan, S.L., 2011. Social learning among organic farmers and the application of the communities of practice framework. *Journal of Agricultural Education and Extension* 17, 99–112.

- Murphy, J., 2012. The contribution of facilitated group learning to supporting innovation amongst farmers. *Studies in Agricultural Economics (Budapest)* 114, 93–98.
- Nerbonne, J.F., Lentz, R., 2003. Rooted in grass: challenging patterns of knowledge exchange as a means of fostering social change in a southeast Minnesota farm community. *Agriculture and Human Values* 20, 65–78.
- Oreszczyn, S., Lane, A., Carr, S., 2010. The role of networks of practice and webs of influencers on farmers' engagement with and learning about agricultural innovations. *Journal of Rural Studies* 26, 404–417.
- Osty, F., 2013. Devenir un professionnel : le rôle multiforme de l'expérience. *EDUCATION PERMANENTE* 197, 29–40.
- Phillips, T., Klerkx, L., McEntee, M., 2018. An investigation of social media's roles in knowledge exchange by farmers. *International Farming Systems Association (IFSA) Europe, Chania, Greece*, pp. 1–20.
- Phuong, L.T.H., Wals, A., Sen, L.T.H., Hoa, N.Q., Lu, P.V., Biesbroek, R., 2018. Using a social learning configuration to increase Vietnamese smallholder farmers' adaptive capacity to respond to climate change. *Local Environment* 23, 879–897.
- Proost, J., Weperen, W. van, 2006. Creating space for change: farmers' learning groups in the Netherlands. *Compas Magazine N*, 18–19.
- Prost, M., Prost, L., Cerf, M., 2017. Les échanges virtuels entre agriculteurs: un soutien à leurs transitions professionnelles? *Raisons éducatives* 129–154.
- Quiroz, C.M., 1988. The self-directed learning process in a selected group of adult farmers in Michigan. *Dissertation Abstracts International, A (Humanities and Social Sciences)* 49, p.409.
- Restrepo, M.J., Lelea, M.A., Kaufmann, B.A., 2018. Evaluating knowledge integration and co-production in a 2-year collaborative learning process with smallholder dairy farmer groups. *SUSTAINABILITY SCIENCE* 13, 1265–1286. <https://doi.org/10.1007/s11625-018-0553-6>
- Ridley, A.M., 2005. The role of farming systems group approaches in achieving sustainability in Australian agriculture. *Australian Journal of Experimental Agriculture* 45, 603–615.
- Rodriguez, J.M., Molnar, J.J., Fazio, R.A., Sydnor, E., Lowe, M.J., 2009. Barriers to adoption of sustainable agriculture practices: Change agent perspectives. *Renewable agriculture and food systems* 60–71.
- Rogalski, J., Leplat, J., 2011. L'expérience professionnelle : expériences sédimentées et expériences épisodiques. *Activités* 08. <https://doi.org/10.4000/activites.2556>
- Röling, N.G., Jiggins, J., 1998. The ecological knowledge system. In 'Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty'. (Eds NG Röling, MAE Wagemakers) pp. 283–311. Cambridge University Press: Cambridge, UK.
- Ruault, C., Lemery, B., 2009. Le conseil de groupe dans le développement agricole et local: pour quoi faire et comment faire. *Conseil et développement en agriculture Quelles nouvelles pratiques* 71–96.
- Ryschawy, J., Debril, T., Sarthou, J.-P., Therond, O., 2015. Analysis of support networks used by farmers making the agroecological transition: an initial study in the Tarn - Aveyron region. *FOURRAGES* 143–148.
- Schneider, F., Fry, P., Ledermann, T., Rist, S., 2009. Social learning processes in Swiss soil protection - the "From Farmer-To Farmer" project. *Human Ecology* 37, 475–489.
- Schneider, F., Steiger, D., Ledermann, T., Fry, P., Rist, S., 2012. No-tillage farming: co-creation of innovation through network building. *LAND DEGRADATION & DEVELOPMENT* 23, 242–255. <https://doi.org/10.1002/ldr.1073>
- Spielman, D.J., Davis, K., Negash, M., Ayele, G., 2011. Rural innovation systems and networks: findings from a study of Ethiopian smallholders. *Agriculture and human values* 28, 195–212.
- Šūmane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. des I., Rivera, M., Chebach, T., Ashkenazy, A., 2018. Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies* 59, 232–241. <https://doi.org/10.1016/j.jrurstud.2017.01.020>
- Toffolini, Q., Cardona, A., Casagrande, M., Dedieu, B., Girard, N., Ollion, E., 2019. Agroecology as farmers' situated ways of acting: a conceptual framework. *Agroecology and Sustainable Food Systems* 43, 514–545. <https://doi.org/10.1080/21683565.2018.1514677>
- Vaarst, M., Nissen, T.B., Østergaard, S., Klaas, I.C., Bennedsgaard, T.W., Christensen, J., 2007. Danish stable schools for experiential common learning in groups of organic dairy farmers. *Journal of Dairy Science* 90, 2543–2554.

- Vermersch, P., 1994. *L'entretien d'explicitation*, Collection pédagogies. Paris: ESF.
- Vial, M., Caparros-Mencacci, N., 2007. *L'accompagnement professionnel. Méthode à l'usage des praticiens exerçant une fonction éducative*. Bruxelles: De Boeck.
- Vygotsky, L., 1978. Interaction between learning and development. *Readings on the development of children* 23, 34–41.
- Warner, K.D., 2006. Extending agroecology: grower participation in partnerships is key to social learning. *Renewable Agriculture and Food Systems* 21, 84–94.
- Wood, B.A., Blair, H.T., Gray, D.I., Kemp, P.D., Kenyon, P.R., Morris, S.T., Sewell, A.M., 2014. Agricultural Science in the Wild: A Social Network Analysis of Farmer Knowledge Exchange. *PLOS ONE* 9. <https://doi.org/10.1371/journal.pone.0105203>
- Wood, D., Bruner, J.S., Ross, G., 1976. The role of tutoring in problem solving. *Journal of child psychology and psychiatry* 17, 89–100.
- Wypler, J., 2019. Lesbian and Queer Sustainable Farmer Networks in the Midwest. *SOCIETY & NATURAL RESOURCES* 32, 947–964. <https://doi.org/10.1080/08941920.2019.1584834>

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
<p>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.</p>	<p>Challenges and opportunities do farmers experience, or perceive, regarding integrating crops and livestock that are relevant to organically managed farms.</p> <p>In what instances do the opportunities of integration mitigate the challenges?</p> <p>Which challenges of integration are perceived, or experienced, as being unmitigated or beyond the control of farmers?</p>	<p>What challenges and opportunities do farmers experience, or perceive, regarding integrating crops and livestock that are relevant to organically managed farms?</p> <p>In what instances do the opportunities of integration mitigate the challenges?</p> <p>Which challenges of integration are perceived, or experienced, as being unmitigated or beyond the control of farmers?</p>	<p>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”.</p> <p>They question the influence of micro variables as farmer experience, and the influence of some macro and meso level factors such as information collectives.</p> <p>They question the influence of collectives on building farmers’ identity.</p>	<p>Iowa, Pennsylvania or Minnesota</p> <p>Livestock farmers and organic prioritised</p> <p>The total number of participation incidences was 51 over two years: 21 focus group participants and 30 interviewees</p> <p>Three farmer focus groups (21 farmers total) were conducted between July and August 2016 for observation.</p>	<p>Some CoP theoretical background but not used as a theoretical framework</p>	<p>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</p> <p>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.</p>	<ul style="list-style-type: none"> - 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. 	<p>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.</p>

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