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# **The potential of community interactions as inducers of agroecological transition: the case of a digital agricultural community**

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## **Abstract**

**Purpose:** To study community interactions and thus to highlight potential ways to support farmers' professional transition toward more sustainable agriculture.

**Methodology:** Mixed methods with a questionnaire, interviews, peer-to-peer interactions, and a theoretical framework to analyze drivers of indeterminacy that can trigger a break in farmers' routines. The study took place in a digital agricultural community.

**Findings:** We highlighted three potential drivers of indeterminacy in a professional transition process like Agroecological Transition (AET), as well as the role of community facilitator.

**Practical implications:** Integrating into farmers' training and extension services the issues of valuation to discuss how practices and objects are priced and evaluated. This can open a way for new meanings and values that support AET and support a departure from usual standards.

**Theoretical implications:** Applying inquiry theory as an epistemic proposition to examine support for farmers' professional transitions and their training in relation to their real work situation.

**Originality:** We propose an articulation between the study of a digital platform and the analysis of the drivers of engagement in an agroecological transition process.

**Keywords:** indeterminacy, agroecological transition, farmers, digital community, extension, social media

**Paper type:** research article

## **1. Introduction**

In agriculture, although transition towards more sustainable farming systems has become an important political and social issue, it has not resulted in effective large-scale change in practices (Guichard et al., 2017; Prost et al., 2023). For each farmer, the challenge is to enhance synergies between the elements of the agroecosystem (plants, animals, soil, water, etc.) and to reassess their links to sociotechnical systems (input providers, supply chains, institutional actors, etc.) as a basis for avoiding dependency on synthetic inputs and on mainstream food supply chains. This is in line with the agroecology principles of diversity, synergies, efficiency, recycling, resilience, co-creation and sharing of knowledge, responsible governance, circular and solidarity economies, human and social values, culture, and food traditions (FAO, 2018). In this paper, we present an analytical approach to understand how peer-to-peer interaction can potentially help trigger change at farm level in a digital agricultural community. This change, referred to as Agroecological Transition (AET), is a systemic transformation of farmers' activity (Coquil et al., 2018; Chizallet et al., 2020). It stresses the key role of farmers themselves in building practices, professional norms and values (Coquil et al., 2017, 2018) adapted to their own environment and situation (Stuiver et al., 2004).

The role of peer groups has often been pointed out, and is seen by policy makers and researchers alike as key to the processes of transition to more sustainable farming (Michael Rosset et al., 2011; Hayden et al., 2018). For example, the Ecophyto Plan set up in France to support farmers' transition to reduced pesticide use largely emphasizes the role of peer-to-peer interactions for sharing experiential knowledge, skills, and innovations (see Cerf et al., 2017; Lucas, 2021; see also Sutherland and Marchand, (2021) for similar results regarding AET at EU level). The literature on advisory services has long been interested in finding ways to support peer-to-peer interactions, particularly

when the traditional expert role of advisors is called into question, and when other roles they can play are recognized (e.g. to support the learning process) (Cerf et al., 2011).

However, we lack some consistent conceptualization to understand how peer-to-peer interactions support and influence individual change at the farm level (Slimi et al., 2021).

In this paper, we shed light on digitally supported peer-to-peer interactions that facilitate farmers' agroecological transition. Usually the studies focused on peer-to-peer interactions concern face-to-face groups, whereas we know that farmers in AET also rely on online communities (Schnebelin et al., 2021; Prost et al., 2022). Digital communities are thus potential avenues to support farmers' AET, as they can be used to circulate information without spatial or temporal boundaries (Soullignac et al., 2019). Agricultural research has increasingly been analyzing the uses and roles of digital technology in the circulation of knowledge and information, particularly through the networking proposed by social media (Phillips et al., 2018; Mills et al., 2019; Nain et al., 2019; Prost et al., 2022). For their part, advisors are also considering the use of digital technology and its effect on their professional activities (Eastwood et al., 2019; Charatsari et al., 2020; Klerkx, 2021). However, to our knowledge, there is no research focusing on the way digitalization influences peer-to-peer interactions and the transformation of farmers' activity, nor on the ways advisors can contribute to enhancing the potential of such digitally supported interactions. To bridge these gaps, we propose an analysis of a community whose members interact through a WhatsApp platform, although some members also meet in real life groups. Our analysis is based on the concept of indeterminacy developed by Dewey (1938) in his inquiry theory: "that very condition for the new" (Hutter & Farias 2017) which is a key state to trigger change. Understanding the conditions conducive to indeterminacy is the path we wish to explore in order to identify some drivers of practices that depart from the status quo and potentially transform

farmers' routines (Dewey, 2002; Simpson and Lorino, 2016). We also point out the role that the facilitator of this community plays in enhancing the farmers' commitment to AET.

## **2. Theoretical framework: inducing indeterminacy as a way to induce transition**

Along with other researchers (Hazard et al., 2021), we have proposed (Slimi et al., 2021) the analysis of farmers' AET as a process of inquiry, in the sense of Dewey (1938). Inquiry is a process of transformation of experience, that is, of the ways of doing, thinking and valuing a situation. It usually arises in so-called indeterminate situations where individuals experience tension, dissonance, doubt, uncertainty, contradiction, and surprise in the course of their action. This indeterminacy can be caused by discrepancies with routines or what is held to be true, by a lack or an excess of different types of references and resources to deal with new phenomena, by failure to adapt the means to an end, and by unpredictable consequences of action taken (Thievenaz, 2017a). Dewey (1938) insists on the fact that this indeterminacy is not purely intellectual. It is constructed in the transaction between the subject and the environment by bringing into play an activity of valuation, which makes it possible to determine what is desired and prized or, on the contrary, what is feared.

We explore how indeterminacy can be fostered in a way that could itself potentially trigger an inquiry, and consequently AET. In that respect, Hutter and Farias' work (2017) is very valuable. They have worked with the idea that newness is "sourced" through practices that induce indeterminacy, the drivers of which they investigate. They have developed the idea that indeterminacy is organized through socio-material conditions and practices. Whether it is a material object, a shared practice, or a rule of action, the "new

object” makes sense (and can exist) only when there is a re-articulation with that which already exists. The tension at play in this re-articulation process is related to the existence of more than one parameter or value to judge the created object (Hutter and Stark, 2015). Hutter and Farias (2017) propose three drivers for inducing indeterminacy (Table 1), based on their work in the cultural domain: configuring frames, creating objects, and risking valuation.

Drivers of indeterminacy	Description
<i>“Configuring frames”</i>	Frames have to provide space for intimate engagement with materials, tools and projects where usual values and rules are suspended. This creates a break to shelter new ideas and provide a breathing space for dissonant composition. It engages actors in a process of exploration that may lead to newness through inquiry.
<i>“Creating objects”</i>	The process of creating new objects can lead to sudden destabilization of courses of action in such a way that the object (non-human entities, a practice, a rule, a story, etc.) which is considered new is unknowable. Creation connotes the introduction of an altered state in an existing situation without already appraising the future consequences.
<i>“Risking valuation”</i>	“Valuation practices situate novelty on a map of desires and fears” (Hutter & Farias 2017) and lead to the challenging of accepted norms and rules in a profession. The term valuation is used to mean prizing, by holding dear and getting emotionally attached, and appraising, by holding against a standard or believing in the quality-detecting power of social or material measures.

Table 1. Summary of theoretical propositions from Hutter and Farías (2017)

Based on this theoretical framework and our fieldwork (Slimi, 2022), we have developed an analytical framework adapted to our research object: the interactions between farmers on a digital platform in the context of farmers’ AET.

### **3. Material and method**

#### ***3.1. Collection of data***

We focused our analysis on the WhatsApp (WA) interactions of a community set up in 2018 by an actor from an agricultural cooperative to support groups of farmers engaged in the French government's Ecophyto plan. This plan, launched in 2008, aimed at halving the use of pesticides by 2018, by funding development agents to support farmers' groups for that purpose. The facilitator of the WA group had worked as technical advisor in the cooperative since 2006, and started the facilitation of farmers' groups in 2011 when the Ecophyto Plan was launched. At the time of our field work, he was also in charge of innovation and technology watch.

At the time of our data collection (between 2019 and 2020), the WA group we consider in this article included about a hundred participants (it fluctuated between 90 and 120 members). As represented in Figure 1, the participants were:

- Field crop and crop-livestock farmers taking part in the Ecophyto Plan through group discussions, training sessions, and trials.
- Advisors involved or not in the facilitation of these groups, who also met up regularly with farmers for individual farm monitoring visits and participated in the same training sessions as the farmers.
- Experts who addressed agroecological issues during the training sessions of these groups (pioneer farmers, agronomists, biodiversity specialists, etc.)..

The facilitator of the WA group from the agricultural cooperative allowed this study to take place by including the first author in the group and introducing her to the participants.

He also forwarded our questionnaire to the members of WA community, thus giving us the opportunity to recruit volunteer farmers for the interviews. All of them participated in the study voluntarily, and an informed consent form was used for the data collection.

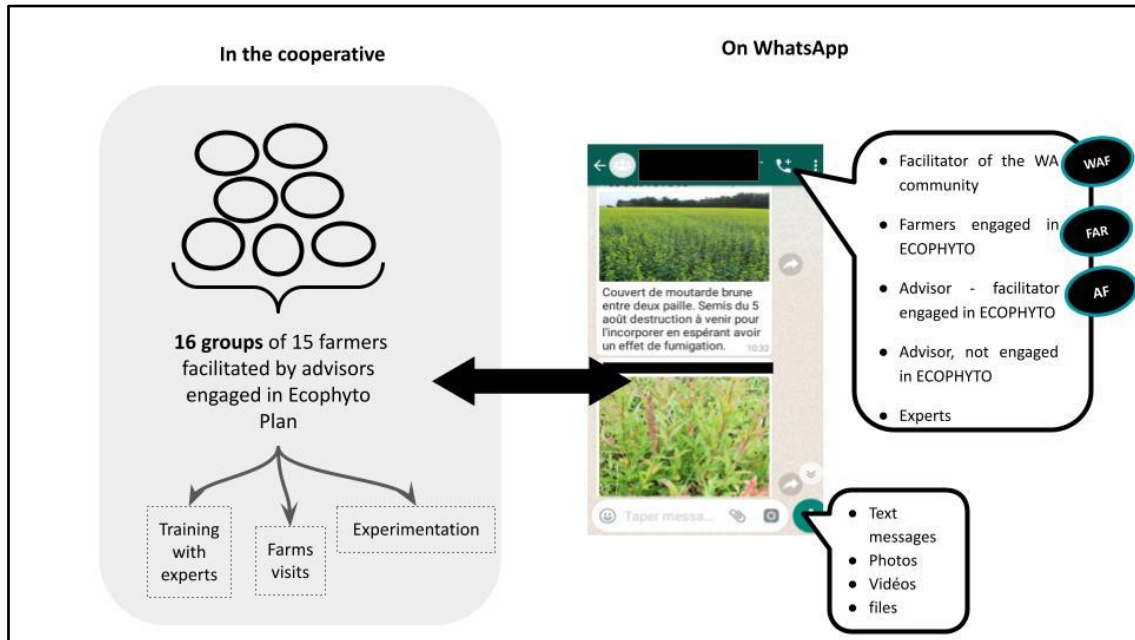


Figure 1. Description of the digital community and its links with the cooperative

Data collection to define four datasets took several forms. The need for multiple data sources appeared necessary through the process of iterative analysis and given the exploratory path we had embarked on to identify drivers of indeterminacy. As described in Table 2, there were: 2 exploratory interviews with advisors-facilitator (data 1); a questionnaire for the WA participants (data 2); 8 interviews with farmers (data 3); specific messages from the WA group associated with keywords identified through interviews (data 4).

	<i>Data type</i>	<i>Objectives</i>	<i>Examples of information requested</i>
<i>Data 1 (D1)</i>	Transcription of two exploratory interviews with advisors-facilitator in 2019	Build a first understanding of the process of setting up the WA group, the different actors involved, the objectives behind its creation, etc.	<ul style="list-style-type: none"> <li>• When and how was the WA group created? For what purpose?</li> <li>• What do you discuss with farmers during group sessions?</li> <li>• What did the WA group help you to do?</li> </ul>
<i>Data 2 (D2)</i>	39 responses to a questionnaire launched on the WhatsApp group in March 2020	Have a global view of the actors and their uses of the group, to know their interest (especially farmers) and the possible consequences on their work.	<p>Multiple-choice questions about:</p> <ul style="list-style-type: none"> <li>• Duration of their enrolment</li> <li>• The frequency with which they read messages</li> <li>• What they like about WA</li> <li>• What the group has enabled them to do</li> </ul>
<i>Data 3 (D3)</i>	Transcription of eight interviews with farmers between May and June 2020	Gain a deeper understanding of the farmers' transition process and how the WA group and peer-to-peer interactions were part of this process.	<ul style="list-style-type: none"> <li>• Discuss farmer's transition path and arrival in the group</li> <li>• Discuss farmer's current work and group support</li> <li>• Read WA group messages to observe farmers' reactions</li> </ul>
<i>Data 4 (D4)</i>	Messages from WhatsApp group associated with keywords*, identified through the interview.	Identify the practices associated with these keywords (rapeseed, sunflower, cover crops) and possible traces of evaluation by the farmer.	

Table 2. Description of the four datasets. \*This search does not guarantee access to all the messages containing these keywords as some videos and photos do not include comments.

### **3.2. Data analysis**

Our analytical framework (Figure 2) serves to examine the potential of the WA group to induce indeterminacy through three interrelated themes. These three themes are an

adaptation for our study of the three drivers for inducing indeterminacy proposed by Hutter and Farías (2017). The particularity of our study is that it focuses on the transition of farmers' practices and profession in the context of peer-to-peer interactions on a digital platform. Through a thematic analysis (Braun and Clarke, 2006), we examine:

- (1) Configuring the WA group to shelter “new” ideas: we study the characteristics of the social environment and those of the digital platform. The goal here is to capture every aspect of how these characteristics create a frame that generates fertile tension fueling farmers' reflection while offering a protective space.
- (2) Sharing “new” objects: we study the agronomic practices that farmers are exposed to in the WA group. The aim is to identify in the data the objects and practices that can contribute to provoking tension in relation to the existing objects.
- (3) Stimulating new valuations of the farming profession: we study the interactions that contribute to building a new discourse on the agricultural profession in relation to AET. The aim is to identify the expression in the WA group of tension created between the old values and norms of the farming profession and those of more sustainable forms of agriculture.

This analysis relied on several readings of the corpus to become familiar with the data set. Through interpretative work, the first author developed the three themes by cross-examining the data set and the theory. Each theme was categorized according to a coding scheme, for example, “configuring the WA group to shelter ‘new’ ideas” was coded with characteristics of the WA group participants (such as the composition, and the relationship between the members of the WA group or the facilitator's framing of the interactions). She then identified in the data set expressions of rupture, questioning, discrepancy, and new ways of doing things or of valuing objects related to the coding

scheme. We then collectively reviewed each identified element from the data set, for each theme, to check for coherence. The results are presented in a descriptive mode, drawing on the verbatim of three types of actors (Figure 1) and on the four datasets described in Table 2. For reference in our analysis, each verbatim is labelled as follows: individual code/dataset code.

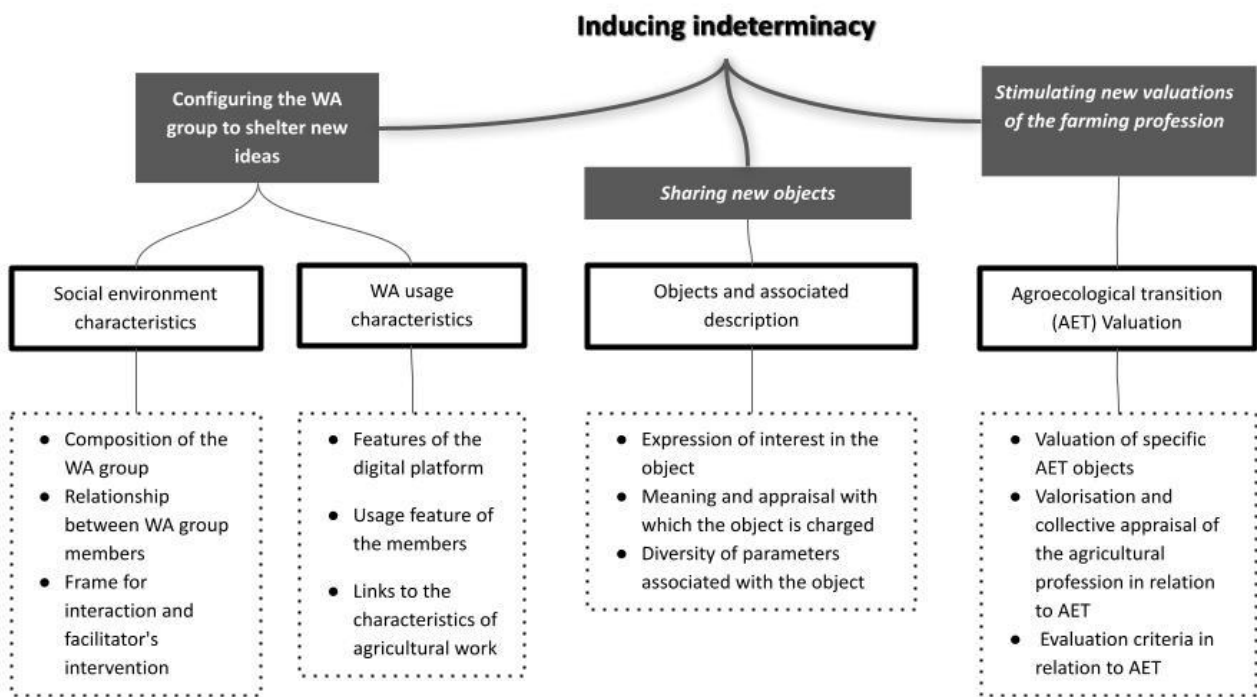


Figure 2. Analytical framework developed drawing on Hutter and Farías (2017) to study the induction of indeterminacy in a WA group.

#### 4. Results

To understand how the WA group potentially induces indeterminacy, we present the results of our data analysis along the three dimensions of our framework: 1) the configuration of the WA group to shelter new idea; 2) the sharing of “new” agricultural objects; and 3) the stimulation of new valuations of the farming profession.

#### *4.1. Configuration of the WA group to shelter new ideas*

Two features of the WA configuration seem particularly likely to induce indeterminacy:

1) the openness of the social environment; and 2) the instantaneous sharing of visual content.

##### *Openness of the social environment*

The analysis of the characteristics of the WA group's social environment suggests that the group opens up each participant's environment, including that of the farmers. This openness can be seen through the connections that are built between diverse actors, and through an ecosystem of support that involves both farmers and advisors.

The WA group is a space where a diversity of actors meet, and where connections are built between farmers who did not necessarily know one other and who are in different dynamics of change:

*“There are connections that are made, there are groups that are more or less advanced. The first ones help the others to move ahead.” AF1/D1*

*“We will soon come up against a brick wall here, with all the resistant weeds... It also allows us to find solutions through these interactions with other farmers, to see how others are doing things.” FAR24/D3*

The WA group affords members the opportunity to identify people seen as interesting and to meet them, or to arouse interest in certain new themes:

*“On WA, the guys in my group saw the testimonies of people who were enthusiastic about bio-indicator plants and inevitably it made them suggest: you saw what they did next door, it would be good if we could do it in our group.” AF1/D1*

These links between farmers are particularly useful as the WA group is used very frequently: the majority follow the messages daily (29 of 39 responses). Although participants do not systematically share content, almost all of them read the information posted on the group (34 of 39 responses):

*“When we did the strip-till with [farmer], we made a video ... but it wasn't commented on much. We'd been to Poitiers to an agricultural fair and there [we'd heard]: 'ah, but it's with your friend that you make videos'. There you realize that people don't react, but they've seen it.” FAR03/D3*

These interactions take place in a relatively kind context, handled by the facilitator, although in some situations the large number of messages can be off-putting.

The WA group does not exist by itself; it is part of an ecosystem of farmers' support, training and monitoring within the cooperative. For instance, the advisors take part in the training sessions on agroecology practices that are proposed (e.g. plant macerations for crop protection), in the same way as the farmers do. Their involvement as actors of the AET can thus help to maintain a certain tension, caused by the training sessions and the WA group, when they meet farmers during regular farm monitoring visits. This contributes to the relationship of trust in the advisory process, because both parties are committed to change and are aware of the risks:

*“When we enter this type of agriculture ... we're at the same training, with the advisors, so anyway we're on an equal footing, we co-construct things, and this is something that I really liked.” FAR25/D3*

*“The fact that I saw intercropped sunflowers with the WA group and, well, we talked about it when the advisor came for my potash concerns on my plot.” FAR18/D3.*

Another original aspect of this WA group is that it integrates independent experts who participate in the training sessions of the groups involved in Ecophyto. The integration of these experts helps to build confidence in the direction of change and to reassure those who are ready to change their practices. This ecosystem reinforces the diversity of ideas that are exchanged.

*“Post a photo of an unknown insect larva, need advice on rapeseed and [agronomist] responds immediately... WA brings together a lot of competent people with experience, we have answers!” FAR05/D2*

### *Sharing of instantaneous visual content*

The analysis of the use of the WA group reveals the importance given to the sharing of visual and instantaneous content. This sharing creates opportunities to access unexpected content, to explore a diversity of parameters for a “known” object, or to participate in enriching the links between objects built during the training courses.

The sharing of audiovisual content (videos and photos) is the most popular function among the WA group participants (33/38 responses). This audiovisual content shows the feasibility of certain practices:

*“The downside of the snapshot is that you can’t say everything in a photo and a comment, but it creates interest.[...] When it’s repeated on a daily basis, it makes you say, all things considered, there are many more people who practice, why not me.” AF1/D1*

The members are aware that images are insufficient to provide all the information, but they are a start to interactions that may take place elsewhere:

*“The drawback of the snapshot is that you can’t say everything in a photo and a comment, but it does spark interest, discussion.” FAR18/D3*

The sharing of visual content is an important feature, as it mobilizes the farmers’ “eye” on their fields: color of the crops or soil, presence of diseases, regularity of crops, density, etc. The visual nature of the content contributes to the accessibility of information on crop management and thus facilitates the comparison of different realities.

*“When you click on the photo, you see a crack in the soil. It’s the same with me, at this time of year there’s not much density. Afterwards, I can’t see how it was sown...” FAR03/D3*

It sometimes makes it possible to observe progress during the crop year or from one year to the next, and puts the farmers in a position where their own situations remain to be qualified:

*“For example, the corn at [farmer]’s [...] this year, it was a success, there’s good progress. When I compare it to last year, it was a mess, and today it has a nice*

*cover. Unfortunately you need failure to succeed. [...] It makes me want to do it like that [...] There's really something to think about." FAR12/D3*

The WA group provides spaces for comparison, self-examination, and an image of the “desirable” practice that can serve to induce indeterminacy. The facilitators also participate in configuring this space by urging farmers to feed the group with news about their activities. In this way, they help to create opportunities to access unexpected content or to explore a diversity of parameters for a known agricultural object. For example, they ask farmers to share photos of insects to identify pests, or of beneficial insects to reflect on the need for phytosanitary spraying.

To sum up the ways in which the configuration of the WA group shelters new ideas, we can see that it supports both social components (e.g. diversity of actors) and functional components (e.g. ease of sharing audiovisual content). This configuration helps to give access to the unexpected and increases the frequency of communication of elements that are potentially dissonant for the farmers. It urges them to examine and to question their own situations. The heterogeneous composition of the WA group may also encourage a form of reassurance and thus keep the tension within a window of tolerance, to initiate a process of inquiry.

#### ***4.2. Sharing new agronomic objects***

In this part, our analysis of the contents of the WA group shows two forms that new agronomic objects take, and which can contribute to inducing indeterminacy: 1) innovative, even transgressive agricultural practices that break away from “conventional” ones, and 2) known practices that take on new meanings with a different appraisal.

##### *From new practices to transgressive ones*

The majority of farmers stated in the questionnaire (89%, n=19) that they thought the

primary role of the WA group was to discover new farming techniques. What mattered was to show what was “new”:

*“WA's role is to show us things that are being done that I don't know much about. Sunflower with fenugreek and doing double cropping, that's a good idea [...] that I haven't had.” FAR25/D3*

For the facilitator, sharing this content can support innovativeness and the enrolment of farmers in innovative practices. We will consider two examples here, one on the management of intercropped rapeseed and the other on that of intercropped sunflower.

The intercropping of rape with other species is discussed extensively within the WA group:

*“It cheered me up to see photos on the WA group of farmers who practice intercropping with rape. With this way of working, we see that we're not moving into the unknown, there are some who're already doing it.” FAR24/D3*

This practice is already well referenced both in the agricultural world and in agricultural research. The sharing on the WA group of content related to this practice shows the diversity of ways to implement the practice by identifying the different types and combinations of species that can be intercropped with rapeseed, as well as other characteristics of their management: the spacing of the rapeseed, the variety sown, its date of sowing, rainfall condition, the tillage applied, the phytosanitary treatments, etc. For example:

*“Intercropping rapeseed with clover - direct seeding in a buckwheat catch crop and after barley. Problem of nitrogen availability when vegetation restarts following under-fertilization. Too much clover development.” FAR21/D4*

These indications, based on key elements of the farmers' usual management, can help to introduce new properties into their transaction with the “rapeseed crop” object, such as no longer associating the rapeseed crop with the use of insecticides:

*“I grow rapeseed without insecticides, whereas before that was inconceivable, we used 5-6 insecticides on rapeseed.” FAR12/D3*

The WA group also allows farmers to start building shared references around an

unfamiliar practice such as intercropped sunflower. References are collectively built through experiments and observations of the competition between sunflower and the associated plant. This practice is guided by the objective of reducing chemical weed control without any references to its advantages:

*“Intercropping sunflower is not common today, but it may help me save on weed control or create a symbiosis with the sunflower and then, one day, allow me to sow directly in covered and healthy soils.” FAR12/D3*

The experimental nature of the content shared arouses interest, although not enough to trigger the decision to implement new practices:

*“Sunflower is usually weeded, so that weeds do not penalize the sunflower. This is completely different. It's legumes! I hope that these people will contribute some information about that practice. [...] After that, having meetings, developing the subject...WA gives ideas, but it's not enough, after that you need to have a testimony, to have [information on] results, on economic returns.” FAR24/D3*

This interest is found not only among the experimenters who are imagining new trial modalities, but also among those who are following the group and for whom it opens up gaps in their way of thinking about the management of certain crops. Thus, exposure to these experiments potentially disrupts the norms and rules established around an agricultural object, thus offering new parameters to explore.

### *New meanings*

The WA group also shares information about agricultural objects that the farmers are familiar with, as interactions around these objects open up new meanings. Confronting the farmers with these new meanings can help to induce indeterminacy. Among the various objects discussed in the WA group, plant cover crops are a good example of this renewal of meaning. The practice of cover cropping, traditionally associated with a regulatory standard on soil nitrate management, has become an important agronomic asset in the farmers' agricultural management. The benefits of the practice go beyond water quality: input of organic matter, input of nitrogen thanks to legumes, improvement of soil

structure, and so on. For some farmers, the change of meaning has led to changes in their appraisal of this object, from being restrictive and undesirable, to being something positive that can potentially help to solve problematic work situations, particularly those related to compacted soils, or to save on fertilization inputs:

*“Ten to fifteen years ago, I was against it. I went from being against it to being indifferent, finding it unnecessary, and now, I’m not putting it as a priority, but considering it as a crop in its own right. [...] When I see what it can do for my soil structure problems, I can see that part of the solution to the problem is there, but I had to be taught and shown and have it demonstrated.” FAR25/D3*

Through the WA group, farmers are exposed to these new meanings of plant cover crops, which are deployed in a variety of ways in the group: the types of species sown, the sowing management (date, tillage tools, etc.), fertilization, destruction and cover crop succession. This evolution of meanings potentially helps to induce indeterminacy, so that the farmers introduce new properties of the cover crop into their transaction that may come into tension with their usual management:

*“I’m following the work on total soil covering, but that’s not yet the case on my farm, we still do tillage. I’m not totally ready to go there yet, but I’m interested.” FAR10/D3*

To sum up, the sharing of new agronomic objects helps to disrupt the status quo of the farmers' activity without placing them entirely in situations of uncertainty. Exposure to the variability of the spatio-temporal modalities, operations and agronomic objects involved in the management of a crop, and their progressive follow-up over time, are potentially conducive to indeterminacy. This exposure can create destabilization, questions, surprises, and therefore potentially a new valuation engaging a desirable practice hitherto unknown in the farmer's situation.

#### ***4.3. Initiation of new valuations of the farming profession***

The WA group promotes the production of new valuations for individuals and the

collective by reflecting a new narrative for the agricultural profession at the time of the transition to agroecology. This narrative consists of elements of a discourse showing what it is to be a farmer today or, in other words, what professional model organizes farming methods and ways of being a farmer. The discourse of the facilitator in the WA group leads us to believe that he devotes energy to renewing the narrative that structures the identity of the agricultural profession, in order to integrate the challenges of transition to agroecology. Through his interventions, the facilitator participates in resituating the elements shared in the WA group in this perspective. This narrative also plays a role in the revalorization of the agricultural profession, particularly in view of the image of the “polluting farmer”, to which the farmers in the group seem to be receptive:

*“It [the WA group] is a great tool that provides an important link, especially in these times when the farming profession is not always looked upon in a positive light.” FAR07/D2*

The narrative is thus built around several elements of discourse, particularly of the facilitator, including: i) agriculture is a solution to meet societal challenges, particularly in relation to the ecological and climate crisis; ii) there is a convergence between improved economic performance and agroecological practices; iii) it is important to train and to experiment, to be part of a progressive process in trajectories of change; iv) improving soil structure is a central pillar of work in the process of changing practices; v) redesigning agricultural systems starts with crop rotations; vi) we need a diversity of agricultural systems and strategies (e.g. conservation agriculture, organic agriculture, mixed farming); vi) the collective and relations between farmers are key to overcoming difficulties and helping one another.

The WA group is a space where value-laden ideas that depart from or perpetuate the dominant agricultural model can coexist or come into conflict. It thus potentially allows for the promotion of new values and work rules without prohibiting the expression of

values and rules that are “currently” practiced (e.g. crop productivity). The facilitator thus relies on agronomic objects such as “soil” to introduce new meanings of the soil object, and to encourage a new valuation of the agricultural profession. For the facilitator, approaching AET through the issue of soil makes it possible to avoid the tensions caused by the injunction to reduce pesticide use. The “soil” as an object makes it possible to reconcile diverse perspectives:

*“Innovations and practices related to the preservation and quality of the soil, and also techniques that make it possible to reduce the use of pesticides [...] Everyone has a soil, it speaks to everyone, it brings everyone to the same goal.” FAC/D1*

The “soil” as an object is also an element that regularly intervenes in explanations given by the facilitator or produced by the farmers themselves when content relating to difficulties, questions or dissatisfaction with crop development is shared. For example, the facilitator reacted to photos shared by a farmer about disease problems on flooded crops:

*“Poor water circulation/penetration on the plots is just as detrimental in a dry year as in a wet year. In short, poor rooting and root asphyxia equals poor plant nutrition, which consequently makes crops more vulnerable to pests [...]. Having a healthy, well-structured and dynamic soil is a major issue for the agricultural profession. With less pesticides in the future and more climatic hazards, the robustness of your soil will be a guarantee of profitability.” FAC/D4*

Mobilization of the soil object to reconstruct meaning participates in its integration in the appreciation of work situations without, however, precluding other criteria of evaluation and interpretation that are more usual for farmers. By showing a diversity of ways of valuing work situations, the WA group becomes a space for farmers to test new ways of evaluating their own work.

To sum up, it seems that, through the discourse on certain objects, the initiation of new criteria for valuation of the farming profession does generate new values and norms. The proposal of a narrative can help farmers to envisage another form of coherence for their

profession, one which supports valuation criteria that allow them to consider new practices, norms and criteria. Our analysis highlights the particular role of the facilitator in supporting the renewal of valuation, in the sense of engagement in agroecological transition.

## **5. Discussion and conclusion**

Our work started from the acknowledgment that there is a lack of research on the use of digital tools in the process of farmers' agroecological transition. The aim was to contribute towards bridging this gap by proposing a conceptual and methodological framework for examining the links between digital use—in our case peer-to-peer interactions in a WA group—and the process of AET—captured here through the concept of inquiry. More specifically, this framework allows us to understand how the use of a WA group in a community of diverse agricultural actors can participate in inducing the indeterminacy that initiates inquiry for farmers. Understanding potential drivers of indeterminacy opens some practical options for extension services to enhance the way farmers are supported.

We show the interest of building a space where potentially dissonant and re-assuring elements coexist, in order to motivate the farmers' commitment to AET. This seems to be possible thanks to the facilitator's efforts to maintain fertile tension among farmers and thus to foster a training dynamic in the community, with regard to the agroecological transition (its practices, norms, work logics, etc.). This effort cuts across our three themes: it supports the exploration of “new” objects and their properties; it provides new explanations of the phenomena noted by the farmers; and it participates in building links in an ecosystem of support. In comparison with the work of Hutter and Farías (2017), the professional transformation of farmers implied by AET requires persistence “in the long

run”. It is a challenge for advisory services, which need to give access to a diversity of situations and interpretations to enable farmers valuations of their activity and thus to depart from the status quo. In order to create a fertile tension, advisors need to organize disruption in farmers' situations while maintaining a form of continuity with the existing situation, so that the tension remains sustainable. Like other studies on communities of practice (Tarmizi et al., 2006; Probst and Borzillo, 2007; Gosselin et al., 2010; Bootz, 2015), we therefore emphasize the importance of the facilitator as a pilot of the community. The role of a pilot providing facilitation and coordination functions is to “stimulate without stifling” the activities of the community (Josserand and de Saint Leger, 2004). In our case study, we highlight how the facilitator stimulates farmers’ valuation activity and the sharing of innovative objects in order to engage in AET. Thus, beyond the discussions about innovative practices, we think that the essence of this community is its ability to question the values and knowledge relevant to conventional agriculture. It is also to support each participant in breaking from their routine while collectively engaging in the definition of new standards of work satisfaction, more appropriate to sustainable agriculture. Additional work would be needed to further develop the characteristics of what might be called a “valuation community” and how it influences farmers’ behavior and work. As Navarro-Aguilar (2017: 72) points out, “*Understanding value as an outcome of valuation practices opens a fruitful avenue to investigate the power effects of valuation on strategizing and organizing. This can be done, for instance, by examining the valuation practices and mechanisms that enhance (or diminish) the ‘strategicness’ of ideas-to-be-enacted*”. Furthermore, there is a challenge for the training of facilitators: they have to build new skills so that they can stimulate this valuation activity that supports farmers' inquiry. To develop this skill, facilitators have to pay attention to ways in which values are debated in a situation, and how such a debate is

shaped at two levels (Dussauge et al., 2015): i) the nature of the concern (what is of concern to whom), and ii) the “right way” to value an issue (according to what values). WA features, and especially the sharing of visual content, are an interesting medium to use to initiate the debate and trigger a valuation activity. Because of the existence of a professional culture that comes with concerns about peer judgement and recognition (Lamine, 2011; L  mery, 2011), we believe facilitators must support a value-based AET (Hazard et al., 2021) to help farmers distance themselves from the usual assessment criteria of conventional agriculture. Navarro-Aguilar (2017), Rosental (2013), and Kaplan (2011) argue that such content, like evidence, highlights some striking characteristics of an object, practice, or phenomenon, and thus emphasizes the values to be performed or the meaning to be negotiated in uncertain environments. Other artefacts can be used, as in the case of Hazard et al. (2021), where a diagnostic tool, designed to be evidence-based and prescriptive, was used for judging the social acceptability of solutions that made sense in each farmer’s own situation.

Furthermore, we point out that giving access to the “new” is an opportunity to induce indeterminacy and not just a way of proposing a ready-made solution to be adopted. As Coquil et al. (2017) pointed out, the discovery of something new shifts what is thinkable and opens up new perspectives. This is an important issue with regard to farmers’ training in AET, as past experience can reduce the scope of their awareness, causing them to overlook some elements of their working situations and therefore to be less able to doubt or to be surprised (Hadzigeorgiou, 2013; Schinkel et al., 2020; Thievenaz, 2017b). In our study, exposure to the diversity of rapeseed intercropping practices contributes to these practices being perceived as accessible and producing satisfactory results, in terms of input savings for example. Highlighting the experiments also shows that the established rules and standards can be called into question, while seeing these changes as part of a

progressive, step-by-step process of trial and error. Opening an inquiry also implies risk-taking and an effort to suspend judgment and “gamble on the unknown” without knowing the outcomes of the transformation that will occur (Bourgeois and Nizet, 1997). Thus, a challenge for farmers' training and support consists in being attentive to what prevents indeterminacy and, ultimately, the opening of the inquiry. Considering these moments of dis-adjustment in subjects' activity from the outset of professional training (Thievenaz and Piot, 2017) can help to ensure that farmers' barriers to change in AET are taken into account.

Although our work is based only on a case study, one of the supports that seems important for the deployment of these digital tools is their articulation to the existing ecosystem of extension services. Farmers reliance on a diversity of resources and actors to navigate in their work makes it difficult to isolate the digital community from the whole ecosystem of support. From this perspective, it is essential to understand how the WA group is used to question farmers' activity in relation to what matters to the community. The facilitator must be able to grasp what the community values and acknowledge each farmer's work situation to meet to their specific needs.

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