

From evidence to value-based transition: the agroecological redesign of farming systems

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Abstract

The agroecological transition of agriculture not only requires changes in practices but also in ways of thinking and in their underlying values. Agroecology proposes broad scientific principles that need to be adapted to the singularities of each farm. This contextualization leads to the identification of agroecological practices that work locally and could serve as evidence-based practices to be transferred to local practitioners. This strategy was tested in a 4-year experiment conducted with dairy-sheep farmers in the South of France. The aim was to collectively engage in the agroecological transition. Our work focused on the creation of a diagnostic tool that was used to analyze local farms and identify virtuous practices to be promoted locally as evidence-based practices. But this strategy came up against the complexity and singularity of the situations to be transformed: not only was no evidence found but the construction of the diagnostic tool itself led to controversy concerning the models of agriculture to be promoted. The experiment then took a pragmatic turn: on-farm workshops were organized to enable farmers to benefit from the professional judgment of peer farmers who were willing to help their colleagues accomplish their agroecological transition. The diagnostic tool, which was designed to be prescriptive, was then used to judge the social acceptability of solutions that made sense in each farmer's own situation. Our experiment led us to conclude that managing the agro-ecological transition of farmers and their farming system is better conceived as a value-based process than as an evidence-based one.

Keywords Co-design • Generative experiment • Participatory design • Pragmatic inquiry • Professional judgement • Transition management

Abbreviations (please identify and add these here)

AVEM	Association Vétérinaires Eleveurs du Millavois
CETA	Centre d'Etude et Technique Agricole
EBITDA	Earnings Before Interests, Taxes, Depreciation and Amortization
EM	Equivalent Milk
EF	Equivalent Fuel
FAO	Food and Agriculture Organization [United Nations]
INRAE	Institut national de recherche pour l'agriculture, l'alimentation et l'environnement

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Introduction

Agriculture is in crisis. Most modes of agricultural production are no longer sustainable (Tittonell 2014). Agricultural intensification has had a series of unexpected negative effects, particularly on the environment and on consumer health. The majority of European citizens consider the situation has become untenable and that agriculture must engage in a sustainable transition (De Schutter 2014). As already proposed by Röling & Jiggins in 1994, undertaking a sustainable transition in agriculture requires a shift from input-intensive to knowledge-intensive agriculture. Agroecology is an alternative agricultural model that makes use of ecological knowledge to redesign new farming practices and systems (Gliessman 1990). Major principles have been proposed to create more sustainable practices by restoring the natural functioning of the agroecosystem (taking advantage of biodiversity, closing nutrient and water cycles, etc.). The need to take advantage of the context of agricultural production led to a more systemic view of agroecology and in turn, to an agroecology of the food system (Francis et al. 2003). This has resulted in more general principles that should guide the agro-ecological redesign of socio-technical systems (see for example the 10 elements of Agroecology proposed by FAO, Barrios et al., 2020). These principles suggest a shift from considering agricultural production as the transformation of synthetic inputs to the result of agroecosystem functioning (Tittonell 2014). It is no longer a question of controlling and artificializing the means of production but of steering a complex system and enhancing local ecological potential. Transitioning requires a profound change in the way farmers think about their practices and, consequently, in the values that underpin these ways of reasoning. The problem is then how to implement such a transition to create sustainable production systems that are adapted to each specific context.

Developing agroecological practices and systems that work challenges the way of thinking about the relationship between knowledge production and innovation. As pointed out by Coquil et al. (2018), the top-down regime of knowledge and technology transfer that continues to prevail cannot produce tailor-made solutions that are adapted to local contexts. Without calling the principle of promoting evidence-based practices into question, the way of producing such evidence is nevertheless at stake. Agroecology is not intended to directly produce “recipes” for farmers. Rather, it proposes a set of principles to guide the search for local solutions that account for the ecological, economic, and social context, and in particular, for local culture and path dependencies. If transition towards agroecology is to be evidence based, such evidence should result from the contextualization of the main principles of agro-ecology and involve local actors and their experiential knowledge (Duru et al. 2015; Coquil et al. 2018; Barrios et al. 2020; Gliessman 2020).

Generating knowledge on new agroecological practices with local practitioners that can be disseminated locally refers to the idea of practice-based evidence (Green 2008). In this case, evidence is produced on the basis of practices that work, i.e., practice-based evidence for evidence-based practices. This strategy originated in the health sector in the 1990s (Sackett et al. 1997). It was rapidly adopted in agriculture, particularly in agroecology where the idea is to promote evidence-based practices that work locally (Shackelford et al. 2019). Putting practitioners like farmers in a position to produce such evidence is likely to give it social relevance that would help get their peers involved in the transition. Indeed, this strategy takes what is good for farmers and their communities into account (Chambers 2021), but relies on proving that the new practices work for them in their context.

In this article, we present and analyze a project for the agro-ecological transition of dairy sheep farms in the Roquefort region in the South of France. It was originally conducted based on a strategy of producing practice-based evidence to build evidence-based practices. The project took the form of a generative experiment that is recalibrated by trial and error until it works (Stoker and John 2009; Ansell and Bartenberger 2016). Such experiments are guided by the actor's reflexivity and learning (Luederitz et al. 2017). It is managed as process-oriented action research that aims to transform a problematic situation (Miller 2013) and to produce solutions (Kemmis 2010). Conducting this generative experiment led us to consider that before being "evidence-based", such a transition was "value-based". It led us to reconsider the professional judgment of practitioners in the face of the ineffectiveness of evidence-based strategies alone in transforming a complex situation.

Generative experimentation

The generative experiment on the ecological transition of dairy sheep farms was designed and launched in 2014. It lasted until the end of 2018. It took place in the Roquefort cheese production region (South of France), where dairy sheep farming is the most intensive in the world. It started when a group of farmers became aware that such intensification was no longer sustainable. The farmers belonged to an association (called AVEM) that grouped 160 livestock farmers (mainly dairy sheep breeders) and their advisors (three veterinarians and an agronomist). These farmers felt that the gap between the needs of their herd and the feed they were able to produce on their farm had increased drastically. Two of the farmers (who were board members of the AVEM association) decided to set up an experiment with their advisors and one researcher (L. Hazard). The experiment followed an evidence-based strategy in which the goal was "farm autonomy". The rationale was that restoring autonomy would result in more profitable and ecologically friendly agricultural production. The first step of the plan was to design a diagnostic tool for the assessment of farm autonomy and its impacts on farm incomes and on the environment (Box 1). Autonomy was defined as the amount of milk that could be produced based only on the functioning of their own agroecosystem, i.e., without purchasing either feed or any other inputs such as fertilizers or diesel fuel. Diagnosing AVEM farms would help identify "good" practices and the levers needed to start an agroecological transition. Farmers would then volunteer to re-design their practices and to monitor the changes they made. The experiment was planned as a three-year project (2014-2017, hereafter referred to as SALSA) that was subsequently funded by the French Ministry of Agriculture under its call for tenders on Agroecology.

<<Box 1 about here>>

The project partners were the local organization responsible for technical and economic monitoring of dairy sheep farms in the area (CETA), the Regional Natural Park, the local Agricultural High School, and the French National Agricultural Research Institute (INRAE). These partners formed the steering committee of the generative experiment with the AVEM agronomist, who acted as the project facilitator. All the actions were planned, and their outcomes discussed, during steering committee meetings. The experiment finally resulted in a new method of managing the agroecological transition by the AVEM association.

During the first phase of the SALSA project, we, as researchers, were participants along with the other partners, in co-designing the diagnostic tool. We sought to guide the process toward greater consideration of the context in which the tool is used in collaboration with the farmers but without taking control of the process. In the second phase, we (the researchers) were responsible for the task of redesigning the farming systems. Throughout the project, our main concern was to work with the project facilitator to make sure that, during the meetings, there was always opportunity for reflexivity and social learning that would enable “*the questioning (and possible integration) of assumptions, knowledge, goals and values*” (Wittmayer and Schöpke 2014).

At least one of the authors participated in all the meetings, workshops, and day sessions on the farms. Their minutes were collected and some were audio or video recorded. Moreover, C. Lacombe took notes on her observations and interactions with the project partners. She also conducted two sets of interviews with the farmers and other participants in the project and in the region. The aim of the first set of interviews was to better understand both the farmers’ current situations and their needs in terms of farm advisory services, and the situation of the advisory services within the AVEM association and the territory. These interviews were completed by direct observations of the practices used by the adviser during group training sessions for farmers and during individual visits to the farms. The second set of interviews was conducted at the end of the SALSA project to identify the changes that had taken place both in their farming practices and in the advisory services provided by AVEM. This database was analyzed through our understanding of the shift from evidence-based to value-based practices, in the sense of Biesta (2010), that had happened during the course of the experiment (Fig. 1).

<<Fig 1 about here>>

Results of the generative experiment

A tool to objectify and increase farm autonomy

Initially, the diagnostic tool was built based on the practice-based evidence put forward by the farmers who led the project for the fact that the greater the autonomy of the farming system, the better its environmental and economic performances. The idea was to build on this evidence to convince farmers to redesign their farming systems to achieve more autonomy and start using environmentally friendly practices. Conceiving and designing this strategy was also expected to identify the “good” practices that would help transform the systems.

Choosing and combining indicators

The diagnostic tool took the form of a model and a multi-criteria evaluation framework to estimate respectively, the level of farm autonomy and its impact on the environment (Box 1). The “autonomy” model was built by adapting the CETA tool used to optimize the technical-economic performances of farming systems. This adaptation was difficult for the CETA technical adviser. First, he had to find a way to calculate the “autonomous” milk production of the farm, i.e., the quantity of milk that could be produced without purchasing feed or other inputs to improve agricultural production (3rd technical meeting, April 7, 2014). No reliable data existed on the impacts of inputs on forage production, a problem the advisor brought up during a steering committee meeting (2nd steering meeting, March 4,

2015). Moreover, a farming system with no inputs made no sense to him. He shared the same vision as the farmers of a farm as a unit that transforms inputs into goods (Fig. 2).

<<Fig 2 about here>>”

Redesigning the CETA model led to reductions, approximations and, for example, to converting the meat produced by the culled ewes and lambs into liters of milk. It also led to over-simplifications that were the subject of disagreement. For example, the farmers who participated in the creation of the tool removed the rangelands from the calculation of on-farm feed production: indeed, estimating the rangeland’s contribution to milk production is difficult and the farmers concerned considered it was negligible. However, their point of view was not shared by all the farmers, and some expressed their concern during the workshops held in November and December 2015 to present the project and the tool to the members of the AVEM association.

The multi-criteria evaluation framework that was being created to assess the environmental impact of a farming system focused on what was measurable. After various proposals from all the partners, the question of the type of indicators to be developed was raised, such as indicators of state vs. indicators of practices. The farmers wanted indicators that qualified their practices according to their assumed environmental impacts. The goal was to create a tool that would easily reveal the best farming practices to be used to achieve a high environmental score. One of the AVEM veterinarians consequently suggested reworking a framework created previously and used by AVEM. It was mainly based on the practice indicators to measure farm sustainability. This proposal won the support of the farmers on the project committee because it enabled very concrete discussion of the criteria to be measured. A lot of work was done on the choice of indicators and their respective weighting (3rd technical meeting, April 4, 2014; 2nd steering meeting, April 3, 2015). A negative score could be given to some indicators, like manure management. The significance of giving a negative score to a few indicators was extensively debated but finally retained without a consensus being reached. Weighting also led to a debate on being organic or not, since it clearly favored organic farming. A few corrections were made to try to avoid directly disqualifying conventional farming systems so as to remain inclusive and to encourage all the farmers to engage in a transition toward autonomy.

Finalizing the tool led to the definition of a goal for the transition

At the end of the first stage of the project, the assessment of the autonomy and the environmental impact of a farm were reduced to one score each. As proposed by the farmers (9th technical meeting, June 10, 2015), the assessments were presented in the form of an orthonormal system (Fig. 3). This graphic representation created an implicit relationship between the two scores and defined the virtuous quadrant in the upper right part of the graph as the target: that of autonomous farms whose negative impact on the environment was low (Fig. 3). *“This representation is considered appropriate to position the (farming) systems on the technical-economic and environmental levels and make it possible to think about the path to be followed to reach a position in the upper right part”* (minutes of the 9th technical meeting, June 10, 2015). The idea was not to give good and bad marks (even though this is in fact what is done) but to create a representation that would allow one to think in terms of margin of progress. Further improvement should be supported by collective reflection. This was an important value for the AVEM, and is reflected in the way

the association gives advice. At this stage of the project, the tool had become a normative graph, which was not planned in the initial project.

<<Fig 3 about here>>

Putting the tool to the test failed to reach a consensus

At the beginning of the project, interviews with farmers revealed a wide range of practices, situations, and projects. Many of the farmers interviewed were already moving toward what they believed to be more agroecological farming systems (e.g., organic farming, conservation agriculture, processing their products on-farm to create a local food system). Autonomy was not expressed as a goal. The decision was taken to test the tool with a few farmers who had not been involved in its design. This test revealed the lack of a social dimension in the tool that many farmers of the association valued. These farmers considered the best farming system was one that allows the largest possible number of people to live on a farm with little impact on the environment, regardless of its level of autonomy. In order to take these values into consideration, indicators of well-being and employment were added to the diagnostic tool (11th technical meeting, January 26, 2016). In 2015, the project partners had decided to broaden the consultation within the AVEM: *“to get farmers who did not participate in the construction of SALSA involved, it was decided to hold meetings with them in the four geographical sectors of the AVEM. These meetings would be based on the presentation of the results obtained by a farmer belonging to the SALSA working group. The farmer would present his position and consider possible changes in his system that would be discussed collectively”* (minutes of the 9th technical meeting, June 10, 2015). At the end of 2015, four workshops were organized. The farmers on the steering committee presented the project, the method, and the tool. They explained their own farm diagnoses and discussed them in relation to the diagnoses conducted on other farms. This led to a fruitful debate with peers about the relevance of the tool and how to use it. The farmers appreciated the opportunity to measure how good they were compared to others. It triggered discussion about their farm management strategies. These workshops confirmed the farmers’ need for an overview of the situation of their farm as expressed in the project proposal. They also validated one aspect of the project strategy: discussion between peers as a way of identifying and promoting agroecological farming practices that work (12th technical meeting, December 4, 2016). This proposal was in line with the practices and values of the AVEM, which since its creation, has promoted the exchange of experience both peer-to-peer and collectively.

No evidence found for good practices to be implemented to reach the transition goal

When the results of the diagnosis conducted on the farms were analyzed, no significant correlation was found between farm autonomy, its environmental score, and its economic performance. As a result, it was impossible to identify and promote any “good” practices linking these different dimensions. Rather, the analysis revealed a diversity of practice arrangements in line with the strategic priorities of each farmer. Achieving coherence between autonomy, the environment, the economic and social aspects was the result of a strategic social construct and not as the expression of a generic law.

The tool became a heuristic to discuss and engage in making changes on the farms

At the end of 2015, the technical committee acknowledged that the statistical analysis of the data collected with the tool had not produced the expected results. The disappointment was so intense that one of the two farmers who had developed the project resigned from the steering committee, as he considered the project had failed. But, based on the results of the 11th technical meeting held on January 26, 2016, the steering committee agreed that the tool offered an interesting basis for collective discussion of the situation of one or more farms (Lacombe et al., 2016). It was at this time that the researchers proposed to use the tool as a heuristic to work with local farmers' groups on their individual goals for their farms and to define the strategy to reach them (Fig. 4).

<<Fig 4 about here>>

With the help of the project facilitator, between July 2016 and January 2017, C. Lacombe organized and acted as facilitator for three groups of volunteer farmers to think about and promote changes toward agroecology. Three sessions were held, the first on a farm whose owner wanted to discuss his plans for change with the other farmers. The whole day was dedicated to reaching a collective understanding of the situation of the farm and comparing it with the situations faced by the other farmers who attended the session. At the end of the session, the group decided on the direction they wanted the re-design work to take and which topics they considered relevant to inform their ongoing or future processes of change. The second session took place on a different farm that was chosen for its relevance to these topics. The third session could be either a visit to another farm, or a session to simulate and discuss relevant changes to be implemented on a farm belonging to a volunteer.

During these sessions, the tool was used as a support to compare the farmers' individual strategies and choices and identify their strengths and weaknesses, but also to help farmers think about the possible and acceptable changes they could make or were already making on their farm. It was also used as a simulation tool to enable discussion of the changes one farmer was already making or wanted to make. The overall picture it provided of a farm situation (technical and economic efficiency in the use of inputs, environmental impacts of farming practices, social and economic evaluation of the farm) allowed the groups to discuss all the aspects in one session, which was very useful for the farmer whose case was being discussed as it enabled him to envisage the situations his farm could be in as a result of the changes he wanted to make. For example, one of the farmers who was changing the dairy period on his farm explained: *"it helped us build a comprehensive picture of what we could expect from the changes we were making"* and that *"it was really reassuring and useful"* (Florian, November 29, 2017). During these on-farm sessions, practices that had not previously been considered in the tool were discussed. This was the case, for example, of the acceptability of wrapping in relation to its environmental impact linked to the use of plastic. This led to changing the tool to include plastic waste and recycling.

Return on the global strategy of the project

The researcher and the project facilitator who moderated these sessions wondered how to capitalize on her experience with the farmers and the members of the steering committee who did not participate. During the steering committee

meeting on January 11, 2017, a video of the on-farm sessions was presented to discuss this method of farming systems redesign. During the final meeting of the SALSA project, one of the points that came up was that the way of working used in the project made it possible to continuously review the tool and its use. It also gave the farmers the opportunity to use the tool themselves to pursue their own questioning about their farms. At the end of the project, the project partners wanted to continue monitoring and thinking about the tool and how to use it to be able to analyze “*how it changes*” and “*how it is used by the different partners in the long run*” (minutes of the final meeting, March 20, 2017). Other opportunities for reflexivity about the work undertaken during SALSA arose at several meetings with the AVEM's administrative board in 2016 and 2017 when the project facilitator reported on the progress of the project. During working meetings held specifically to think about the sustainability of agroecological monitoring at AVEM, the members of the board decided to continue the small group facilitation that began during the project and to use the diagnostic tool during these sessions, if the farmers in the groups so desired.

Discussion

The aim of the SALSA project was to manage the agroecological transition of dairy sheep farms by implementing the evidence-based practice that states that the economic or environmental performances of a farm increases with increasing farm autonomy. This strategy failed because of the impossibility of objectivizing the complex functioning and performance of these farming systems in their environment and of establishing causal relationships. Consequently, the idea of identifying virtuous practices to be promoted in order to achieve this autonomy no longer made sense. This failure turned out to be an opportunity because it enabled a debate on the ends and means of the transition. It tipped the project into a strategy that can be described as “value-based”. The aim of the collective approach was no longer to explore a diversity of cases in order to identify generic levers of action, but to produce a shared framework to evaluate the acceptability of the individual solutions to be implemented on each of the farms. This shift signals a profound change in the way of considering the place of knowledge and the place of values in the transition process and has practical implications for project management.

Impossible objectification

Thinking about change requires reducing complexity, and as Davoudi (2006) says: these reductions are value-loaded because evidence makers are not value free. In farming system transformation, the first reduction consists of representing the socio-technical system in which the practices take place. The farmers construct their own representation of their production system and its interactions with their environment. Producing evidence-based practices requires a shared representation of the system in which these practices take place. In the case of SALSA, the representation of the farming system to be modified was explicit since it was represented schematically (Fig. 2) but never discussed. A debate would have allowed the researchers to question the linear nature of the representation with inputs and outputs versus more circular representations of an agroecosystem functioning (Tittonell 2013). Referring to the ESR model (Efficiency/Substitution/Re-design) developed by Hill (1985), the representation clearly indicates that the change envisaged remained within a logic of efficiency and did not get farmers to redesign their system. This representation was foundational to the strategy developed in the SALSA project and influenced the creation of the

diagnostic tool. One may thus consider, as indicated by Hatchuel and Weil (1995), that the way of thinking of the tool's creator can implicitly frame the way of thinking of its users.

If in SALSA, the representation of the production system was not put to debate, the choice of performance indicators of these socio-technical systems to build the diagnostic tool were discussed extensively. This debate revealed how difficult it is to objectify a notion such as performance. The indicators of performance were chosen for their ease of use and their ability to measure what SALSA partners valued. However, certain dimensions were abandoned because the project participants did not know how to quantify them and/or thought they were not relevant for milk production. This was the case of the use of rangelands: first, their contribution to milk production is not known because there is no simple way to assess a grazing animal's intake, and second, the farmers concerned, because they are involved in intensive farming, consider rangelands to be a negligible source of feed for their animals. Bossel (1996) speaks of "orientators" to describe indicators whose choice is value loaded. In this case, building a diagnostic tool that enables the objective and faithful representation of reality was shown to be impossible. Moreover, objectification was also undermined by the need to include social concerns. For example, the first version of the SALSA tool scored organic farming systems higher than conventional ones. It had been reweighted to avoid this cleavage the farmers thought could be counterproductive to getting all the farmers involved in the transition. In fact, defining the notion of performance in that case should be seen rather as a form of negotiation that accounts for the diversity of what is valued by those who refer to it, as long as the different dimensions thus made explicit are compatible. This finally raises the question of the compatibility of what is valued before the problem of its objectification.

Several values of agriculture were revealed during the project. The farmers who joined the project were all farmers who wanted to get away from the logic of technological intensification based on chemical inputs and mechanization. They expressed their concerns about their negative impact on the environment and employment on the farms. A first axiological division was revealed by the debate concerning rangelands and their exclusion from the indicators chosen for the diagnosis. This exclusion can be interpreted as the sidelining of farmers qualified by the group as "degrowthers", those who had decided to reduce their level of production and income by using natural resources as much as they could (Thenard et al. 2014). Among those wanted to maintain a high level of production, it is possible to distinguish between those who value the environment the most from those who value employment on the farms the most. The former managed the project. Their strategy is what Tittonell (2014) calls "ecological intensification", using biological diversity to foster complementarities between species and biological regulations. The environmental grid reveals this vision showing the importance attached to crop diversity, mixtures, the use of heterogeneous farmer varieties, etc. (Box 1). However, during the course of the project, some farmers revealed their attachment to the social component. This vision led to enriching the diagnosis with new indicators to reflect this social concern. These were farmers who want to solve environmental problems through their engagement in organic farming and maintain a high level of production and income by purchasing food off-farm. Their objective is to maintain a maximum possible employment on the farm at the expense of farm autonomy. Finally, a last axiological divide appeared, epistemological and radical in nature, between those who left the project when they understood that the evidence-based approach was

failing, and those who remained, accepting the idea that performance and technical coherence are social constructs that needed to be reworked to account for all operating values.

From controlling to steering

According to Biesta (2007) the building of “evidence-based practices” follows a “causal model of professional action”: it intends to provide evidence that an intervention will result in certain effects. Our experience shows that it is not possible to establish causal relationships within sociotechnical systems such as farms that are managed by humans in a complex and changing environment (Voß and Kemp 2005). The link between farm autonomy, economy, and its environmental impact, if there is one, is to be sought in the farmer's way of thinking: they are the ones who create coherence in managing their farm. Such coherence is not external to the interaction that farmers have with the objects they manage. In the SALSA project, given the diversity of contexts and farmers' ways of thinking, it was not possible to find generic levers of change to be promoted for use on all farms. Establishing causal relationships and, consequently, a mode of action based on this causality requires operating in a closed environment (Biesta 2010; Guile 2019).

In agriculture, evidence-based practices are more effective when implemented in controlled production systems such as hydroponic greenhouses or indoor husbandry. It is in medicine that evidence-based practices are the most successful because they are applied in a closed environment such as a hospital, and sterile spaces (Slavin 2002). Evidence is all the more operational the more the conditions of its use resemble those of their production (Callon et al. 2009). Agricultural intensification based on scientific knowledge and technical innovation was mainly a process of control and artificialization of production environments. This artificialization enabled an increase in production and in the sanitary quality of agricultural goods. However, despite attempts to close agricultural systems, they have always remained connected to the surrounding ecosystem. As a consequence, unexpected leaks occurred, such as nitrates polluting groundwater. Agroecology proposes to shift from that logic of control to that of steering an agroecosystem while acknowledging and valuing its interactions with its singular ecological, economic and social context (P. A. Tittonell 2013). The goal is to embrace the complexity and to consider the farm as an open system that moves us away from a causal model of professional action described by Biesta (2007).

Values-based practices

Being unable to implement practices based on evidence, actors have no other choice than using their “professional judgment” to take action. This professional judgment is an inference that calls on professional expertise to identify which of the possible actions in a situation is the most appropriate (Guile 2019). While the SALSA project seemed to have reached an impasse, the work conducted on farms with a few farmers willing to help their counterparts opened up new perspectives. Thanks to this work, the logic of evidence-based practices was replaced by a logic of value-based practice. It took the form of a collective inquiry, in the sense of Dewey (1938), to support a farmer in redesigning his/her own production system with the help of his/her peers. This inquiry was carried out on the farm, well anchored in its context and in the farmer's activity. It was what Lacombe et al. called “activity-centered design” (Lacombe et al. 2018). Solutions came from the sharing of the professional judgements of the participants examining the farmer's

situation. The on-farm inquiry conducted in the SALSA project aimed to promote dialog between the farmers who were seeking advice on how to redesign their practices and their peer helpers. The aim of the dialog was to understand both their situation and their own project in order to propose solutions in line with what Guile (2019) call their “web of reasons”. According to Biesta (2007), professional judgment is the only way to deal with “highly singular” situations.

A professional judgment is not only about what is possible but what is desirable (Biesta 2007). In addition to the horizontal learning that occurs in the peer-to-peer format (Anderson et al. 2018), professional judgments involve value judgments. In the case of SALSA, the diagnostic tool conveyed that axiological dimension. In the farm inquiries, the SALSA tool was no longer used as prescriptive but as a normative heuristic that defined the collectively negotiated scope of what was desirable. It was no longer considered as producing a true representation of reality but rather as a space of socially acceptable solutions based on the values held by the actors involved in the project. The tool was the subject of negotiation. It has thus evolved to incorporate a social dimension that was originally absent. The SALSA tool acted as a “boundary object” (Jeantet 1998) articulating two dimensions: a collective dimension that resulted in a normative framework for the transition, i.e., “what is acceptable or desirable”, and an individual dimension that allowed each farmer to develop his/her own projects in his/her own situation, i.e., “what is possible” while complying with the collective values. These two dimensions can then be articulated in a dialogical process where both collective norms and individual projects are reconsidered according to “what works” from the point of view of the actors.

The democratic issue

The shift from a prescriptive transition based on evidence to a normative one based on values underlines the democratic issue associated with participation in the transition process. The virtue of our case study is to show that participation is not a problem of statistical significance but of democratic control of the transformations considered. Here the construction of the intermediate object (i.e., the diagnostic tool) clearly established a norm in the redesign process. It appears from this trivial activity that the means and the end of the agro-ecological transition must be treated as a democratic issue without assuming there is only one possible outcome (Lane and Down 2010; Loorbach 2010; Miller 2013). In the SALSA project, no major deliberation was originally planned. Nevertheless, it took place during the course of the four workshops that were originally designed to present and test the diagnostic tool. It was at this moment that farmers realized that this tool did not account for the social dimension of the agro-ecological transition. As revealed by Christiansen et al. (2018), maintaining and developing social life in the rural space and promoting employment are the first expectations for an agro-ecological transition in this area. The tool was then equipped with new social (number of workers on a farm) or psychological (level of satisfaction of the farmer) dimensions that were not originally identified. However, at the end of the experiment, only 30 farmer members of the association had taken part in the project, i.e., a minority of its 160 members. Many farmers in the association did not feel concerned by the agroecological transition of their farms.

Shifting from an evidence-based to a value-based transition challenges the method of project management. This shift requires an epistemological change in the way of conceiving knowledge and its role in how the transition is conducted.

SALSA revealed the limits of the instrumental approaches that dominate science and the management of change to be able to act in complex and uncertain situations like those inherent to an agroecological transition (Hazard et al. 2020). This experience was so violent that one of the farmer-designers of the project quit the steering committee. It should be noted that rationalism and its instrumental vision of knowledge largely dominates current ways of thinking about the transformation of production systems in agriculture. This very normative view is widespread among farmers and their advisers. This is not surprising because, in France, they have been “immersed” in this scientific culture through their professional training and by the scientific foundation on which the agricultural productivist model is based (Noulhianne 2016). Their ways of thinking are influenced by the classic linear and deterministic way of managing a project. When working with counselors, communicating with public authorities, or dealing with banks, farmers are confronted with this logic. Clearly this logic greatly interfered with the implementation of SALSA, hindered the development of fully adaptive project management that could have made the transition from an evidence-based to a value-based strategy easier.

Pragmatic inquiry into a new theoretical foundation for management of the agro-ecological transition

The agroecological transition deals with indeterminate situations in the sense of Dewey (Dewey 1938). An indeterminate situation is a situation in which the actors know that they cannot continue doing what they usually do without knowing how to act. These are situations where “habits” no longer allow the problems encountered to be posed and solved. The goal is then to restore a form of determination, i.e., everyone knows how to act in a successful and satisfying way (Dewey 1925; Dewey 1938; Lorino 2018). The aim of adopting an evidence-based strategy is to rapidly reduce this indetermination. As soon as evidence is found, the transition becomes a deterministic process of implementation. However, in the process of agroecological transition in which farmers are engaged, the goals, the ends to be achieved, remain to be defined. Agroecological transition is an open-ended process, a kind of journey in which the ends are to be redefined at the light of the achievements. In this respect, this process gives rise to many processes of valuation in the sense of Dewey (Dewey 1938), i.e., processes of inquiry in which the relationship between ends and means is frequently questioned: if what is not wanted is known, what is sought is gradually redefined in the intimacy of the problematic situation. In such a context, an evidence-based strategy is doomed to failure. As shown by Biesta in educational research (Biesta 2007; Biesta 2010), the evidence-based strategy prevents the practitioners who use the results of the research, which in our case were advisors and farmers, from discussing the objectives of the actions they take and, more generally, from discussing what is desirable and how to achieve it. Agroecological transition requires, on the contrary, conducting a collective inquiry with all the actors concerned in the pragmatic sense of the term (Dewey 1925; Dewey 1938; Lorino 2018). A pragmatic inquiry consists in analyzing the problems and the solutions to be implemented by examining past or future actions from the point of view of their practical and moral consequences. The case of the SALSA project, beyond the failure of an evidence-based approach to deal with complexity, is a good example of a collective inquiry that brings together farmers, their advisors and researchers. This inquiry gradually led them to reflect on the type of tool they needed in relation to the objectives they had set themselves. This resulted in a shift from a tool that aims to diagnose the farms in relation to a predefined end, to a tool that allows for dialog between peers. In this dialog, they gradually redefined the ends and means of their

personal projects but also the “ends in view” for the more collective project in terms of agroecology for their living area and the ways to achieve them. In this respect, the Salsa project has gradually become a value-based approach.

Beyond the case of SALSA, the exploratory logic of pragmatic inquiry seems to be particularly relevant to manage agroecological transition: besides identifying what is no longer suitable, it is a matter of producing a better intelligibility of the problems encountered and finding ways to solve them. Inquiry in the sense of Dewey starts from an indeterminate situation, an existential malaise that challenges habits (Lorino 2018). It is then the process of inquiry that will allow for the work of problematization - understanding what is not working - and the search for a solution. The problematization process is important because it makes it possible to define what is important and what is less important to avoid looking for solutions to problems that will later prove to be irrelevant (Lorino 2018). The definition of the problem can change during the course of the inquiry, as shown in the case of SALSA. The logic of pragmatic inquiry leads the actors to think that the relationship between means and ends needs to be regularly reexamined in the course of action.

The pragmatic inquiry is also a social process. Sociality, for pragmatists, is dialogical and “trans-actional”: it emerges from the “trans-actions” i.e., reciprocal interactions between individuals and their environments. The actions of these individuals are adjusted and framed by these interactions. For Dewey, the resolution of existential discomforts (such as those that trigger agroecological transitions) leads to the creation of a community of inquiry in which all actors concerned should participate (Dewey 1938; Lorino 2018). Participation in this community will directly influence the scope of the inquiry, the way in which issues are defined, and the valuation processes involved. For an issue such as agroecological transition, in which a multitude of actors are involved, allowing all the actors concerned to gradually become involved in the process becomes a real challenge in the management of the collective action, as shown by the SALSA project.

Conclusion

The generative experiment we conducted with a group of dairy sheep farmers and their counselors over a period of more than four years demonstrates that, when it comes to redesigning farming systems, the evidence-based strategy, even grounded in local practices and contexts, does not work. The causal-mechanistic notion of “evidence” proved to be fruitless in the face of the complexity and the need to comply with their ecological, social, and economic singularity in order to redesign sustainable production systems. More time to collect more facts and data would not have helped. We overcame that problem by testing an approach inspired by the pragmatic inquiry to initiate changes on a few volunteer farms. We then relied on the professional judgment of peers who wished to help their colleagues. This judgment put the “desirable” back at the heart of the transition process. Values take precedence over evidence, but do not replace it. However, in that shift, evidence is no longer immutable truth but “warranted assertions”, as termed by John Dewey, that allow farmers to develop reassuring routines that work until they feel the need to revise them because their effects are no longer satisfactory.

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Tables and Figures

BOX 1: the AVEM diagnostic tool

At the end of the SALSA project, the co-created tool for the diagnosis of the sheep-milk farms was composed of a way to calculate feed autonomy, an environmental grid for multi-criteria assessment and a rough economic and social evaluation. The details of this work, including a quantitative analysis, are presented in French on www.avem12.org/salsa_89.php.

Farm autonomy

'Farm autonomy' was calculated as the part of the animal production covered by the feed produced on the farm. The feed given to ewes covers their maintenance needs, and those associated with milk and meat production (ewes + lambs). These needs are all converted into equivalent milk (EM). The feed for the maintenance of a Lacaune ewe is estimated at 730 kg of dry matter per year or 2 517 EM. The conversion of meat into milk is based on the fact that 4 l of milk are needed to produce 1 kg of lamb meat. It is thus possible to calculate the production and maintenance needs of a herd in EM based on annual production and the number of ewes. The quantities and types of feed purchased are recorded throughout the year. INRAE conversion tables enable calculation of the EM allowed by these feed purchases. Simply subtracting the part covered by purchased feed allows from the production needs of the herd estimates the proportion of animal production covered by feed produced on the farm. In the case of the farms surveyed in our study, it varies from 0% when the production of feed on the farm does not even cover the maintenance needs of the herd (1 case) to 94% (average 49%).

Environmental grid

The multi-criteria assessment of the environmental effects of the farms is structured in three main categories the farmers refer to as: 'biodiversity', 'soil functioning', and 'resource protection'. Each category includes several topics that group and summarize different criteria to which a score is attributed. The numbers in the table below correspond to the maximum score attributed to a topic by the farmers. A score of 0 indicates that the rating is negative.

Biodiversity 39	Soil functioning 40	Resource protection 56
Animal diversity 3	Crop rotation 10	Drinking water 15
Crop diversity 15	Crop lifespan 10	Manure management 1
Perennial species 5	Soil cultivation 10	Bare ground 0
Field surface 2	Amendment 10	Synthetic chemicals 40
Agroecological infrastructures 11		Waste management 0
Wild biodiversity 3		

To give an example, 'Crop diversity' contains four criteria and their maximum score is 15:

- total number of cultivated species: $(n > 15) = 5$, $(8 < n < 15) = 2.5$, $(n < 8) = 0$,
- % of perennial crops grown in the mixture: $(n > 70) = 3.5$, $(40 < n < 70) = 1$, $(n < 40) = 0$,
- % of annual crops grown in the mixture: $(n > 70) = 3.5$, $(40 < n < 70) = 1$, $(n < 40) = 0$,
- number of local and peasant cultivars used: $(n > 3) = 5$, $(2 < n < 3) = 4$, $(1 < n < 2) = 3$, $(n = 1) = 1$.

The farms diagnosed during the project received scores ranging from 33 to 103 points. This diagnosis was completed by an energy efficiency score, in which the energy spent on the farms was calculated. The score includes both direct (diesel and electricity) and indirect consumption needed to produce fertilizers, food inputs, seeds, medication, etc. These different items were converted into Equivalent Fuel (EF) spent to produce 1 000 EM. Energy consumption ranged from 150 and 350 EF for 1 000 EM (average 228). This energy efficiency (EE) was translated into points to complete the environmental diagnosis: $(EE < 200) = 40$, $(200 < EE < 250) = 20$, $(250 < EE < 300) = 10$, $(EE > 300) = 0$

Economic and social evaluation

The evaluation was completed (i) by the EBITDA (Earnings Before Interests, Taxes, Depreciation and Amortization) per unit of labor on the farm, which ranged from 23 000€ to 99 000€ (average 55 000€); (ii) by the number of days the farmer took off per month, which ranged from 0.5 to 7.6, and (iii) by the farmer's satisfaction, scored from 1 to 4.

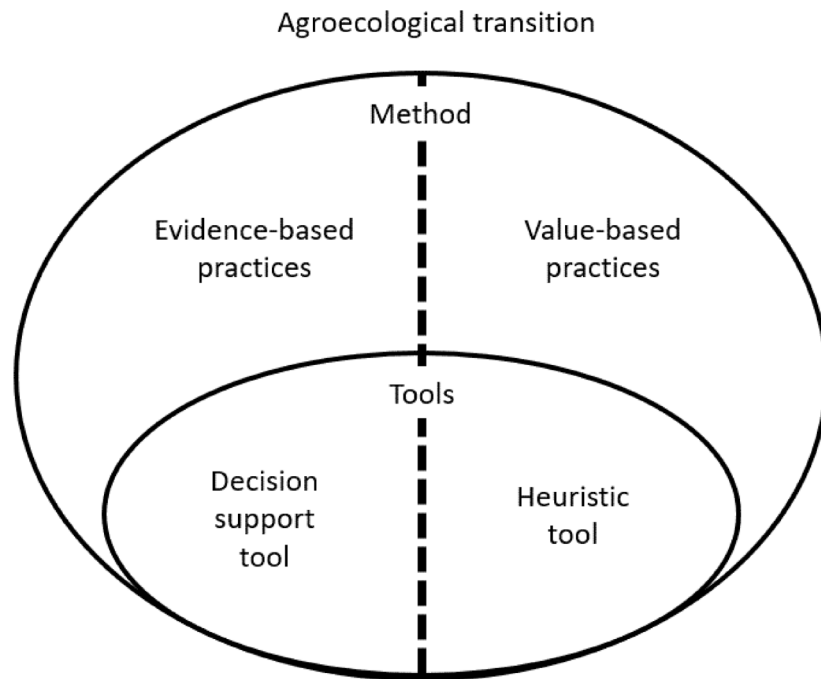


Fig. 1. Analytical framework: the dashed vertical line symbolizes the difference between evidence-based and value-based practices. The evidence-based transition is driven by the production of evidence and the regulatory use of the diagnostic tools as a decision support tools to guide the actors in their decisions. Putting the values first in the definition of new practices led to using the diagnostic tool as a heuristic to help understand the complexity of the situation as experienced by the farmers and to build socially acceptable hypotheses of action to be tested. We analyzed the data and reported the results according to the shift within this analytical frame over time.

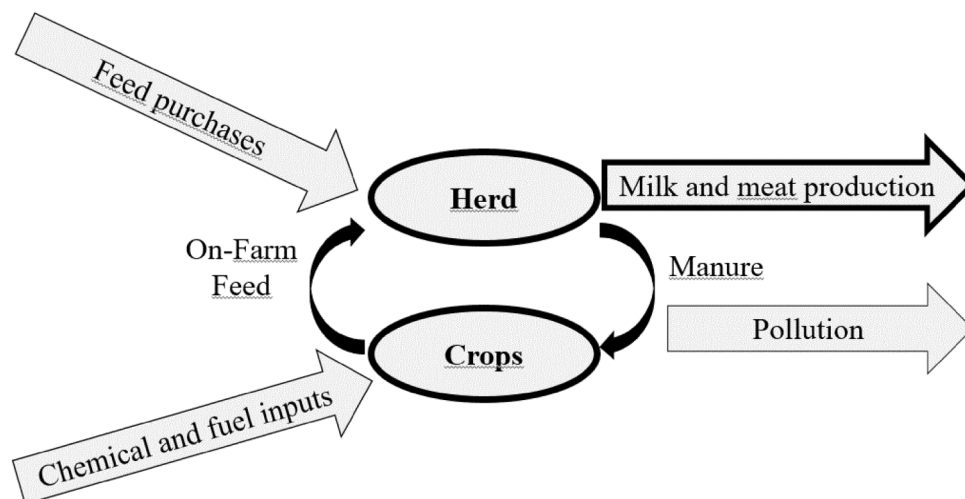


Fig. 2. The CETA scheme of farm functioning used by the steering committee to design the tool to assess farm autonomy at the beginning of the project.

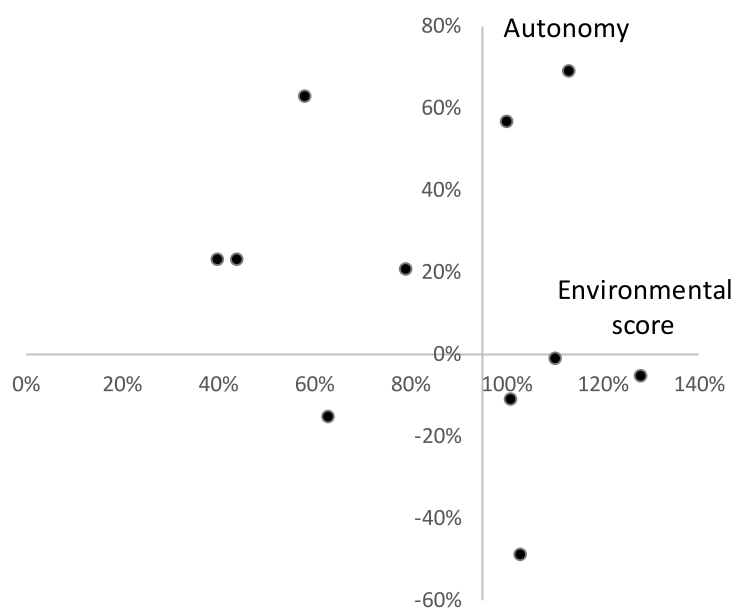


Fig. 3. Representation of the level of autonomy (x-axis) and environmental score (y-axis) of 11 farms. The top right quadrant represents the desirable situation to be achieved in the opinions of the farmers on the steering committee.

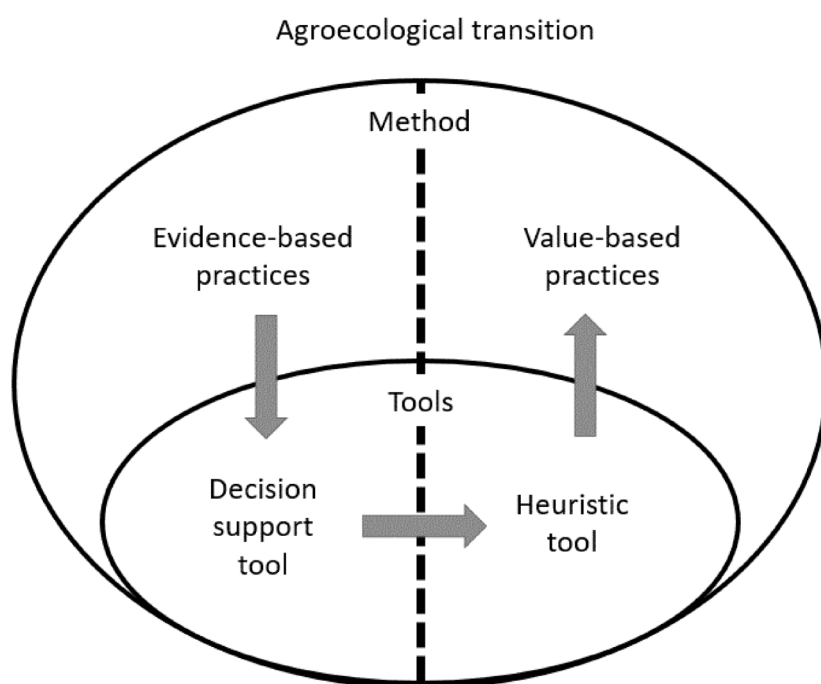


Fig. 4. Shift from an evidence-based to a value-based process in the SALSA experiment: using the tool as a heuristic to facilitate discussion among farmers.