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▶ **To cite this version:**

Sylvain Dernat, Rebecca Etienne, Nathalie Hostiou, Jean-Yves Pailleux, Cyrille Rigolot. Ex-post consequences of participatory foresight processes in agriculture. How to help dairy farmers to face outcomes of collective decisions planning?. Frontiers in Sustainable Food Systems, 2022, 6, pp.776959. 10.3389/fsufs.2022.776959 . hal-03958084

HAL Id: hal-03958084
https://hal.science/hal-03958084

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frontiers | Frontiers in Sustainable Food Systems

TYPE Original Research
PUBLISHED 03 November 2022
DOI 10.3389/fsufs.2022.776959

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OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Land, Livelihoods and Food Security, a section of the journal Frontiers in Sustainable Food Systems

RECEIVED 14 September 2021
ACCEPTED 19 October 2022
PUBLISHED 03 November 2022

CITATION
Dernat S, Etienne R, Hostiou N, Pailleux J-Y and Rigolot C (2022) Ex-post consequences of participatory foresight processes in agriculture. How to help dairy farmers to face outcomes of collective decisions planning? *Front. Sustain. Food Syst.* 6:776959. doi: 10.3389/fsufs.2022.776959

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Ex-post consequences of participatory foresight processes in agriculture. How to help dairy farmers to face outcomes of collective decisions planning?

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The analysis of the consequences of participatory foresight in agriculture over the long term is little studied in the scientific literature. In particular, it questions how farmers deal with the proposed scenarios afterwards and the modalities of their implementation. This article aims to overcome this by proposing an ex-post analysis of a foresight process with New World Kirkpatrick's Model (NWKM) carried out in mid-2018 in the Fourme de Montbrison cheese Protected Designation of Origin (PDO) area in the Massif Central (France). A set of 24 semi-structured interviews was conducted in spring and summer 2020 with the dairy farmers involved. Moreover, collective organization has been investigated through participatory observation and an analysis of project's progress reports until March 2021. The results show that while the engagement of farmers in the collective dynamic remains, it needs to be continuously rebuilt over time, particularly in order to overcome the effects of social risk-taking and insecurity that farmers must face. In addition, the place of stakeholders needs to be clarified. The article proposes a series of guidelines based on the project's experience and the "Monitor and Adjust" approach of the NWKM. It demonstrates the importance of establishing long-term follow-ups to foresight approaches to encourage farmers into action.

KEYWORDS

prospective, agricultural extension, participation, local governance, PDO

Introduction

Participatory foresight (also called prospective or scenario-guided) consists in an inventory of situation (or diagnosis) carried out jointly with people concerned, with or not experts, followed by the development of scenarios (Vervoort et al., 2015). It is often conducted for a decision-making (shared or by public decision-makers), or even the construction of an agenda of actions. For the past 20 years or so, participatory foresight has been the subject of a real enthusiasm in the fields of agriculture to address environmental or food issues in urban or rural areas (Reilly and Willenbockel, 2010; Vervoort et al., 2014; Hebinck et al., 2018). It is seen in particular as a means of

questioning local strengths and aspirations of different stakeholders (farmers, citizens, consumers, etc.), building resilience in face of crises (global markets, climate change, etc.), establishing new strategies (sectors, new products, etc.) or dealing with territorial recomposition (Duru and Therond, 2015; Barbier et al., 2016). The introduction of a participatory dimension is intended as a means of meeting the needs, expectations and aspirations, but also the limits and constraints of farmers as well as elected officials and citizens… (Abrantes et al., 2016) and gives visibility to local unknown actors (Imache et al., 2009). The methods can then vary (shared diagnosis of territory, decision trees, public meetings, films, creative imagination, serious games, etc.). However, they follow a fairly common operating philosophy (Nikolova, 2014) based on modes of thinking and layers of reality (Voros, 2006). The mobilization of firms specializing in these services is regular and some extension professionals develop competencies in this way (Labarthe and Laurent, 2013; Hauser et al., 2016; Knook et al., 2020).

Many scientific publications highlight the use of participatory foresight approach in the North (among others: Oteros-Rozas et al., 2013; Vervoort et al., 2014; Hautdidier et al., 2016; Mangnus et al., 2019) and in the South (among others: Hertzog et al., 2017; Van Klink et al., 2017; Ajilore and Fatunbi, 2018; Blancas et al., 2018; Schmitt Olabisi et al., 2020). In agriculture, a major orientation since the 90's tends to make participatory foresight, not only a tool for anticipation or prediction, but also a tool for collective construction for action (Ramos, 2006, 2017). Lardon and Noucher (2016), relying on several authors, thus see it as an attitude for action, a way of moving from seeing to doing. Given the fact that actors are involved and that they take ownership of the proposed approaches, and that these approaches make it possible to link political incentives and local initiatives, prospective approaches would gain a certain legitimacy and could be put into action more easily. Participatory foresight would above all be a factory of cognitive arrangements able to promote change and action: questioning preconceived and dominant ideas, building capacity, transforming representations and reconfiguring the interplay of actors to make it easier to take the initiative (Ramos, 2017; Hebinck et al., 2018; Szetey et al., 2021).

However, we often note the absence of a real analysis of the concrete actions carried out following these participatory foresight processes in agriculture, of their scope, of the actors involved, but also of the possible discrepancy existing with participatory discussions and actions taken afterwards. While some studies have addressed the reason of farmers to get involved in participatory research projects, few have attempted comparable studies/researches on the question of real actions *a posteriori* (Vlontzos et al., 2021). It's particularly true with farmers although they play a key role as the primary operator that acts on the territory (Menconi et al., 2017). This may seem understandable because the involvement of researchers in the field rarely takes place over a long period of time. The observations of participatory foresight are thus often short term, whereas the anticipated transformations take place over a longer period of time, especially in farms. Moreover, as highlighted by Barrett et al. (2021), foresight research exhibited considerable naiveté around the potential for scientific knowledge to resolve barriers to the adoption of innovations by producers and, more broadly, to ensure the inclusion of underrepresented groups like farmers. This is reinforced by a large promotion by local extension workers of technical and scientific approaches of knowledge only, who neglect the results of the participatory process (Landini, 2020). Thus, the developed perspectives, changes, innovations, modifications at the agricultural level seem to be difficult to put into action or even to be monitored as illustrated by Rollin et al. (2017) or Antier et al. (2021). These authors show that the approaches are often reduced to the actors likely to participate without friction into it. In this case, actions deeply challenging existing socio-technical practices and productive models of agriculture, are absent from the agendas in the field. Farmers are often disconsidered and require specific power management strategies (López-García et al., 2021). For Serrano et al. (2021), agricultural actors are nevertheless impacted by the orientations chosen collectively, which might come up against their own aspirations, choices and adaptive capacities.

In this perspective, this article addresses the question of the capacity of participatory foresight to generate tangible changes of practices among farmers. It aims at analyzing in a comprehensive way the effects of participatory foresight on the actions of farmers in their activity over several years. The central hypothesis is that the scenarios of participative prospective studies are not adapted directly to farmers. Understanding the kind of subsequent adjustments and negotiations needed for action is essential in terms of support for agricultural extension services.

Materials and methods

Context

This study took place on the PDO area of the Fourme de Montbrison cheese, in the Massif central mountains in France. This blue cheese produced from cow milk is considered a minor appellation among French cheese PDO (46 cheeses), in terms of production levels, geographical area, reputation and the number of farmers and dairies involved. Currently, the geographical area of the Fourme de Montbrison encompasses 33 villages in the Forez mountains, a region where the altitude ranges from 600 to 1,300 m with a predominantly grass-based production (more than 80% of the ration for the farms). In 2020, 64 farms delivered 12.9 million liters of milk, for the production of some 668 tons of cheese proceeded by four dairies companies. Two processors

share more than 80% of the Fourme de Montbrison production. These are large agri-food companies affiliated with two major French groups. A PDO union is composed of all milk producers, processors and related institutions (control for organoleptic quality, respect of the technical specifications, inspections). It is organized in the form of a Board of Directors (BoD) of 10 people (farmers and dairies' representants). A president (always a farmer to date), is chosen and nominated by the directors to represent the union and to apply the policies determined by the BoD. Two salaried facilitators manage the coordination work.

In 2018, a research-action program was carried out at the request of the BoD in response to the low level of farmers participation in decision-making and the PDO's difficulty in projecting itself into the future. This program was based on game-based learning and has been conducted to initiate a collective dynamic and to carry out a participatory foresight. An initial six-stage process that lasted a year, in which serious games played a central role, led to the proposal of 54 actions to develop the PDO by stakeholders: farmers, processors, elected officials, tourism professionals, agricultural advisors, veterinarians, state representatives, teachers of the local agricultural college. This prospective process is detailed by Dernat et al. (2021a) and has resulted in co-constructed guidelines that constitute the backbone of a new common vision for the future for the PDO stakeholders (farmers, processors) with a 10 years horizon.

The guidelines contain four major topics: (i) the internal organization of the PDO and its functioning; (ii) communication focusing on the diversity of the product, reflecting the diversity of production methods and stakeholders, and meeting the different expectations of consumers; (iii) improvement of the product sanitary quality; (vi) an orientation of dairy production toward an agroecological and cultural heritage approach in order to improve economic (higher milk price for farmers) and environmental development of the PDO area (Dernat et al., 2021a).

This last topic involves farmers directly and is at the heart of this article. The new orientation of dairy production toward an agroecological and cultural heritage approach would lead to significant evolutions of current livestock systems. The PDO's BoD major proposition (i.e., not mandatory) was that farmers transition to an all-hay diet for the livestock (with an objective of at least 60% of PDO farms within 10 years). The switch to all-hay (from grass and maize silage, or wraps) is expected to improve both economic performances (through the valorization of milk and cheese), and ecological performances (fewer inputs needed). Particularly, the development of local species-rich permanent pastures would place an emphasis on natural heritage at the heart of dairy production. The link between grassland characteristics and the product's nutritional and sensory qualities is known to appeal to consumers.

After the foresight, in 2019, a process of implementation was initiated within the PDO. A group of farmers, representing 25 farms (of the 69 total farms), voluntarily formed to work on the reorientation of dairy production. The group is facilitated by the PDO board staff, which organize meetings and other events such as training and field trips on a regular basis. In the first post-foresight year, 2019 and until mid-2020, a direction was chosen by the PDO administrators to discuss first and foremost with farmers the all-hay issue collectively in the PDO area through a series of meetings, visits and training (Figure 1). The central idea was to continue the exchange and to highlight the knowledge (local and scientific) necessary to implement changes in practices on the farms.

Farmers received a lot of information about different options to implement an all-hay diet. Quite soon in the process, an emphasis was given to the practice of barn drying. In addition to the flexibility that barn drying confers to the harvest and storage of good quality hay (a crucial point), this practice has other perceived advantages such as a reduction of working time. Moreover, four farmers were already practicing barn drying, providing opportunities for collective learning. About eight events were organized with the farmers and other local stakeholders who had participated in the foresight.

The research team continued to participate in this phase both to support the operationalization of the actions and to analyze them, with the question: How to help farmers to face the outcomes of collective decisions planning?

Data collection and analysis

The data collection is structured as proposed by the fourth level of New World Kirkpatrick's Model (NWKM), as shown in Figure 2 (Kirkpatrick and Kirkpatrick, 2016). Usually used in training and learning programs, Kirkpatrick's model is a recognized conceptual model to evaluate learning processes in agricultural education and extension (Murphrey et al., 2018), and lends itself particularly well to assessing the outcomes of foresight (Gary, 2019).

The first level refers to which participants find the foresight favorable, engaging and relevant to their jobs. It could be assessed by how participants are actively involved in and contributing to the learning experience. The second level refers to which participants acquire the intended knowledge, attitude, confidence and commitment based on their participation. These first and second levels have already been assessed in a short-term assessment (Dernat et al., 2021a): farmers were largely satisfied by the foresight process (level 1: assessed from the debriefing at the end of the collaborative day and at the end-of-year general assembly), and have shared and learned many knowledges and engaged themselves through the project (level 2: assessed through interviews and observations during the whole foresight process).

The third level refers to the new behaviors and attitudes toward action. It is evaluated by processes that reinforce, encourage critical behaviors and foster on-the-job learning.

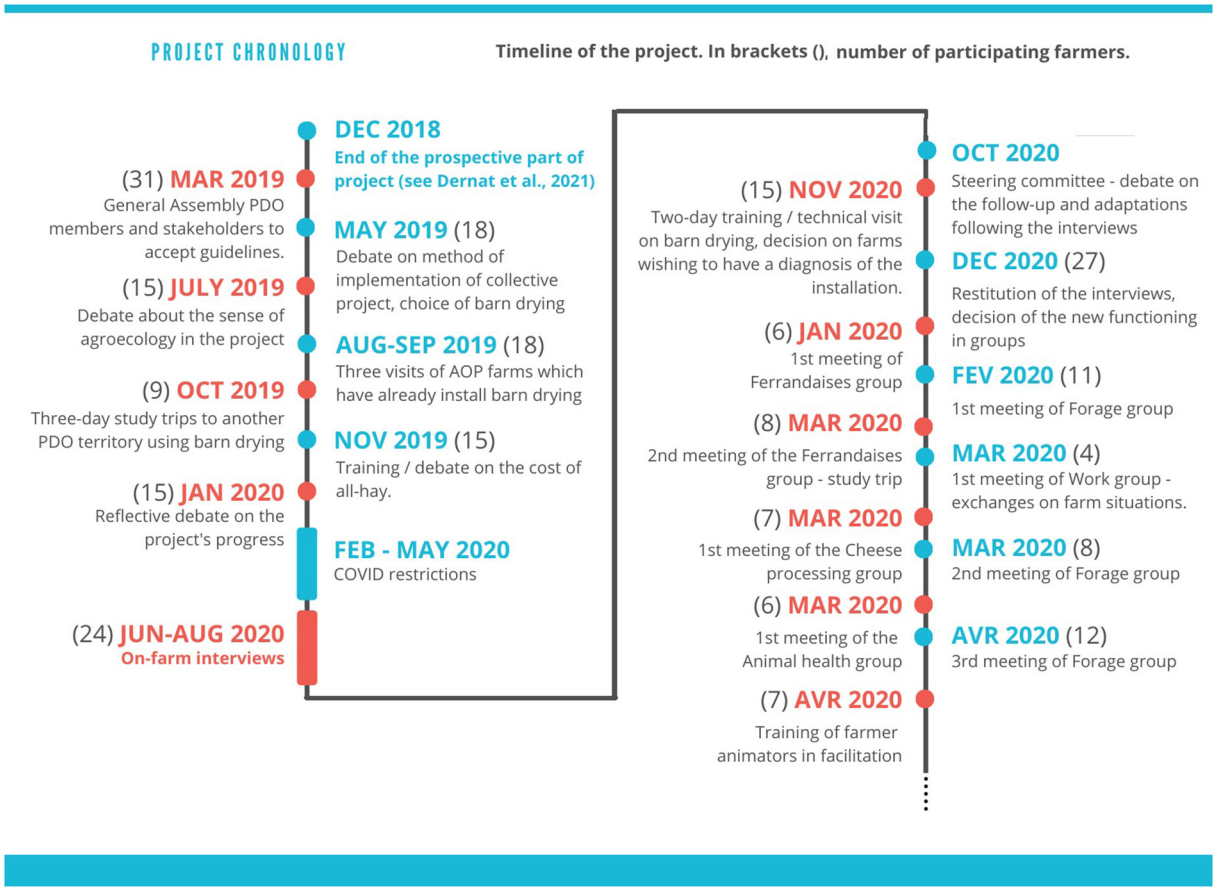

FIGURE 1
Timeline of the project between December 2018 and April 2020.

The fourth level concerns the result of the process, which aims to define what is produced in reality. Here, it is what the participatory foresight has been able to achieve in action: setting up new structures, new practices, new organizations, new activities, etc. It could be assessed by mid-term observations and measurements (leading indicators) suggesting that critical behaviors are on track to create a positive impact on desired results. These two levels are at the core of the present article. According to the NWKM, levels 3 and 4 should be monitored and adjusted over time. The assumption here is that foresight is not an end by itself, but an ongoing process.

Our research team followed all the meetings and events since the collective foresight. We assume a participatory research stance, meaning that we are not passive observers in the process, but also active contributors. For the analysis, we mobilized 26 reports from project meetings, all validated by the farmers/stakeholders participating in the project or by the scientists. They provide information on the evolution of discussions and interactions within the group and with other stakeholders in the area. Reports on trainings, projects and interventions carried out by stakeholders are also aggregated with the data. Moreover, interviews were conducted with 24 farmers of the voluntary group between February and September 2020. The interviews lasted between one and a half and 4 h and were often coupled with a farm tour. They were conducted in a comprehensive approach (Kaufmann, 2011), based on a general structure and open questions. After a brief overview of the farm's history, the farmers were asked about their vision of the collective dynamics, the follow-up of the participatory foresight, the limits or opportunities, and their wishes for the further application in the PDO. The comprehensive approach is not based on similar interviews but on a process of building knowledge as the interviews progress. All interviews were recorded and then transcribed in full. In accordance with French legislation, the agreement of each participant to the collection and use of the data was obtained beforehand. All recommendations relating to the European Data Protection Regulation have been complied with.

The interviews and reports were subjected to a thematic analysis (Terry et al., 2017) with the software QDA Miner Lite

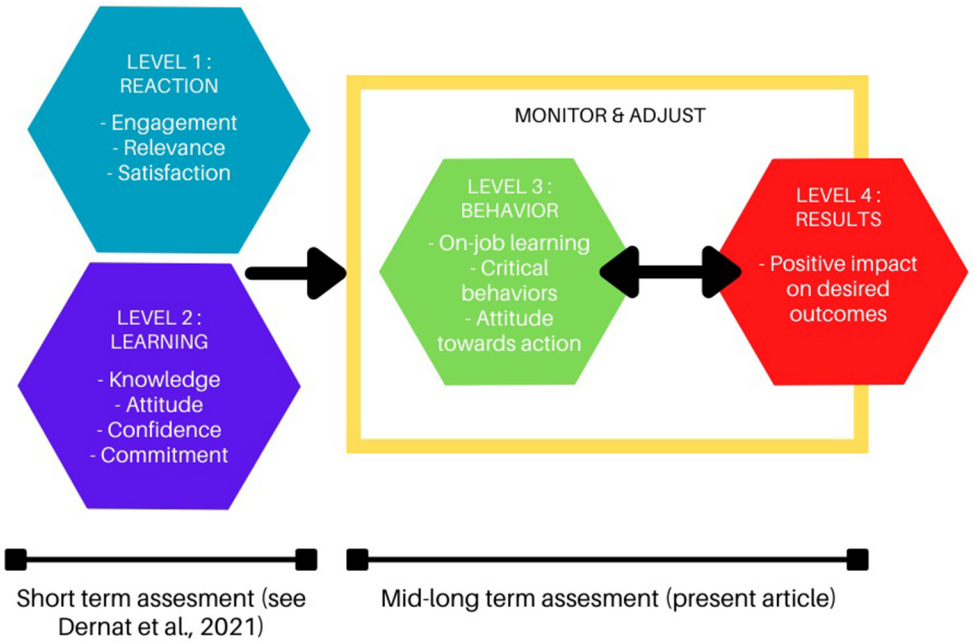

FIGURE 2
New World Kirkpatrick Model (NWKM from Kirkpatrick and Kirkpatrick, 2016).

(v2.0.8, Provalis Research, Montreal, Canada). This analysis allows to identify the salient points in the farmers' discourse. Based on comprehensive interviews (Kaufmann, 2011), this type of analysis does not produce thematic quantitative data. The software is used here to facilitate the identification of salient theme elements based on the model of understanding mobilized in the interviews. A coding of the text is conducted and then refined to produce a thematization (Lejeune, 2019). A first reading is carried out to bring out an initial exploratory of discourses. Each interview is then reread to identify the different themes present, or even to add new emerging themes. This second reading allows the thematization to be refined. A cross-cutting reading of the themes is then carried out and analyzed with the elements of the reports in order to complete it. This method allows the model of understanding to be saturated in order to make the situation under analysis explicit. The data from the project meeting reports provided additional material for building the model.

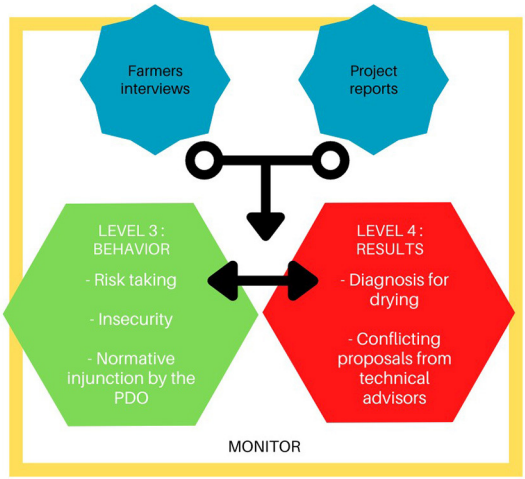

FIGURE 3
Monitoring of behavioral changes (level 3) and practical results (level 4), based on New World Kirkpatrick Model (NWKM).

Results

Project monitoring

Figure 3 summarizes schematically the results obtained from the data collection and analysis, which are then detailed in two parts: the farmers' representations of the post-foresight process and relations between stakeholders.

Farmers' representations of post-prospective process

The analysis shows that the work on barn drying after foresight process gives some results and is translated into actions. Mid-2020, six farms have carried out a diagnosis to install a drying system, in addition to the four farms that already

have one. However, a majority of farmers are still skeptical about the facilitation carried out in relation to this theme of drying system, mostly focused on a technical dimension. For some farmers, the all-hay and barn drying proposals were perceived as a misjudgment on their work, in favor of those who already have a more agroecological approach. Some of them even perceive themselves as being outside of what the PDO wants and this worries them. They think that the PDO standards will evolve without them. For them, there is an overvaluation of farmers who have barn drying. There are also assessments like: *others are looking favorably on the proposed changes whereas I do not feel capable of doing so, or those who will switch to all-hay will have problems, such as keeping the cows in good milk production*. The risk-taking by farmers is at the heart of the debate. In some interviews, "all-grass" appears as a preliminary step toward all-hay. This is easier to initiate but still raises the question of possible shortage of fodder due to drought. All-grass production would be a first argument to the consumer to maintain a favorable economic dynamic before considering all-hay production.

> "In the PDO they talk a lot about hay. I have nothing against hay, but afterwards... all our farms are already limited in terms of food autonomy. Putting everyone on hay... I'm not sure that putting everyone on hay will solve the problem of self-sufficiency. [...] In any case, with the years we've had, we can see that the grass isn't growing... Here, we grow sorghum, we grow corn... but it's not something that's fashionable in the PDO."
>
> *"I have nothing against hay, but afterwards there has to be a price for it. I have calculated that, compared to the price we are paid today, it would cost 100€ more if we set up a barn drying system. Because those who already have barn drying have finished paying for their buildings and everything. As they set up their system, they said: this is great, everyone should do this".*

Farmers have mixed feelings about how the transition to the all-hay orientation has been managed to date, which is illustrated here by a sample of verbatim quotes. Indeed, this orientation raises many questions, particularly in the context of climate change. In the light of the interviews, there is a diversity of fodder conservation methods that are used in different ways (hay dried on the ground, wrapping, silage), with various backgrounds (work comfort with reduced stress, reduction of work time during the mowing season, technical productivity), reflecting a diversity of ways in which farmers consider the risk (putting all their eggs in the same basket or not). Farmers are trying to cope with recent recurrent droughts, and crops appear to be useful buffers compared to hay. For some farmers who are not ready to switch, the all-hay approach rather appears as an injunction to change quickly. Other farmers worry about consequences of all-hay in financial terms (especially farmers at the end of their careers without a successor), but also in their daily work, which can become more stressful. These fears of change reflect the risk-taking nature of the foresight process.

> "Those who don't have barn drying, how do they get it (all-hay) valued? These are real questions"
>
> "On the one hand they say: you have to cut early to make the most of the grass and everything, because in summer it's complicated. Then, if you do all-hay, it means that the cutting is later. Instead of making two cuts, we risk making only one. [...] Before, we used to cut at the end of May or the beginning of June, but in ten years or so, we'll probably cut on the 15th of May. And to make hay on 15 May, if we don't have barn drying, it's complicated, it's even impossible. [...] Barn drying is not possible for me: the building has just been built, that's all. [...] Those who mow early today, or in silage or in wrapping, it doesn't matter, they manage to make two cuts. The parcels that are cut into hay, we only make one."
>
> "It's a whole issue [...] If you go for agroecology, you make all-hay. The parcel where you make hay you don't put ammonitrate. If you use ammonium nitrate, you have everything wrong. But if you don't use ammonium nitrate to make hay, I wish you well..."

The whole situation as perceived by farmers can be summarized as both individual and collective insecurity: as a farmer, it is difficult to know whether one's farm corresponds to expectations of the group and of the PDO and whether the intentions are collectively viable for the future. To overcome these pitfalls identified with the farmers, the new modality of a smaller thematic group on climate change adaptation is perceived as relevant for them. It remains focused on the problem of feeding, but in a broader way than just "all-hay". It brings together a large proportion of the original farmers, but without some of those who already have barn drying or those who find this dimension less central to their thinking. The group's declared ambition is still to be all-hay, but this is done in a less direct way, rather through the redesign of each farmer's systems over time. This new modality has thus brought a renewal to the project, as attested to by a farmer group leader who felt subject to the judgments of others beforehand and rediscovers through the group a renewed modality of sharing his work.

> "Before I didn't want to participate too much (during the first events on barn drying), it wasn't too positive, it was critical. I preferred to go elsewhere. But now we see that there is a new dialogue in the group, that there is sharing, it's good. For me, it's a real rebirth".
>
> "Technically, it's true, to be accompanied, to have training is always enriching. Afterwards, you really have to adapt as you go along, but managing to keep a dynamic is the most important thing. Otherwise everyone works in their own corner. You have to set a common objective, otherwise

> one person will say 'I'm very good', but... there are some who are very good but who don't necessarily go in the direction they should in the long term. We really need to get everyone on the same path, so that in a few years' time, if we need to have a common solution or eventually switch to all-hay or 80% hay, if we're already moving in the same direction in the group, it will be easier to get everyone on the same path. Even if we are not too many in the group, it doesn't matter, everyone has ideas."

Relationships between stakeholders

Two important issues related to the relationships between the different stakeholders: PDO farmers, processors, PDO union, technical advisors, others farmers…

The first issue concerns the role of the PDO union as a support body for farmers and the cheese sector. The farmers were initially very critical of the PDO union's reappropriation of the collective dynamic by encouraging barn drying. In their view, the PDO union had adapted the proposals decided collectively to meet its own needs, in particular with barn drying.

> "That's my opinion, I was still surprised... When we had our meeting in Montbrison (during the 2018 foresight)...then it came out that (he talks about barn drying). I think I'm not the only one to have seen it and say today that it's surprising that it's focused on that. But I was still surprised. The last years there is no problem to dry hay. I would even say that this year we will soon be able to do without barn drying and it will work by itself. No dew, wind... it dries itself. But a few years ago, in 2016, those who had barn dryers were unable to make hay, they made fermented grass wraps".

The second issue concerns the role of some stakeholders involved in agricultural extension (local advisers: Chamber of agriculture, milk control) or education (local agricultural high school). In farmers' discourse, these stakeholders are presented as skeptical about the whole process oriented toward agroecology. Rather, they value a purely technical-economic approach, focused on productivity. During the various events organized in the first year, several interventions in this sense were noted. In particular, a training session was held by PDO board and animated by a private extension firm that openly criticized forage production centered on hay, in disagreement with other interventions proposed elsewhere. The farmers also reveal that these advisors, who are present on the farms on a daily basis, criticize the project and its progress. In this way, they support the farmers in their current practices, which they themselves have facilitated in the past. They even suggest new practices openly in contradiction with the collective "all-hay" orientation, such as the introduction of maize as a strategy to cope with global warming. As a farmer said:

> "I think we were going in the right direction. From a blank sheet of paper, we started with a nice concrete thing. Afterwards, we noticed that it was still a bit slow. What's the reason for this? We weren't helped by... I wasn't there, but on barn drying the intervention of the milk controller was... It's my milk controller though. But it's the typical speech: we don't have to change, we make a lot of milk and that's it. So, when you have interventions like that when there are people who could potentially leave in a system, you destroy everything in a short time."

Project adjustment

After the interviews with farmers, consistently with NWKM model, the project dynamic was adjusted. This was done on the basis of proposals from the researchers and with agreement of the PDO board (Figure 4). Five thematic groups were designed to correspond more closely to the evolving expectations of farmers. The first group (1) deals with the adaptation of feeding to climate change, especially for farmers for whom drying in barns was not suitable (too expensive, operation not suitable in the short term). This group proposes more specifically to exchange collectively, to come to an agreement and to test innovative solutions adapted to the PDO. The other four groups are related to other orientations already present in the foresight. The second group (2) is interested in the integration of the local Ferrandaise breed into the herds (heritage and biodiversity), with the medium-term objective of producing a cheese solely from the milk of this breed. Currently, 90% of the cows on the farms are of the Montbéliarde and Prim'Holstein breeds (with a predominance of Montbéliarde), the remainder being made up of Alpine breeds (Tarine, Abondance), Jersiaise and mixed herds. A group is working on cheese production (3) in order to share techniques between dairies and farm producers to improve quality in the PDO. Animal health and welfare is the focus of a fourth group (4). The aim is to exchange tips and tricks between farmers to reduce the use of medicinal inputs while improving welfare: for example, for drying off without antibiotics. Finally, the last group (5) focuses on the wellbeing and working conditions of farmers at work. This group aims to encourage everyone to express themselves in order to resolve tense situations, and to (re)develop relationships through activities related to work issues (debates, joint events, etc.).

Each group is thus managed by a duo formed by one of the PDO facilitators and a farmer, and supported by a researcher of the project. The presence of the farmer as group leader aims to strengthen shared governance. This rebalances the exchange and promotes mutual trust in the shared project through common governance. The groups are much smaller and operational: farmers could participate to all groups but in fact choose the one or two groups which are the most relevant for them. Figure 2

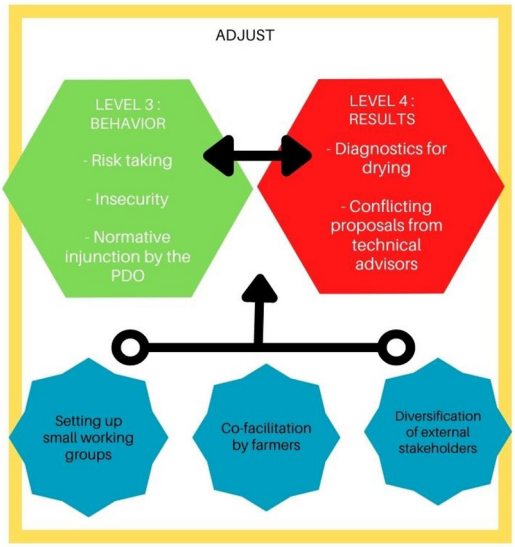

FIGURE 4
Adjustments of behavioral changes (level 3) and practical actions (level 4), based on New World Kirkpatrick Model (NWKM).

presents the timeline of the project, with the number of farmers in each event. The evolution is marked by a switch from events with a unique group of 15–20 farmers at the beginning, to multiple thematic groups with 4–12 farmers per event. The thematic groups are particularly relevant to allow motivated farmers to propose relevant solutions, to be more reflexive collectively and to test them more quickly on the ground.

In order to keep the discussions open, it was decided to involve other stakeholders from the public or non-profit sector. In this way, the diversity of worldviews in the interactions with the farmers is strengthened, bringing a more nuanced approach and balancing the discourse of skeptical advisers. In practice, this adjustment reduces the insecurity felt by some farmers in relation to conflicts between too contrasted discourses. They feel more confident to propose ideas and test them on their farms.

Discussion

Articulating collective and individual support to deal with social risk-taking

As López-García et al. (2021) point out, participatory processes have better chance to work if farmers are specifically managed over the course of participation. Our results illustrate well what Rollin et al. (2017) or Antier et al. (2021) say about the limits of including farmers in participatory perspectives. Implementation on the ground after participatory foresight is not a self-evident fact. An essential element is related to the risk-taking that farmers experience in these processes. This is an important element but is often discussed in a general and economic way (Slijper et al., 2020). We refined it by the example of farmers' view of the all-hay option: farmers worry about the risks related to climate variability and tend to consider more secure buffer adaptations, like the insertion of small areas of crops (Darnhofer, 2014). Our results show that risk-taking is not only perceived by farmers from an economic point of view but also from a social point of view, involving especially changes in their work and their perceptions of it. There is a form of negotiation that takes place between what changes in the collective and what the farmers change at home (on the farms, about themselves, about their work activity). This negotiation is made up of back and forth, involvements and withdrawals. In the interviews, we note many questions anchored in daily life: how to organize myself? Am I doing my activity wrong? Despite it allows critical thinking (level 3 of NWKM), participatory foresight can then appear as an injunction to change and a form of judgment. Risk-taking must therefore also be understood in terms of the perceived norm, i.e., the farmers' perception of how others will judge the planned changes (Khamzina et al., 2021).

This raises questions about the historical shift from agricultural extension to participatory approaches, where the networking of heterogeneous stakeholders has become a major strategy for innovation (Koutsouris and Zarokosta, 2020). Historically, since the end of the 1980s, agricultural extension has been based on individual advice oriented toward technical and economic performance (Labarthe and Laurent, 2013). This can be found in some advisory or education structures of the farmers in our case study (chamber of agriculture, milk control, agricultural high school) which are attached to technical performance with a top-down and question-answer approach to advice as evoked by Coquil et al. (2018a). The metric through which farmers analyze their daily lives and futures is therefore linked to this: it is often technical-economic and short-term. By questioning this metric in the participatory approach (long-term projection, insertion of socio-environmental arguments), the farmers then feel insecure because they find it difficult to hold on to everyday assessment elements. The evaluation of the 3rd level of the NKWM was therefore not a complete success and require adjustments. Support for risk-taking in the transformations induced by participatory foresight must therefore be central and must be achieved by reassuring farmers, redefining metrics and be more open to new criteria (image of the farm, environmental factors, consequences on labor…).

Allowing a continuous (re)building of the foresight

In order to best support farmers in participatory foresight processes, or even participation in general in agricultural extension, it seems necessary to design a continuous articulation

of collective and individual scales. The articulation of the scales of design and the coherence of the project and the scenarios must allow the regulation of collective and individual insecurity: it must encourage the adaptation of farmers to new and more systemic forms of assessment of their work (Coquil et al., 2018a). During the studied period, the structure of the collective project has been modified, from a global approach to smaller and operational farmers' working groups. It corresponds to the fourth level of NWKM by allowing new structures and activities which encourage critical behaviors to impact desired results. These groups make it possible to discuss design solutions directly, while avoiding the pitfalls of a larger number of participants: isolation, asymmetries of roles and knowledge… In this way, they are similar to communities of practice groups (Lave and Wenger, 1991) used in agriculture, focused on the exchange of practices and reflexivity (Morgan, 2011; Dolinska and d'Aquino, 2016; Coquil et al., 2018b), although they do not fully meet all the characteristics of it. This process of operational transition to small groups of farmers on issues that concern them following a broad participatory foresight seems relevant. The participation of all farmers in all actions is therefore not a need, nor a necessity. However, this is sometimes seen as a form of frustration by farmers who would like to participate in everything but cannot due to lack of time and feel that they are not following "what is said" in the groups. This could be improved by better internal communication as proposed by the farmers themselves.

The question of scales seems to be of primary importance for a continuous renegotiation of collective objectives. It is essential to recognize what is reasonably achievable both spatially and temporally for farmers on an ongoing basis. Our study provides a clear illustration with the "all-hay" scenario, which was initially negotiated as a 10-year objective. In practice, it appears that this is not an achievable objective for some farms, for different reasons: financial, technical, no successors, no motivation or unfavorable agroecological conditions. It is necessary to establish intermediate adjustments with each farmer to pay equal attention to how people break with past practices (Vetter, 2020). In the present case, an intermediary objective has been identified as "all-grass", which includes practices such as fermented grass feeds (silage and wraps), reducing crops and concentrated feeds and putting more the grasslands at the center of the feeding system. This allows an intermediate point to be reached which does not remove the initial objective while maintaining the dynamic with the farmers.

It seems important to go beyond the injunction to be participatory in foresight approaches to think of it as a continuum for action. There is a continuous process of (re)building the implementation of scenarios produced with and by the farmers and stakeholders. Allowing continuous adaptive renegotiation of scenarios by groups of farmers, without questioning the initial orientation, thus appears as a relevant guideline.

Adaptive governance with stakeholders

Finally, to achieve the described (re)building, the governance of the partnership over a longer term is a key element: it is necessary to define instances specific to each territory, adapted to local contexts, knowledge and farmers (Nettle et al., 2017). Such adaptive governance has to be aware of power issues between stakeholders' contrasted approaches. In our case study, some extension or education workers (especially private) actively promote technical and modern approaches that neglect the results of the participatory process (Landini, 2020). This is reflected in everyday speech (outside of collective activities) to the farmers. There is a pursuit of legitimacy in the territories by these stakeholders from the agricultural extension, in concurrence with other public or non-profit actors of extension (Prager et al., 2016). These stakeholders are generally companies and associations that depend on support through training, advice, diagnosis, etc. They have an interest in proposing actions quickly that meet both the needs identified, sometimes at the expense of collective orientations as the stakeholders' areas of action are overlapping. This tends to increase the phenomenon of autonomization or individualization of farmers practices (Dernat et al., 2021b). These elements are critical to the fourth NWKM level of evaluation of our support. Even if the project allows the setting up of new structures to think about new behaviors, it remains limited by the typology of actors and their actions. The initial resources put in place to manage the partnership did not allow the construction of a concerted support. It seems that it would have been possible to collectively rethink each other's ways of thinking earlier.

Our findings on farmers' insecurity and partners' relationships confirm propositions of Richter and Christmann (2021): key players are needed for dealing with internal opposition and overcoming external hurdles. These elements argue for the implementation of intermediation between stakeholders in agricultural extension to promote better risk management (Bertolozzi-Caredio et al., 2021) and farmers' role transitions (Hauser et al., 2016). This also means building an approach to advisory work, which must itself be understood more broadly as an intermediation, as Koutsouris (2014) points out. It therefore requires a change in the local level of coordination of actors (Faure et al., 2019). In our case study, returning to the farm with a small group of farmers, accompanied by various advisory actors, has been useful in understanding how the instrumental change could be implemented. Small groups are also useful to deal with the large diversity of worldviews in the present case study. It differs from other situations in literature where collective action is facilitated because farmers and advisors share more similar ideological commitment, as described by Coquil et al. (2018b, 2019). To better understand effective adaptive governance, it seems important to put these new local micro-governments

(small thematic groups of farmers in this case study) on the agenda of research on social innovation in agriculture (Klerkx, 2020).

Study method limits and strengths

Our results must of course be moderated with regard to our sample (which does not represent all the farmers of the PDO) and the specificities of our case study. Moreover, the comments of the farmers interviewed depend fully on the period of data collection. The study time can also be limiting (two years after the foresight) and has been impacted by the COVID-19 crisis. It will be interesting to revisit the farmers after several years of monitoring. It can nevertheless be considered as a long-term analysis in view of the existing literature, which is generally limited to a maximum of 6 months after the foresight. The interest of this study is also in revealing a rapid need for adjustments in facilitation of this type of project with farmers. These results shed important light on the scientific literature on participatory foresight processes including farmers by allowing us to approach longer-term effects. The creativity of participation with a diversity of stakeholders, which is often valued, can thus be faced with a number of long-term pitfalls. Although accepted in foresight processes, proposals may be difficult for many farmers to apprehend over time. However, there is still a black mark: the recurrent non-participation of a small number of farms that categorically refuse any link to the project (or to the PDO collective). Even if reasons can be given (no takers for aging farmers), some remain outside without any obvious reason other than a clearly stated lack of interest.

Conclusion

Participatory foresight does not translate automatically and straightforwardly into tangible actions on the field afterwards: it needs to be monitored in the mid and long term. The farmer, actor of change, cannot be left alone on his farm to adapt practices that have been decided collectively at a different scale, far from his daily life. Particularly, our study suggests that risk-taking must be at the heart of the transition process, and managed through a governance design that allows continuous monitoring between the collective process and the individual situation on the farm.

In the context of the Fourme de Montbrison area, the creation of small thematic operational groups working in a similar way as communities of practice seems to be a promising innovation. These thematic groups encourage the exchange of knowledge and reflexivity in order to adapt the guidelines of the foresight to the farm context. In the process, it is necessary to move away from a traditional technical-economic vision, and to move toward a systemic vision of the adaptations that can deal with huge uncertainties and local specificities.

As a perspective, this research demonstrates the value of an analysis in the longer-term analysis (in terms of analysis of the 4th and 5th levels of the NWKM) to provide new solutions to agricultural extension. This is fully consistent with Williams et al. (2020) on the role of collaborative action research to coordinate challenging imagined scenarios and actors' routines, joint development of concepts, collection and sharing of new information, tensions, generation of ideas, and new tools or frameworks. Whereas, the duration of research projects is generally very short-term, our study shows the interest of an analysis in the longer-term analysis and follow-ups to provide more appropriate solutions to ongoing environmental transitions. In this sense, the mobilization of a general evaluation framework such as the NKWM brings a definite added value. It avoids a short-sighted analysis which only points out the favorable elements and also allows the necessary adjustments to be made with the farmers throughout the implementation process.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SD and CR wrote the first draft of the manuscript and reviewing versions. RE, NH, and J-YP provided suggestions to improve the manuscript. All authors approved the final version of the manuscript.

Funding

This work was supported by the Research Project Trans[Fourm]ation (leader: SD) funded by the PEPIT program from Auvergne-Rhône-Alpes region (France).

Acknowledgments

The authors are grateful to all the individuals who gave generously of their time and shared their opinions, knowledge, and experiences through the interviews and the project.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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