Creating the conditions for a transition towards more sustainable farming systems: a participatory approach with prospective scenarios

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Abstract: *Transition to more sustainable agrifood systems is a challenge considering the constraints of present systems and the diversity of socio-technical lock-ins. A classic vision of the transition of the agricultural sector is the substitution of conventional systems by ecological or organic systems. However, the required conditions and possible pathways for such a substitution, and the extent in which it could occur are not always explicit. We developed a participatory method that seeks to foster favorable conditions for the transition process by creating a shared framework that combines acknowledgment of the diversity of the production systems, ambitious long-term targets and integration of the vision of a majority of actors. The method is based on four steps: 1. assessment of the sector's extant characteristics; 2. definition of the main production systems and evaluation of their share; 3. elaboration of prospective scenarios towards 2050, including a baseline scenario and scenarios that lead to significant ecologization of the agriculture; and 4. focus groups comprising representatives of different visions for discussing relevance of the horizons and possible pathways to reach them. The method was implemented in the cereal sector in the South of Belgium. It effectively brought together a variety of the sector's actors, favored the elaboration of a shared understanding of the existing situation of the sector and its production systems, and led to a discussion on its organization, performance, and environmental consequences at the regional level and the long term.*

Keywords: *agriculture; cropping systems; transition management; participatory approach; focus groups; prospective scenarios*

Introduction

In Belgium, a strong societal pressure has developed on the topic of agricultural methods, and in particular on the use of chemical plant protection products (PPP) due to their possible impact on human health and the environment. The objective of reducing the level of use and impact of PPP has been more and more discussed in the political arena over the last years, both at the federal, regional and local level. A possible target of reaching 'zero phytopharmaceutical products' was announced by the Walloon Minister of the Environment in 2016. If all actors seem to agree on the relevance of reducing the use and impact of chemical plant protection products, the definition of the target to pursue has been actively discussed by organizations from the agricultural sector. So far, the pathways to reach such a target have not been clarified yet, and their implementation is seen as a challenge considering the constraints of present systems and the diversity of socio-technical lock-ins in Western Europe (Vanloqueren & Baret, 2008; Meynard et al., 2013). One of the classic visions of the transition of the agricultural sector is the replacement of conventional industrial systems by organic or ecological production systems which use no or less chemical inputs (Duru et al., 2015). However, the conditions requested to foster such change are still a topic for research. The challenge is, therefore, to identify these conditions and to develop practical approaches, methods, and tools that support the transition process towards more sustainable, less input-dependent agricultural systems.

Context and objectives

Historical evolution of the western European agriculture and its new challenges

After the second world war, western European agriculture resolutely oriented its objectives towards increasing productivity. With support from the Common Agricultural Policy (CAP), mostly under the form of subsidies and prices and market regulation systems, the majority of farmers progressively turned towards highly productive farming systems that were based mainly on inputs coming from outside the farms (especially PPP, nitrogen (N) fertilizers and antibiotics). This evolution was favored by the high availability and affordability of those inputs, provided by a growing upstream sector. At the same time, the downstream sector organized to process the agricultural production and market it in a more and more standardized and centralized way.

The development of international exchanges and the entrance of highly competitive countries into those markets, while the CAP progressively reduced its price regulation systems since the 2000s led to a growing pressure on agricultural production prices and prices variability while the inputs price progressively increased (see, for example in Belgium (Statbel, 2015; Bouquiaux et al., 2016)). Simultaneously, the intensive input-based agriculture model was more and more challenged about multiple environmental and health aspects.

In this context, farmers practicing intensive conventional agriculture and research progressively explored the possibility of optimizing the use of inputs to mitigate their impacts while trying to maintain high productivity and farms' economic viability. In parallel, organic agriculture gradually gained attention and other visions of agriculture such as 'integrated farming' and others appeared in agronomic research, farming experimentations, and debates. Although the adoption of organic agriculture has been growing in European countries over the last decade, it remains low today (6 % of the EU agricultural area in 2013 (Le Douarin, 2016)). Ecological practices are known but poorly implemented; and the most sustainable systems such as organic farming are still weakly invested by research (Baret, 2015).

Elements of the nature of change in agriculture

The substitution of intensive farming systems for more sustainable systems is a long-term process that starts much before the effective changes in a farm, and that has consequences on the long-term (Lamine & Bellon, 2009). The shift to a new farming system entails changes in many dimensions, both material and immaterial, such as: the rearrangement of agricultural practices; significant financial and cognitive investment required to adopt new practices; the evolution of the farmer's relationships to the soil, his products, work organization, marketing, social networks (Lamine et al., 2009); possibly, changes in the inputs supplier and in the production purchaser; farmers' positions with regard to the future, to the concepts of "professional excellence" and risks (Lamine, 2011). Those changes are often hindered by a path dependency phenomenon (Cowan & Gunby, 1996). The level of risk and potential benefits for a farmer to adopt a new system is related to conditions that are external to the farms, especially: the public policies orientation, the diffusion of knowledge about alternative farming systems, and the value chain opportunities and constraints. Farmers' willingness to enter a transition pathway is therefore strongly influenced by the other agents of the sector (Lamine et al., 2010).

Transitions are now described as 'involving a broad range of actors' and 'high levels of co-evolution, complexity, and uncertainty' (Rotmans & Loorbach, 2010). At a larger level (such as the agricultural sector), a transition can be portrayed as a long-term process of change during which a society or a subsystem of society fundamentally changes (Rotmans et al., 2000, 2001).

Objectives

We developed a participatory approach that seeks to foster favorable conditions for the transition process towards more sustainable farming systems. The approach is based on acknowledging the current situation of the sector (agronomic and organizational aspects) and discussing diverse possible future horizons and pathways during multi-actors focus groups. The approach was implemented on specific agricultural sectors (cereals, dairy) in Wallonia (Southern region of Belgium). In this article, we detail the developed method and its background (section 1). We then present its first phase of implementation on the cereal sector in 2017 in Wallonia (section 2). Finally, we discuss the advantages, limits, and perspectives of this method (section 3).

Approach and methodology

Overview of the approach

The approach falls into the field of transition management. Transition management aims to better organize and coordinate transition processes at a societal level and tries to steer them in a sustainable direction. Key elements of transition management includes: systems-thinking in terms of more than one domain (multi-domain) and different actors (multi-actor) at different scale levels (multi-level); trying to change the strategic orientation of regime actors; long-term thinking; back- and fore-casting: the setting of short-term and longer-term goals based on long-term sustainability visions, scenario-studies, trend-analyses and short-term possibilities; participation from and interaction between stakeholders (Grin, 2011; Loorbach & Rotmans, 2006). Transition management approaches can be used at different decision levels, from national level (e.g., the Agricultural Transition Pathways initiative (Schwoob, 2016)) to more local levels (e.g., in a defined region (Bergez et al., 2014). This approach was organized at a (meso) regional level. At this level, the conversation focus on long-term options for farming and food systems. A lower level (field & farm) induces a strong focus on short-term technical and economical constraints. A higher scale (challenges for food systems at the European or world level), is key for the global political agenda but is too far from farmer's reality and overlooks the present diversity of food systems. The regional (meso) level allows for acknowledgment of diversity of production systems grounded in reality.

A classical model of transition management process includes the following steps of establishing and developing a transition arena; characterizing the initial situation and framing the problems; visioning (development of a long-term vision for sustainable development); pathway development (elaborating a transition agenda); initiation and execution of transition experiments; and monitoring and evaluation of the transition process (Wittmayer et al., 2017; Loorbach & Rotmans, 2006). The chosen approach corresponds to the first stages of a transition management process: the establishment of a diagnosis of the current situation and its possible future directions.

Also, sustainability assessments in agriculture can be performed at regional, farm, or cropping system level (Bockstaller et al., 2009). Whereas cropping systems are defined by the succession of crops and agronomic practices in the fields of a farm, we chose to focus on a sub-level of the cropping system: the cereal (wheat, barley and spelt) production systems (definition is provided in *Tool 1b. Typology of production systems)* in the Walloon region.

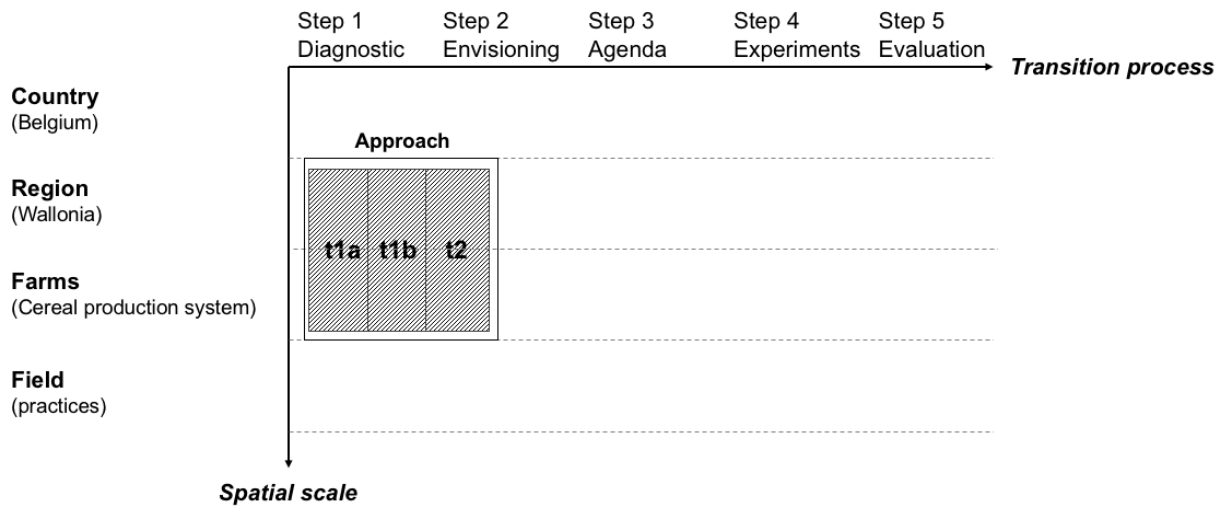

Figure 1. The situation of the presented approach regarding scale and steps of a transition management process

The steps of a classical model of transition management process described in the figure corresponds to: 1. characterizing the initial situation and framing the problems; 2. visioning (development of a long-term vision for sustainable development); 3. pathway development (elaborating a transition agenda); 4. executing transition experiments; and 5. monitoring and evaluation of the transition process. The approach's tools (t) are represented in grey on the figure: t1a. Diagnostic of the extant system; t1b. Elaboration of a simplified typology of production systems; and t2. Scenarios.

The approach includes four steps (Fig. 2): 1. collection of data; 2. the assessment of the sector characteristics, including the description of a simplified typology of production systems; 3. the elaboration of prospective scenarios/horizons towards 2050; and 4. focus groups comprising representatives of different visions in which the scenarios/horizons are discussed.

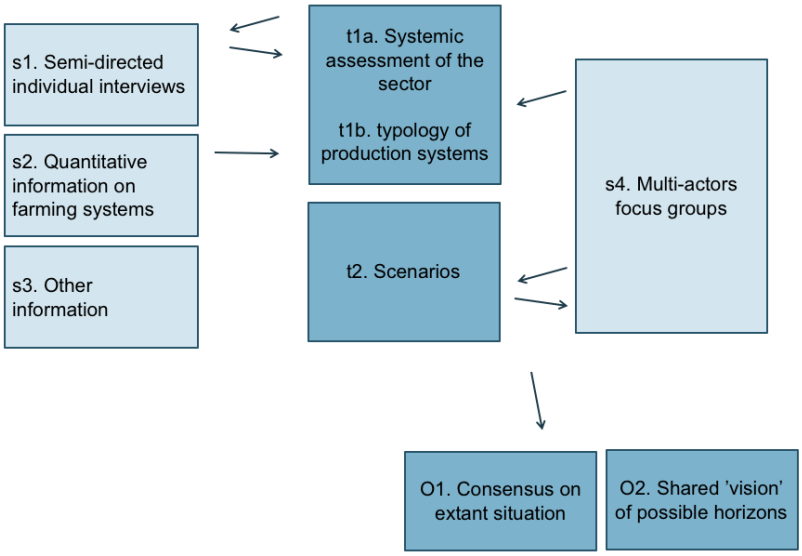

Figure 2. Overview of the approach

In Figure 1, 's' stands for 'sources' of information in the informed participatory research process; s1 to s3 are primary sources of information; s4 is a secondary source of information (in the sense that it is used to refine and complete the assessment of current situation t1 and scenarios t2). 't' stands for 'tools' of transition management, i.e., the material that is used to foster discussion in the multi-actors focus groups. 'O' stand for expected 'outcomes' of the method.

Data collection in an informed participatory research approach

The relevance of adopting a participatory process

Changes in agriculture are interdependent with changes at other levels of the agrifood system. A specific case study on the feasibility of a progressive reduction of chemical inputs in the cereal sector in France showed that these changes must involve, beyond agricultural systems, and in an articulated way, the different components of this agrifood system - which can be defined as a sociotechnical system encompassing farmers, advice, research, upstream and downstream sectors, public policies and regulators (regulation of plant health, pollution, seeds and product quality in particular), consumers and civil society (Lamine et al., 2010). Participatory approaches are useful as they lead to information exchange, but also to the generation of collaborative knowledge (Chantre et al., 2014).

About informed participatory research

The developed method relies on a specific participatory process: the 'informed participatory research' (IPR) approach developed by (Van Damme et al., 2016). The IPR approach combines the classic elements of participatory research and a specific, comprehensive and multi-dimensional assessment of the diversity of farming systems. This method was first implemented in Wallonia, Belgium, to discuss the development of organic farming in the 2010s. Authors argued that the understanding of the diversity of farming systems and a participatory process are needed if the research is to be relevant and grounded in reality. We chose this method to favor the appropriation of the process and results by the sector's actors.

Primary data collection methodology

Data collection was based on semi-directed interviews and analysis of quantitative data available. Semi-directed interviews were held with ten experts of the sector, coming from various institutions, including farmers' unions, cooperatives of the upstream sector, companies from the food processing industry and the retail sector, research institutes, and advisory services. Quantitative data were obtained from a government statistics database, research publications, and grey literature.

Tool 1: the assessment of the characteristics of the sector, including the description of a simplified typology of production systems

Based on data collected, an assessment of the sector was done (tool 1, see Fig. 2). It includes a general characterization of the sector and the description of a simplified typology of farming systems.

Tool 1a. General characterization of the sector

The characterization of the cereal sector includes the following aspects: surface cultivated, farms structure, historical evolution, level of productivity, total and average use of inputs (N fertilizers, phytopharmaceutical products); mapping of the sector's actors and characterization of the information and material flows between them; identification of the commercialization channels; and types of utilization of the production (food versus other uses).

Tool 1b. Simplified typology of cereal production systems

We focused on the cereal production systems within farms. We call *production systems* the set of technical choices that determine the quantities of phytopharmaceutical products and fertilizers that are used for cereals cultivation, their level of productivity (yield) and, to a certain extent, the type of valorization of the production.

Agricultural activity is highly linked to the context in which it occurs, especially natural conditions (soil fertility, climate), socio-economic conditions (distance to downstream infrastructures, opportunities of valorization), as well as path dependency mechanisms. At an individual level, farmers are likely to make diverse choices. Those aspects result in a high diversity of farming systems in a given geographical area. Future pathways of those systems depend not only on the objectives pursued by farmers and other actors, and resources available but also on the characteristics of the farming systems nowadays. Therefore, discussing transition pathways and desirable horizons request understanding and taking into account the current farming systems, in their diversity.

The objective here is to develop a tool that helps grasp this diversity, and that can be used for debating the relevance and performance of the farming systems: a simplified typology of production systems. The tool should be both realistic and simplified, to be relevant as well to facilitate discussions. Such a typology has been used in France in different occasions (Meynard et al., 2009; Butault & et al, 2010; Petit, 2013; Solagro, 2016). However, no typology had been developed in the cereal sector in Wallonia.

Firstly, the diversity of production methods was highlighted through an analysis of statistical data, a literature review and semi-directed interviews. A simplified typology of the cereal production systems was then proposed. It involves four production systems that were chosen on the basis of the literature review and interviews to distribute and characterize Walloon farms on the various criteria mentioned above. The objective is to acknowledge the diversity of production systems without excessive detail to allow useful analyzes for research, farmers and their advisers, and the framing of public policies. Two extreme references were defined (organic agriculture and conventional intensive agriculture), that are minor regarding the share of the total production; and then two intermediary systems were defined. For each of the main cereal species (wheat, barley, and spelt), production systems were characterized in terms use of inputs (fertilizers and pesticides) and average yields, based on interviews with actors of the agricultural advisory services and analysis of the regional agricultural statistics. Finally, the share of production systems in the total acreage was estimated through a collaborative evaluation with stakeholders. This approach allowed building a simplified but valid image of the diversity of cereal production methods in Wallonia, in consistency with available data.

Tool 2: a process-oriented prospective exercise to propose diverse possible horizons

Scenarios were developed with the objective of fostering a discussion on possible horizons and pathways. The horizons were chosen as contrasted yet realistic future combinations of the farming systems in 2050. The prospective exercise is *process-oriented* (rather than *product-oriented*): scenarios/horizons serves as a tool (tool 2, Fig. 2). A prospective exercise is described as « *process-oriented* » when it focuses on the very process that guides the development of the scenario to bring out consensus, minimum levels of agreement or at least a common understanding of the issues involved. In contrast, prospective exercise is described as « *product-oriented* » when the scenario itself and its content regarding technical trajectory are the primary objects of the scenario (Mathy et al., 2014).

The prospective exercise includes the elaboration of a baseline scenario and two scenarios with a stronger ambition regarding ecologization of agriculture (ecological transition scenario 1 and 2). Horizons are characterized by a specific repartition of the production systems, which differ from the situation in 2015. The baseline horizon is calculated as a prolongation of the current

trends whereas the horizons of transition scenarios are based on the target of reducing the use of PPP by 50% (scenario 1) or 70% (scenario 2) by 2050, disappearance of the most input-intensive production system, and development of organic agriculture over 20% (scenario 1) or 40% (scenario 2) of the cereal area in 2050. Optimization of the performance and input-use was taken into account: average yields were supposed to increase (10% to 20% depending on the production system) whereas the level of inputs used per surface unit would decrease (-20% for fertilizers and phytopharmaceuticals). Those assumptions were made based on past evolution and consultation of experts. The consequences of the scenarios were then calculated regarding total production (tons of grains), average yield (tons of grains per ha), surface needed to cover population's cereals needs (ha), total use of fertilizers (tons of nitrogen) and phytopharmaceuticals (kg of active substances).

Scenarios are used as a tool to foster discussion during multi-actors focus groups. The assessment of the scenarios by focus groups includes discussions on the horizons as well as the pathway to reach them, and the lock-ins, enablers and required conditions.

Focus groups methodology

Two paralleled focus groups were organized with key actors of the sector. The list of actors was established to reflect the complexity and the diversity of the sector. It included farmers' unions, farming advisory services, representatives of the upstream and downstream sectors, researchers, public agencies and NGOs representing civil society (Table 1). This list covers three of the four categories of actors identified in the multi-actor perspective (MaP) framework for the analysis of actors and power relations in transitions: *state*, *market*, and *third sector* actors were included whereas *community* actors were not (Avelino & Wittmayer, 2016).

Table 1. Categories of actors involved in the focus groups

Categories	Number of representatives
Market. Farmers' unions and associations	5
Public and private farming advisory services	5
Market. Representatives of the upstream and downstream sectors	5
Researchers from public institutes and universities	5
State. Public agencies	2
Third sector. Representative of the civil society (NGOs)	3

Each focus group was held with 10 to 15 actors, which permitted to reach a total number of actors of about 30 actors. The sector's diagnosis and scenarios were sent to participants in advance. Each focus group lasted half a day and were organized as follows: beforehand, a presentation of the results of the assessment of the current system; and focus group's discussion in two steps: an open discussion guided by the animator and a round table in which actors were asked to talk successively, in order to ensure that each actor had the opportunity to express her or his views.

Focus group discussions were then transcripted and analyzed: firstly, actors' point of view on the relevance of the scenarios, and difficulties and enablers for each scenario were listed; secondly a transversal analysis was done to identify consensus and controversies. Also, focus group participants were asked to provide comments on the assessment of the current situation, and some correction was added afterward (iterative process).

Results obtained during the implementation phase in the cereal sector

The method was implemented in 2017 in Wallonia on the cereal sector.

Key aspects of the extant situation of cereals production in Wallonia

Cereal culture in Wallonia covers about 200,000 ha every year, more than 25% of the regional utilized agricultural area. Winter wheat is the most cultivated cereal with more than 130,000 hectares (68% of the UAA dedicated to cereals in 2014), followed by barley (16%) and spelt (7%). The average yield of winter wheat from 2010 to 2016 was 8,7 t/ha (the annual average yield varied from 6,7 t/ha to 9,6 t/ha). Average yield was 8,2 t/ha for winter barley, and 6,9 t/ha for spelt (Statbel). Cereals account for 40% of the use of pesticides active substances by agriculture in Wallonia (data 2013) (Comité Régional Phyto, 2015). The average amount of nitrogen fertilizer used is about 200 N/ha for winter wheat, 180 N/ha for winter barley, and 160 N/ha for spelt cultures, 90% of which were mineral fertilizers (DAEA, 2013, 2014 and 2015). The use of nitrogen fertilizer for these three cereals thus represents 18% of the total annual nitrogen fertilizer consumption in Wallonia. The number of farms that produce cereals showed a decrease of 25% over the last 15 years, from 11,076 farms in 2000 to 8,332 farms in 2015. The cereals sector involves a large number of actors. The public authorities and various organizations publish standards, studies and provide advisory and support services. Different actors provide inputs (fertilizers, plant protection products, machinery, seeds, etc.) used by farmers. Downstream actors are traders, processing industries, and retailers. The association Synagra is the representative of both agricultural inputs suppliers and cereals collectors and traders. The collection, storage and trading of cereals production are carried out by 80 to 100 operators, although the two main traders collect 50 to 60% of the production. Primary processing industries are about 40 actors in Wallonia and 220 actors at the Belgian level. The cereals produced in Wallonia are mainly used as raw material for animal feed (46%), source of energy (32%), food processing in Belgium (9%), and export (14%) (Delcour et al., 2014).

Simplified typology of the cereals production systems and scenarios

An example of the typology of production systems for winter wheat is presented in Table 2. The aggregation of the data for each cereal allowed to estimate the total cereal production (Fig 3). Three horizons in 2050 were then developed to illustrate possible evolution of the repartition of the production systems (Fig. 3 and Table 3).

Table 2. Typology of cereal production systems in Wallonia: example for the culture of winter wheat

Production system label[1]	Average yield (t/ha)[2]	Use of PPP (Number of treatments)[3]	Use of PPP (kg of a.s.)	Share (% of surface)[2]
Intensive system	10	6	4,0	20%
Integrated system	9	4	2,6	70%
Agroecological system	7	2	1,3	9%
Organic system	5	0	0,0	1%

Notes: [1] The label of the production systems were chosen according to existing definitions and frameworks: organic systems are consistent with EU organic specifications; agroecological systems are consistent with the principles listed by the Belgian Interdisciplinary Agroecology Research Group (GIRAF) (Stassart et al., 2012); integrated systems are consistent with definition from the European Initiative for Sustainable Development in Agriculture (E. I. S. A., 2012).
[2]The average yield and the share of the surface were evaluated with the participatory approach detailed in the above Methodology section. [3]PPP stands for phytopharmaceutical products. We chose to evaluate the use of PPP by the average number of treatments per year. This indicator does not capture the many aspects relevant for evaluating the

use of PPP - especially the type of products used, and the quantity used for each treatment. Those complementary information were not available in public agricultural statistics at the time of the study.

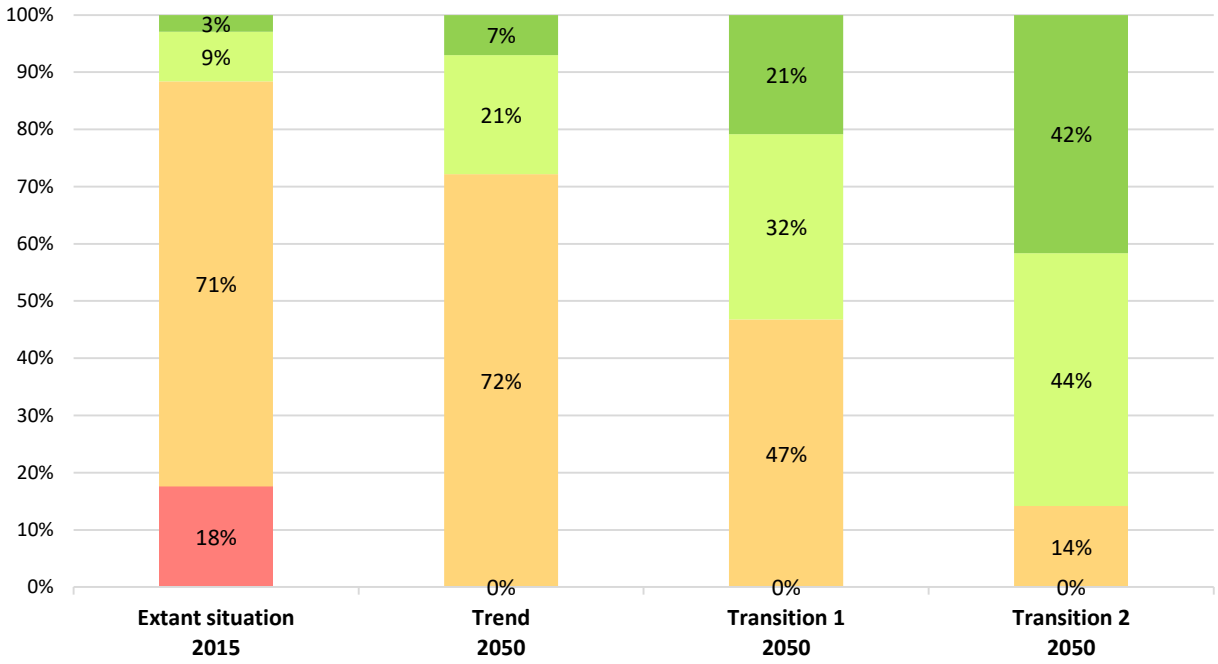

Figure 3. Repartition (share of the surface) of the cereal production systems estimated in 2015 and horizons expected in 2050 in the baseline scenario and the ecological transition scenarios

In dark green: share of organic systems; light green: integrated systems; in yellow: improved intensive systems; in red: intensive systems.

Table 3. Consequences of the scenarios: total cereal production, surface needed to cover population's cereals needs and use of phytopharmaceutical products

Indicators obtained through the sector's diagnosis and scenarios modelling	2015	Baseline scenario	Transition scenario 1	Transition scenario 2
Production of cereals (Mons t)	1,7	1,7	1,6	1,4
Surface to cover population needs (10^3 ha)[1]	54	64	69	77
Share of the utilised agricultural area (%)	8%	9%	10%	11%
Use of PPP (kg of active substances)	720.051	477.921	358.262	206.571

Note: [1]The needs level is calculated for the population of Wallonia and the region of Bruxelles. It only takes into account direct needs (i.e., does not include the need for livestock feed).

Focus groups discussions

Participation in the focus group

Focus groups showed a high participation rate (25 actors effectively participated over 30 actors invited). There were good general feedbacks from participants during and after the focus groups. Talking time differed between participants, but all of them talked at least once.

Position of actors during focus groups

Participants talked mainly about their scope of activity; remarks rarely encompassed the whole chain's organization and challenges. The notion of trade-offs highlighted through the scenarios' results was understood by most participants.

Perception of the ecological transition scenarios

The ecological transition scenarios were seen as proactive scenarios compared to the baseline scenario. There was a consensus on the relevance of reducing the use of PPP. However, the target of the ecological transition scenarios was discussed, both quantitatively and qualitatively. The economic aspects of the transition towards organic and agroecological systems was seen as a key factor by participants from all background.

Discussion

Advantages of the approach

The hereby presented approach was based on a participatory research methodology and gathered actors to discuss the current situation of the cereal sector and future horizons. The approach does not seek to reach an agreement among diverging opinions on what sustainability or ecologization means for the agriculture sector neither to develop a shared agenda. In this regard, the experimentation was rather in the first steps of a transition management process and aimed at creating a shared understanding of the current situation, challenges, and possible futures. This method has two main strengths: the factual support it proposes on which to base discussions towards a possible transition; and the inclusive participatory process. Together those two aspects allow opening an informed constructive dialogue about current and future production systems.

Actors at the heart of the process, in an inclusive way

The importance of engaging actors in the transition processes has been more and more highlighted in the literature. Transitions are described as “multi-actor processes, which entail interactions between social groups” (Geels & Schot, 2010). Wittmayer et al. suggested that "fundamental changes in the roles of actors and in their relations with others are a vital element of any transition" (Wittmayer et al., 2017). More specifically in the agriculture sector, the importance of strengthening actors' coordination is seen as a *sine qua non* condition for building "transition paths to sustainability" (Geels & Schot, 2007) given the need to overcome the locking effects by relying on levers at various levels of the socio-technical system. A key issue is the selection of actors. Our choice was to span the whole diversity of the production systems from organic to conventional and not only the actors persuaded by the importance of a strong transition towards more sustainable practices. As meetings and discussions are often organized among actors sharing a shared vision of farming (for example, organic farming actors are more prone to meet with actors of the organic farming network than with farmers and actors using intensive conventional practices).

The inclusiveness of the actors' selection (both regarding their roles in the sector and of their vision of agriculture) proved to be relevant: actors brought up complementary information and discussed their visions. The fact that focus groups had a high participation rate and good feedbacks is encouraging.

Actors were chosen at the meso level, described in the multi-level perspective as the level of social norms, interests, rules and belief systems that underlie companies’, organizations’ and

institutions' strategies and political institutions' policies (Loorbach & Rotmans, 2006). This choice proved to be relevant, as the focus groups participants showed good field and sector knowledge, direct concern about the sector and they had decision or influence power.

Tools relevance: encompassing the diversity and envisioning future horizons

The choice of using a simplified typology of production systems to highlight the diversity of practices proved to be relevant. We seek to show the performance levels of the different production systems on a variety of parameters to highlight the different advantages and disadvantages (trade-offs), while being as much as possible rooted in the reality of today's diverse agricultural systems. The consideration of the diversity of practices and systems is aligned with the idea that "a practical implementation of sustainable development has to incorporate the inherent conflicts between the values, ambitions and goals of a multitude of stakeholders" and "the fact that sustainability is an essentially contested notion is thus addressed by allowing for diversity in the short term while trying to achieve consensus on long-term ambitions" (Loorbach & Rotmans, 2006).

Outputs

The process allows building a shared understanding of the extant situation, with key indicators and reference data (such as the range of values for productivity and use of inputs used in cereal production in the region) and led to a discussion on the performance, consequences and organization of the cereal sector at the regional level (beyond each actor's particular vision). It also provided a common referential of possible horizons useful for debate on long-term perspective at the regional level (beyond short-term constraints and objectives). The approach allowed the actors to place themselves relative to each other in the sector and will allow them to situate their future actions in a long-term perspective. This a method of objectification (rather than intervention before facilitating the transition) that provides a scientifically documented basis for guiding stakeholder choices at different levels, including policy, and initiates dialogue between the sector's actors.

Limits and further use

The approach was implemented in two sectors (cereals and dairy) in the Walloon region, which allowed verifying its relevance. Implementing the approach in other contexts (other agriculture sectors, other regions) would be useful. The assessment of the sector could be usefully complemented with a retrospective analysis of the evolution of the sector in the past. Such a retrospective work was done on the yellow fruits sectors in France and allowed highlighting the construction of the performances and constraints of current systems (Lamine et al., 2017). Also, the approach could be complemented with a post focus groups follow-up to evaluate the method's effectiveness and consequences.

The tools developed can be used both at a higher level (e.g. for framing public policies) or at a more local level (as a framework to reflect on current practices). These different uses involve building alliances with key actors in the sector.

Conclusion

The conditions and methods requested to foster a shift to ecological and organic systems in Western Europe are still a topic for research. We developed a method based on evidencing the diversity of agricultural production systems nowadays and discussing diverse possible future horizons and pathways. The method was implemented in Wallonia in two sectors. It is based on

a description of the characteristics and organization of the sector, as well as several prospective horizons in 2050. This material was presented to twenty-five actors who expressed their views during focus groups. The method favored the elaboration of a shared understanding of the extant situation of the sector and led to a discussion on the performance, consequences, and organization of the sector at the regional level and long-term. This method will be implemented again in 2018 in the potato sector and the bovine meat production sector in Wallonia and on five livestock sectors in Flanders, the other region of Belgium.

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