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Nurturing niche innovations by agrifood value chains in transition to agroecology. A qualitative analysis through eleven case studies in France.

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Abstract: The agroecological transition of the French agrifood sector is an important challenge for sustainability. This sector is distinguished from others by specific features, including its structuring into 'vertical' value chains. These specificities need to be examined carefully, as they condition the way in which innovation niches can emerge and transform the sociotechnical regime. In this article, we study a variety of agrifood value chain initiatives in France engaged in sustainable practices that can be related to certain dimensions of agroecology. These initiatives are analysed through the prism of the "innovation functions" of Hekkert et al. (2007) to deepen the nurturing step of such value chain innovation niches. We added two functions: a function of governance and coordination and a function of network development. As outcomes, we highlight 1) the relative importance of the different innovation functions during the nurturing phase; and 2) the singularities of the agrifood sector in general and of agrifood value chain initiatives in particular, notably i) the role played by dominant regime actors, ii) the importance of market differentiation, iii) the importance of practices objectivation through certification, iv) the problem of consumer preferences uncertainty; and v) the strategies of inter-value chain connexions, which are key for the transition.

Key words: sustainability transition; agrifood sector; niche innovations; agroecology; value chains

Section 1. Introduction

Agriculture and food are at the crossroads of major ecological challenges, including climate change, the collapse of biodiversity, nitrate pollution and groundwater depletion (Webb et al. 2020; Campbell, Thornton, and Nelson 2022). Agroecology is increasingly being put forward as a new paradigm for considering jointly the transition of agriculture and food towards sustainability (De Schutter 2010; Wezel et al. 2020; Barrios et al. 2020). On an international scale, the FAO provided a framework around "10 elements of agroecology" for thinking about agroecological agrifood systems (FAO 2018). In France, the institutional context is also supporting this transition: agroecology was enshrined in law in 2014 to support its deployment (Bellon and Ollivier 2012; 2018). Although agroecology represents a new framework for transition, we still know little about the transformation processes undertaken by incumbent actors, especially in agrifood value chains. There are many obstacles to overcome, such as the difficulty of building convergent innovations between upstream and downstream, and the lack of recognition by consumers. Similar obstacles have been reported in other contexts (Vanloqueren and Baret 2009; Fares, Magrini, and Triboulet 2012; Kuokkanen et al. 2017; Magrini et al. 2018; Cusworth, Garnett, and Lorimer 2021).

It therefore seems timely to examine agrifood sector value chain initiatives engaged in sociotechnical reconfiguration in favor of sustainability (i. e. *mission-oriented* initiatives in the sense of Hekkert et al. (2020)), and to identify the "enabling and disabling dynamics" (Anderson et al. 2019) that either promote or hinder their development. This is all the more necessary as the agrifood sector remains relatively understudied compared to other sectors (Köhler et al. 2019), despite growing interest in recent years (El Bilali 2019; Lascialfari, Magrini, and Triboulet 2019; Vermunt et al. 2020; Borsellino, Schimmenti, and El Bilali 2020; Cholez and Magrini 2023). Few studies, in particular, propose to carry out these analyses on the scale of so-called 'long' value chains, which nevertheless make up the bulk of the French agrifood landscape. French value chains are led by cooperatives, which account for nearly 75% of French farmers. These in turn are backed by supermarkets, which account for 70-80% of food purchases (La Coopération Agricole, 2022). Sustainable transformations of agrifood value chains have the particularity of requiring coupled innovations from upstream to downstream (Meynard et al. 2017). Value chain analysis can delineate actors networks likely to innovate, particularly with regard to sustainability issues (Magrini 2023). This article therefore proposes to consider a number of differentiated value chain initiatives as innovation niches, i.e. networks of actors focused on novelty, and to understand their development process. Ultimately, the aim is to contribute to the debate on policies to support these approaches, in order to strengthen the process of sectoral transition to agroecology.

Reflecting on transition policies for the agrifood sector is important because this sector presents some notable specificities. Firstly, its strong vertical structure brings together a wide variety of actors (Borsellino, Schimmenti, and El Bilali 2020). A whole range of operators – producers, processors, distributors, consumers, public authorities, researchers, etc. – need to be coordinated (Lamine et al. 2012); and all the more so, as the upstream is characterized by a fragmentation of production into a multitude of farms. This complex organizational fabric can act as a brake on the circulation of knowledge and resources needed to develop innovations (Meynard et al. 2018). For example, Magrini et al. (2016) emphasized the lack of coordination in legume value chains, which hampered their development, despite their interest for the agroecological transition. Cholez and Magrini (2023) showed that value chains coordinated by production contracts, on the other hand, reinforce the diffusion and development of knowledge between streams. For Elzen et al. (2012), it is essential to proceed through "integrated solutions", which take into account the multiple connections between actors as well as the territory in which they are deployed. The sector's strong international exposure – a consequence

of globalization – increases the difficulty (Borsellino, Schimmenti, and El Bilali 2020). The sector is also highly heterogeneous in its productions, organized into sub-sectors whose dynamics may be independent or with varying means of action depending on their added value. The increasing segmentation of the food market, divided into a multitude of consumer goods and specific qualities, also complicates the analysis. Finally, an important specificity of agrifood systems is their anchorage in socio-ecological contexts (Wigboldus et al. 2016; El Bilali 2019; Vermunt et al. 2020), which limits the possibilities of comparison and replication. The analysis of innovation niches (i.e. networks of actors with innovative initiatives compared with the rules prevailing in the dominant sociotechnical regime) aims to understand how the interplay of selection factors favors the development of certain niches, leading to a gradual reconfiguration of the sociotechnical regime. A major hypothesis is that it is from these niches and their relationships with the dominant regime that the latter is gradually transformed, leading to a reconfiguration of collective rules (Figure 1).

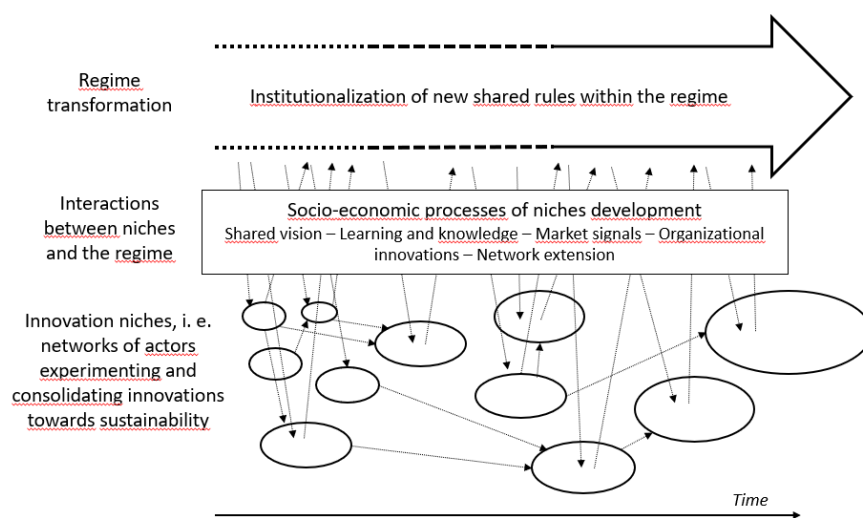


Figure 1 – Conceptual diagram of innovation niche development (adapted from Smith and Raven, 2012)

The literature widely highlighted the multidimensionality of factors influencing niches emergence (e.g. Geels (2004)), pertaining to market (new consumer expectations), research (new scientific consensus), technologies (new techniques and practices), institutions (new public rules). Several works delved into the socio-economic mechanisms of emergence, particularly in the energy sector (Smith and Raven 2012; Raven et al. 2016). Studying the structuring and development of innovation niches along agrifood value chains is all the more interesting as their upstream-downstream layout makes it possible to look for leading economic operators. The question then arises as to whether it is possible to distinguish the niches of the scheme univocally (El Bilali 2019).

The literature distinguishes different phases of the niche emergence process, corresponding to the progressive transformation of the competitive environment in which niches develop (Smith and Raven 2012): i) a stage of protective space creation by modification of the selection factors, enabling the emergence of the niche ('shielding'); ii) a stage of reinforcement, maturation and deployment of the niche, allowed by strengthening interactions ('nurturing'); iii) a stage of stabilization, generalization and standardization of innovations developed by the niche within the competitive environment ('empowerment'). This last stage may mark the advent of a regime transition if the incumbent sociotechnical regime has transformed its rules in such a way as to

standardize and generalize the rules prevailing in the niches. For the French context, the inclusion of agroecology in the law in 2014 can be seen as a first step in the emergence of a protective space for innovations claiming to be based on it. In this article, we turn our attention to the intermediate phase of nurturing. This phase is a critical one, in which the development of innovations is faced with external competition while not benefiting from sufficiently solid support, such as external public resources, or having insufficiently stabilized its business model. While the relationship between niches and the regime is crucial to understanding transition dynamics, it is also important to examine how niches organize themselves in order to develop. The function-based approach to innovation systems enables to draw up a set of actions considered as key to their success (Hekkert et al. 2007). Vermunt et al. (2020; 2022) recently analysed the success of various forms of alternative agriculture in the Netherlands, using this framework. Apart from this recent work, to our knowledge there is no other work for the agricultural sector to advance this research. Our study proposes to contribute to the construction of an analytical framework linking the function-based approach to innovation systems derived from the seminal work of Hekkert et al. (2007) and innovation niche approaches. In particular, our approach proposes to enrich these approaches with an essential function, especially in view of the specificities of the agrifood sector: the coordination and governance of operators' actions, the importance of which has been highlighted in several works (Magrini 2023; Cholez and Magrini 2023; Meynard et al. 2018).

This study is based on a qualitative analysis of a dozen innovative value chain initiatives in France, covering field crop, fruit and vegetable and livestock production. These initiatives are all positioned with regard to sustainability, including animal welfare. Their positioning enables us to link them to agroecology as defined by the FAO (2018). In this article, we do not evaluate the more or less agroecological character of the initiatives, and stick to the operators' declarations. Furthermore, we do not consider organic farming, which is an already well-established sector. Our aim is to study initiatives that have emerged from the conventional sector and seek to differentiate themselves. Our case study approach draws on a variety of sources of information (Yin 2009): reports and communication materials from actors in the sectors studied and from public policy-makers, nearly 30 semi-structured interviews conducted with operators in 2022 and 2023, and a collective seminar attended by the operators surveyed. Our results bring empirically-based insights into developing niche innovations for agroecological transition. By highlighting overlaps between initiatives with regard to the vision of agroecology and analysing their development strategies, we discuss the coherence of public policy support for this transition.

The article is organized as follows: section 2 sets out the innovation functions analytical framework. Section 3 describes methods and how this analytical framework was applied. Section 4 presents and discusses the results, before concluding with some limits and perspectives.

Section 2. Analytical framework

2. 1. Innovation functions in agrifood value chain nurturing niches: rationale

To understand how niches gradually contribute to reconfigure the existing regime, it is important not to consider them as black boxes, but to examine the various levers they mobilize to ensure their development. To this end, we draw on the framework of innovation systems and functions (Johnson 2001; Hekkert et al. 2007; Bergek et al. 2008; Hekkert and Negro 2009). By defining a set of key functions, this framework enables us to understand the inner workings of innovation niches. Magrini (2023) has proposed an initial approach to agrifood value chains

differentiating initiatives from an innovation system perspective, which has yet to be applied empirically. Based on the functions proposed by Hekkert et al. (2007) and enriched by Edsand (2019), Tziva et al. (2020) and Vermunt et al. (2022), we have built a new proposal for analysing niche-innovation value chains through innovation system functions.

In the introduction, we pointed out specific features of agrifood value chains, which led us to adapt the framework proposed by Hekkert et al. (2007) and revised by Vermunt et al. (2022) [Table 1]. In particular, we added two new functions: a governance and coordination function and a network extension function. The first additional function is justified by the importance of coordinating links in the value chain, whose modes of governance have a direct impact on certain key functions such as resource mobilization and knowledge production (Cholez and Magrini 2023). The second additional function is justified by the need to reach a critical size in the nurturing phase, for entering the empowerment phase. This is illustrated, for example, by the requirement to produce a defined volume in order to integrate conventional retail distribution structures. Another example is the importance, for any differentiating initiative, of bringing on board partners who can reinforce niche-innovation legitimacy and facilitate access to external resources. Indeed, the literature stresses the importance of associating different stakeholders representing different social groups within the sociotechnical regime, in order to build a direction for change¹.

Other adaptations include the distinction between financial resources mobilization and human resources mobilization, following Vermunt et al. (2022). Human resources mobilization joins the network extension function. Finally, we choose to group together the functions of knowledge development and diffusion. This choice is justified by the necessarily interactive nature of knowledge building, leading to the fact that knowledge development is inseparable from its diffusion among network actors.

Table 1 – Innovation functions (Hekkert et al. 2007, Vermunt et al. 2022 and authors’ new proposal)

Hekkert et al. 2007	Vermunt et al. 2022	New proposal
Entrepreneurial activities	Entrepreneurial activity	Entrepreneurial activity
Knowledge development	Knowledge development	Knowledge development and diffusion
Knowledge diffusion through networks	Knowledge diffusion	Guidance of the search
Guidance of the search	Guidance of the search	Market formation
Market formation	Market formation	Resources mobilization
Resources mobilization	Resource mobilization – financial	Legitimacy creation
Creation of legitimacy / Counteract resistance to change	Resource mobilization – human	Governance and coordination
	Legitimacy creation	Network development

The conceptualization of innovation functions enables us to break down what appears to be a highly complex interplay of actors. The underlying hypothesis is that it is the combination of these functions that enables differentiating experimental systems to consolidate and bring to market new products with promises of sustainability. To do this, the value chain must consolidate a distribution circuit until the consumer, and test consumer receptiveness to these

¹ « [Empowerment] requires commitments from actors in the wider social world. So in addition to inward-oriented network activities aimed at the practical development of a sociotechnical configuration, global networks are also engaged in outward-oriented activities of representing, promoting and enrolling support for that development » (Raven and Smith, 2012:1031).

alternatives. As explained in the works on innovation niches, it is also a question of building shared visions between the value chain links, increasing learning and knowledge development, and expanding the networks of actors mobilized to disseminate innovations and gain access to new resources.

These processes, which help niches to develop internally, also contribute to modifying the selection environment and simultaneously increase their legitimacy (Figure 1). For example, enhancing their readability on the market encourages other actors to change their own practices. This can also prompt public authorities to put in place additional means to support these initiatives, such as new public certifications or new organizational arrangements to support experimentation. For example, European competition law defines exemption regimes allowing agreements within value chains (including bilateral contracts between producers, processors and distributors) if they increase consumer welfare (Bellone-Closset et al. 2018).

Below, we propose a general description of each of the eight innovation functions.

2.2. Innovation functions in agrifood value chain nurturing niches: delineation and operationalization of concepts

Function 1 –Entrepreneurial activity

Every niche requires an initial impetus. This impetus may come from commercial opportunities, a change in the regulatory framework, the discovery of new ideas or techniques, the resolution of production problems, or new investments in production capacity. This impetus is often provided by entrepreneurs, who remain the driving force behind innovation in the marketplace. Besides, the impetus may need to be renewed beyond the initial phase, as obstacles are encountered that may require the development of new activities.

Two points deserve our attention in relation to this function for the agrifood sector. Firstly, we can assume that the impetus given by a group of producers, for example, is different from that given by a distributor or an intermediary player, as the perception of social expectations and desirable transition paths are probably not the same. Similarly, whether the approach is taken by an individual actor or by a group undoubtedly also changes the situation. The question then arises as to how the impetus will spread, both between the various links and over time. From this point of view, the heterogeneity of links within agrifood value chains can be seen as a specific weakness, requiring particular adaptations.

Function 2 – Knowledge development and diffusion

A niche also relies on specific knowledge, associated with the innovations it deploys. As in the case of function F1, this knowledge must be enriched and maintained over time to ensure the perpetuation of the initiative. The literature identifies three forms of learning: by searching, by doing and by interacting (Hekkert et al. 2007). To ensure this learning process, various means can be mobilized (experimentation, R&D, data collection and processing systems, partnerships with technical institutes and consultancies, etc.), which may require substantial resources (F5).

In the case of the agroecological transition of agrifood value chains, the co-construction of knowledge appears to be decisive, due to the multiplicity and heterogeneity of stakeholders and the challenges of coupled upstream-downstream innovations. Co-construction of knowledge is even seen as a constitutive dimension of the agroecological paradigm (Rossi 2020; FAO 2018). To ensure this co-construction, an initiative can implement specific mechanisms to increase interactions and collective experimentation. French legislation on agroecology offers a number

of mechanisms for this purpose (Economic and Environmental Interest Groups or EEIG², self-diagnosis platforms, etc.). To ensure knowledge development, value chains can also set up dedicated technical advice, for example for diversification crops (Cholez and Magrini 2023).

Function 3 – Guidance of the search

According to Hekkert et al. (2007:423), "guidance of the search refers to those activities (...) that can positively affect the visibility and clarity of specific wants". They consist essentially in making a choice from among all the knowledge gathered (F2), in order to select the knowledge that will enable the initiative to find its bearings. Vermunt et al. (2022) speak here of a necessary "articulation of expectations and preferences".

Guidance of the search is based on the building of shared expectations between operators. Value chain initiatives, because they specialize in a specific area of production and links upstream to downstream (from producers to consumers) seem ideally suited to building such a shared vision. On the other hand, it brings together very specific professions, led by actors that may present a very asymmetrical decision-making power. Such heterogeneity can contribute to maintaining a gap between the various links, which can hamper the initiative deployment.

With regard to the agroecological transition, the question that arises is whether agrifood value chains can move away from a logic of specialization towards the diversification of production systems, which remains key for the transition.

Function 4 – Market formation

Building a market can be seen as a central function, to which all the others contribute. In a context of market economy, opening and maintaining a market is the 'mode of existence' of any innovation niche, which aims to impose its products in the margin of the incumbent regime. Smith and Raven (2012) have identified two possible development paths: i) either the niche imposes itself in an unchanged competitive context ('fit-and-conform' path); ii) or it more or less intentionally brings about a change in the competitive environment ('stretch-and-transform' path). Different valuation strategies are also possible for building a niche market. Emphasis can be placed, for example, on knowledge of consumer preferences (F2), on demonstrating the niche's relevance to societal expectations (F6), or on improving organizational efficiency (F7).

In the case of agrifood value chains, differentiation through product quality is a fundamental market positioning strategy (Allaire 2012). By claiming a specific quality, a company can create a new market rent (a higher price than a product from the same product range) and/or increase the sales volume of its products. First and foremost, this differentiation must be the subject of a "market signal", i.e. a form of communication that makes the consumer aware of this differentiation (readability). It must also appear credible to the consumer. There are two main strategies available to the company, which can be combined: i) affixing a private or public label to the product (possibly with a logo); ii) communicating this quality through various media other than the product itself (CSR commitments, charter, etc.).

The company reinforces the credibility of its approach by choosing between internal auditing and external certification by a third party. The choice of the control mode also reflects the innovation's stage of development and market penetration. In the emergence or experimentation phase, the initiative may be based solely on internal audits designed to build up and share initial

² Economic and Environmental Interest Groups (or "Groupements d'intérêt économique et environnemental") are a French legislative scheme created in 2014 that offers the possibility for groups of farmers to join forces with the aim of implementing sustainability-oriented collective transformations. EEIGs benefit from preferential allocation of certain public aids.

knowledge – leading, for example, to the drafting of a charter of progress. In the consolidation phase, certification based on technical specification may be used to reinforce the legitimacy of the initiative (F6).

Sector operators can also choose to use official labels or create their own. The creation of a new label is accompanied by the registration of a private or collective trademark to reserve its use. This constitutes a form of market protection against incumbent competitors. The choice of a specific signaling enhances the legibility of the initiative and encourages wider adoption.

Function 5 – Resource mobilization

A range of resources, both tangible and intangible (financial in particular), are necessary for the deployment of a niche, particularly as it needs to consolidate its innovation without necessarily benefiting from functional supply channels or a production structure (e.g. Le Velly and Moraine (2022)). These means or resources feed directly into certain functions, such as, for example, in the case of agrifood value chain initiatives, building a label/market signal (F4), improving technical knowledge (F2) or coordinating value chain operators (F7). Consolidation of the initiative also tends to increase its capacity to mobilize resources.

This function is highly dependent on the legitimization function (F6), as well as on the network development function (F8), by mobilizing actors likely to provide complementary resources. For example, a national-scale distributor may provide access to a logistical infrastructure, public institutions may provide access to subsidies, and so on.

Function 6 – Legitimacy creation

Because it seeks to differentiate itself from the rules of the dominant regime, an innovation niche generally has to produce a great deal of legitimization work, whether to attract the partners it needs to build a market, to demonstrate to consumers that its innovation is in tune with their preferences, that it meets societal expectations, etc. This legitimization can be pragmatic, moral or cognitive (Suchman 1995). Several communication channels can be adopted, ranging from more or less formal contacts with industry or government representatives (lobbying) and press statements, to the drafting of charters and advertising campaigns. Legitimization is closely linked to readability (function 4). It remains dependent on the ability of the initiative to build robust knowledge (F2) and conditions access to resources (function 5), and that could conduct to a ‘stretch-and-transform’ path.

In agrifood value chains, building this legitimacy is particularly necessary in view of the diversity of products and differentiating marks that are present on the market - both vis-à-vis consumers and potential partners. From a sustainability point of view, the agrifood sector is undoubtedly one of the most pressured by civil society to change its practices, which may argue in favor of niches positioning themselves in this direction. The existence of a competing market that has long been positioned on this theme – the organic farming market – creates an additional constraint for these niches, which find themselves de facto situated in an intermediate category that they must justify.

Function 7 – Governance and coordination

Any initiative that involves several actors in non-ad hoc tasks needs to find organizational arrangements that ensure a fluid decision-making process and smooth collective functioning. Governance involves all operators adhering to common rules, and presupposes shared business ethics. Coordination between links involves adjusting the decisions made by actors in line with the initiative general direction (F3). These two conditions can be guaranteed by a variety of formal and informal arrangements.

Any initiative aiming at increasing an agricultural production system sustainability requires various technical innovations throughout the value chain (new seeds, new cultivation techniques, new animal feed methods, adaptation of infrastructures for product storage or processing, etc.). While these technical innovations are widely studied in the literature, few studies highlight the organizational innovations that accompany the experimentation and development of agroecological practices, particularly in long value chains. Value chain operators have to face up to the risk of opportunistic behaviour, and can use formal contracts to do so: this moral hazard, well known in transaction costs theory (Williamson 2010), drives agrifood value chains to adopt production contracts (Magrini et al. 2023; Cholez and Magrini, 2023). Other organizational arrangements help to expand the network and disseminate the new practices, such as membership of associative structures. Strategies involving alliances or partnerships between innovation niches can also help to expand the network (F8) and accelerate the diffusion of knowledge (F2).

Function 8 – Network development

The question of niche size is a crucial one, at various levels. From a production point of view, niche development needs to reach a critical size that will enable it to compete in a given competitive environment. To achieve this, it must be able to attract the partners it needs to build and stabilize its value chain (F4). The need to ensure a good knowledge of the market (F2), to find resources (F5) and to establish its legitimacy (F6) requires it to build a network of ‘allies’ that we call partners. These are not actors in the production process as such, but are more or less associated with it (in the governance process or in the initiative’s working groups, for example), and ensure a good connection with the rest of the sector and public institutions. Key partnerships can be forged with different types of actors: they range from NGOs, consultancy associations, to technical institutes.

As agrifood systems are rooted in socioecological landscapes (see section 1), parameters other than strictly commercial ones play a part in defining the optimum size of a niche. The specificity of a terroir, for example, as well as the legislation associated with its protection, can define the maximum size of a niche (e. g. Origin and Quality Markings), independently of demand for the products (Belmin, Casabianca, and Meynard 2018).

Operationalization of concepts

Table 2 breaks down the innovation functions into a set of actions likely to operate in agrifood value chains. These actions are understood as supporting the process of developing sustainable innovation niches.

Table 2 – Operationalization of innovation functions

Function	Definition	Examples	Specific Issues for agrifood chains
F1 - Entrepreneurial activity	Firms taking advantage of business opportunities; creation of new activities; investment in production capacity	New practices and inputs (e.g. seeds); new final products; new methods of organization or materials; new networks of firms	New entrants or incumbent firm initiatives; agency capacity of upstream versus downstream firms
F2- Knowledge development and diffusion	Information and knowledge generation through research (learning by	Technical and market data collection; databases building; training; external advice;	Joint development of knowledge within the value chain (co-building, coupled innovations); contrasting

	searching), experimentation (learning by doing) and exchange (learning by interacting)	recruitment of specialists; field experiments; R&D partnerships; scientific and technical monitoring committees; participation to gatherings, forums, workshops, working groups	views; importance of situated knowledge
F3- Guidance of the search	"Steering the directionality of the innovation process through the articulation of expectations and preferences" (Vermunt et al. 2022)	All stages of the decision process: ex-ante valuation; prioritization; decision; ex-post valuation; roadmap adaptation; consumer expectation perceptions	Continuity of the supporting/business idea over time; actors' (re)positioning with regard to societal expectations (sustainability), various consumers' preferences and competitors; disability of consumers in understanding the complexity of agroecological systems; ability to reposition according to market evolution (price versus environmental expectations)
F4- Market formation	Opening a protected market for the innovation, by means of both market differentiation and search for institutional support	Market signals (private and public labels...); advertising, marketing promotion; communication towards consumers, public authorities, academics; market position (price premium); benefiting of tax-based policy instruments	Choice between environmental public certificates or private ones; confusion of labels or contribution to various transition paths (jungle of labels); combined certifications; segmentation or market transformation; de-correlation from international commodities markets
F5 - Resource mobilization	Raising and allocating resources (of all kinds) efficiently to other functions for successful entrepreneurship and feeding network resources	Links with agricultural advice networks; research and technical institutes; network and organisational resources; search for subsidies, research tax credits, payments for environmental services	Availability of resources within the value chain and between members; unequal or asymmetrical resource access; tension between the value chain vertical organization and the members' autonomy
F6 -Legitimacy creation	Demonstrating the relevance of the innovation with regard to consumers' preferences as well as societal expectations, unlike potential competitors	Lobbying activities; active participation to public gatherings (agricultural shows); reports and publications; relationships with public authorities (Chambers of Agriculture), sectoral organisations, agricultural cooperatives	Legitimacy with regard to the environment or to another issue (health, well-being...); aim to differentiate from the regime (outward movement) or to coexist on the margins (parallel movement);

F7 - Governance and coordination	Finding adequate organisational arrangements between actors to ensure an effective/efficient decision process and functioning	Organisational and decisional models (enterprise, association...); actors' integration and autonomy; stakeholders associated to decision making; frequency of social interactions (meetings...); contractual relationships (formal and informal); obligation of means or performance; price formulation	Responsible and inclusive governance; ethical concerns and trust building; production contracts within competition law; field visits; co-building of a mutual benefit price; co-building of the set of specifications
F8 - Network development	Expanding the actors' network to reach the critical size for market creation and perpetuation	Actions to increase the network's size; recruitment of skilled workforce; types of stakeholders (members, partners) and diversity;	Perpetuation over time (transmission to new generations) ; alliances between value chains to gain in market size

Section 3. Materials and Method

This study is based on a qualitative analysis (Stake 2010) of a series of case studies in four sub-sectors of the agrifood sector in France, including field crops, fruit and vegetables, livestock and viticulture. The aim is to grasp the nature of the dynamics behind the emergence of differentiating initiatives within value chains, both across the sector and within different subsectors.

3. 1. Selection of initiatives

Our selection of case studies combined two approaches. On the one hand, we selected case studies whose some production practices could be linked to agroecology without being certified as organic farming, with regard to the agroecological principles defined by French legislation and the FAO, animal welfare included (cf. section 1). More specifically, through their documentation, the cases selected had to be in phase with at least two of the 10 agroecological principles (FAO 2018). We mobilized various sources of information: the initiative's website, reports, as well as articles referring to it. On the other hand, choices were made in order to reflect different animal and plant production subsectors, as well as different ways of adding value on the market. Three distinct value-adding strategies were sought: i) initiatives with a specific market signal (label) on the product(s); ii) commitment charters covering several products, with or without a label; iii) inclusion of agroecological principles in the CSR of one of the operators leading the value chain initiative or in a collective CSR policy. Table 3 (cf. appendix) presents all the cases selected, as well as all the interviews conducted.

3. 2. Data collection and analysis

The case studies were analysed on the basis of a triangulation of data combining a set of semi-structured interviews and various information media on each initiative (annual activity reports, specifications, charters, scientific articles, press articles, videos or podcasts).

At the start of the study, exploratory interviews were carried out with academic experts and with each of the interprofessional organizations for the products under consideration (from March to April 2022), in order to gather initial information and facilitate contacts with the cases chosen. Subsequently, at least two operators linked to each initiative under study were interviewed on the basis of a two- to three-hour interview, during 2022 and 2023. A common framework of questions served as an interview guide. The interviews were transcribed and analysed by thematic coding (NVivo software), to enable a comparison of the initiatives and to select illustrative verbatims (section 4. 1.). A total of 32 interviews were conducted.

Section 4. Results and discussion

4. 1. Results by function

Function 1 – Entrepreneurial activity

This function is verified by construction: all the case studies chosen explicitly seek to distinguish themselves from the dominant regime. In terms of initial motivations, the conviction is expressed in a strong and transversal way that change is inevitable, that the actors are *forced* to adapt because of growing societal expectations. These initiatives are therefore not solely a matter of entrepreneurial freedom. Three motives come up repeatedly: strong societal expectations (in respect of environment protection and animal welfare), changes in regulations (current or future), and distributor requirements which may condition access to markets.

“We felt... a kind of underlying expectation on sustainability issues... That’s the first point. The second point is the regulations: each year we have more and more synthetic products that are prohibited³. » [Case D]

"I consider that today we have a duty to improve the systems and above all to respond to the evolution of societal demand... If we hadn't done it... we could have had the axe falling in a few years, by saying: that's it, now you change your system... If you're not ready and if you haven't tried things at the same time, you endure, and it's even more complicated to endure. » [Case G]

“Our customers are asking for agroecological practices... They are asking for more and more sustainable raw materials. » [Case A]

Depending on the link’s place in the value chain, the emphasis is placed on one or the other motive. In terms of the convictions expressed, discourses are contrasted: in some cases, to these three “external” motives is added the conviction that this evolution is going in the right direction (in particular among the youngest operators); in other cases, some skepticism is expressed, especially among producers who are not the direct initiators of the process.

"Ensuring production, responding to consumer and market demands... Having to be somewhat perfect everywhere is very difficult... It's a challenge, we can put things in place... you constantly have to restart the machine, integrate young operators who are more awake, because it is also the generation where you are even more aware of these issues..." [Case K]

"There is an expectation... even in the younger generations... they are demanding... they would not understand if we continued to work as before..." [Case J]

Another motive mentioned, although in a more isolated way, is the facilitation of access to bank credit as bank groups required more and more alignment with societal expectations [Case J].

In general, if the value chain layout requires preliminary persuasion work between the links, it offers a privileged basis for the diffusion of the impulse and the coordination of the professions.

³ All interview quotations have been translated from French.

The value chain layout ensures coherence between the technical constraints of production, processing, distribution and the consumer preferences at the end of the chain. A point to note here is the progressiveness of the initiative's scale (in connection with function 8): in most cases, the start is made from a limited number of operators, who are then joined gradually by new partners, who often belong to the same initial value chain – for example, members of the same cooperative, or suppliers of the same distributor.

"We started with voluntary suppliers... who agreed to put test plots on trial, to see a little bit what it could give, to do agroecology..." [Case D]

Function 2 – Knowledge development and diffusion

As a break in practices, agroecological transition involves a profound destabilization and reconfiguration of actors' knowledge. This issue is perceptible in the initiatives studied, which all seek to draw on new knowledge, relating both to changes in the competitive environment and to new technical possibilities. The challenge is to identify the best way to implement the transformation, given the current value chain layout.

"We have to lift the technical constraints, we have to break habits, we have to reassure on the economic aspects: will it cost me more, will I keep the same performance? » [Case F]

"A sector that has no innovation or no R&D is a sector that is dying. » [Case G]

To do this, many sources are mobilized, including the press, Internet, specialized journals, regional and non-regional technical organizations, Chambers of Agriculture, research firms, producer associations, professional gatherings, etc. Knowledge sharing is done with actors outside the network, and even with potential competitors:

"It's really a rapprochement solely on R&D... These are two different cooperatives, even competitors... We really pooled the R&D part only. » [Case G]

Experimentation is generally a decisive step, which makes it possible to verify the adequacy and robustness of the innovations envisaged. It often relies on collective organization, so as to share knowledge as well as risks (pooling of plots and other production means).

"It is indeed from the outside that we enrich ourselves, and through trials... Besides, what is fundamental is that this knowledge is passed from one farmer to another and that it is shared." [Case A]

"It's important for me to share... because we can have the best ideas in the world, if it's to do them on a small plot at home and then not share them, we won't go in the direction, precisely, of agroecology..." [Case J]

The monitoring and evaluation of innovations is another important step, particularly for approaches seeking certification. In this case, an environmental impact assessment is undertaken, which can be a means or results assessment, carried out internally or by an external evaluator (certifying bodies). Particular attention is paid to the objectivity of the measurements as well as to the traceability of the products, in particular in long value chains where links may not know each other. Objectivity and traceability also become central when recognition by public authorities is sought, in order to benefit from official certifications.

"A lot of technical work to consolidate the reference system, refine it according to the arrival of new value chains, new productions, the feedback from field audits as well as from the inspection body, which gradually allowed us to refine the criteria objectivation..." [Case E]

The search for objectivity, the use of external references, may seem in opposition to the respect for producers "situated" knowledge and the concern for their decision-making autonomy, which remains an often-expressed concern:

"We consider that it is the farmer who knows his job and we don't want to tell him what to do, what not to do..." [Case D]

However, the standardization stage remains essential to building legitimacy in a long value chain, unlike short or 'local' ones for which consumers assurance and confidence mechanisms are based on proximity to the farmer.

If the need for knowledge co-construction is regularly highlighted, the search for a complete traceability of technical itineraries is another strong trend, which, to a certain extent, is contrary to the first. An example of this ambiguity can be found in the wish of a processor to provide the farmer, through data collection and processing tools, "with a vision of his own impact and how he can manage it" [Case B].

The objectivity of the standards is all the more important for transnational actors in order to justify the approach to foreign customers.

"For us the international aspect was very important, since we have clients in all countries... who... try to write and standardize. » [Case A]

Function 3 – Guidance of the search

If the need to transform practices is acquired for all niches, the direction of this transformation varies from one case to another. In some cases, the impetus remains mainly due to a leading actor (e. g. the distributor or the food processing company) who seeks to associate the necessary links; in other cases, the impulse emerges from the group of operators.

"From these referent groups emerge proposals... which either come from producers, saying: it would be good if we worked on this or this aspect... Or it is the association that offers its members to work on this topic ... There is not necessarily a single channel of emergence... it is generally collectively. » [Case E]

This direction is based on a shared vision of the necessary transformations, which of course depends on the degree of the actors' support, which may vary. This vision is itself based on a certain mobilizing term or principle, for which the actors show an often-significant sensitivity. For example, the term "agroecology" is regularly disavowed, on the grounds that it would be too divisive or "overused" [Case J]. Its exact content is also sometimes simply ignored. The terms 'integrated'⁴, 'sustainable', 'resilient' or 'regenerative' agriculture seem to receive more approval. A concern for inclusiveness seems to motivate this choice, and the desire to escape the opposition deemed too strong between conventional agriculture and organic agriculture.

"To sum up, we do agroecology without knowing it, actually..." [Case H]

"We do agroecology without naming it. » [Case C]

Beyond the preferred term, the shared vision is built on the basis of sociotechnical interactions between actors, who gradually agree on an approach to follow. One fact that stands out quite clearly is the necessarily evolving nature of the process: the initiative remains conditioned by economic, climatic and regulatory evolutions, as well as by consumer preferences. For the actors questioned, it is less a question of reaching a given state than of initiating a beneficial dynamic, while adapting to the situation.

"We make sure to continue to keep this lead... so that our benchmark always remains in this line of sustainability..." [Case E]

This is materialized in particular by the recurring use of plans of progress (which can even lead, in some cases, to a switch to organic agriculture).

"The notion of plan of progress... must be inseparable from agroecology. » [Case F]

⁴ 'Integrated' is one of the possible translations for the French expression "agriculture raisonnée" ('reasonable').

“The association is there to help companies to progress collectively and individually, to progress on the different dimensions of sustainability. » [Case E]

Function 4 – Market formation

Market formation is the culmination of the initiative, which finds the means to sustain itself.

“We need agroecological practices, and we need a market. » [Case F]

If agroecology, in its primary sense, should lead to cost reductions due to a reduction in inputs and an improvement in process efficiency, in general the niches studied are rather experiencing an increase in costs, which may be linked to the value chain reorganization, to experimentation or to the additional costs of reinforced coordination. These costs can be offset in different ways. In the case of a new value chain creation, a premium price on the market allows a specific remuneration, accompanied by specifications and a specific term for the consumer.

"The program... it's an internal program... so obviously, for us, it's essential to be able to promote this program, it's an investment from the company, it's also the promotion of our collaboration..." [Case B]

In other cases, the innovations are integrated into an existing value chain, with little or no specific exposition, the initiative being considered an integral part of the brand. However, differentiation by certification and labeling remains the route most represented among our cases, particularly for the least recent initiatives (see appendix). In some case, this certified signal market is not sufficient to get a price premium but just secure market access:

“No certification process guarantees a higher price than a product without certification... However, what we see with our producers is that they do not sell with a higher price, but they sell better. » [Case E]

Labeling mainly concerns downstream operators, in contact with consumers. Upstream links, on the other hand, focus more on certification, which guarantees trading partners a certain quality of the product. Two issues appear here on a recurring basis: the first, relating to labelling, relates to the multiplication of quality market signals (sometimes called ‘the jungle of labels’), which it is feared will confuse consumers:

"It's a journey that is long, complicated... and above all that requires a lot of resources, because you have to emerge in the middle of an inextricable jungle of labels, marks, logos, claims, etc. » [Case E]

“The excess of official signs of certification, of denomination is more and more confusing in my opinion... There is a real problem on the display.” [Case H]

The second issue, relating to certification, relates to the multiplicity of specifications, which can complicate the organization of the chain. Some producers, for example, combine environmental certifications with other signs of quality, such as regional designations (PDO), or nutritional certifications with certifications aimed at animal welfare. Intermediate links, such as storage organizations, may have to manage distinct specifications, requiring the organization of specific channels. This multiplicity calls for significant work to integrate the specifications on the basis of criteria equivalences, in order to avoid a counter-productive increase in costs.

The question of consumer preferences is another recurring concern, which conditions market formation. Some operators wonder, in particular, to what extent the gap that persists between the expectations declared in surveys and real purchasing behavior does not constitute a major obstacle to the development of sustainable initiatives.

"There is always a bit of discrepancy between the speech and the actual act of purchase... I am ready to take the time, and then finally in the shop there is the price which speaks despite everything..." [Case D]

Another recurring question is the possibility that consumers will move away from the opposition between conventional and organic agriculture, and open up to other forms of quality certification.

Purchasing behavior is of course conditioned by the distributor strategy, whose role is decisive within long value chains. Some operators have underlined the difficulty of having their initiative recognized by marketing departments, and in particular of getting them to move away from a logic of market segmentation, which confines sustainable products to marginal shelves.

"Where we fight on a daily basis... is how much it represents on the shelves."

[Case D]

"You have to fight against marketing managers who want to segment the market."

[Case F]

Function 5 – Resource mobilization

A wide variety of resources are mobilized to implement and strengthen the initiative. These resources can be internal or external. In the case of internal resources, they can come from a symmetrical actors' mobilization (case of collectives of producers pooling resources for the purchase of expensive equipment) or from an asymmetrical mobilization (case of distributors making logistical means available to partner producers). External resources are also diverse: they can come from subsidies (e. g. for planting hedges), bank loans (for adapting facilities), research tax credits (for experimentation).

"As we have expenses related to research... we benefit from a research tax credit. So that is an aid that we use... It allows us to limit the costs of this project, because it is... quite colossal, what we are committing..." [Case D]

The value chain layout generally seems to be an advantage for this mobilization, in that it ensures a concentration of resources for internal financing, and legitimization for external financing. The adoption of an associative status recognized by the state (e. g. the EEIG) can also be a means of benefiting from subsidies.

Function 6 – Legitimacy creation

Niches often mobilize significant resources to build their legitimacy, with regard to consumers, partners and public authorities. It is not only a question of ensuring their visibility on the market, but more generally of being recognized as full players of the transition (this notably allowing access to more resources to deploy). However, the task is sometimes difficult, in particular due to segmented markets that leave little room for innovation.

"We are told: it is good what you are doing... but we have no box for you." [Case F]

The use of certification, whether private or public, is part of this legitimacy creation. It is often progressive: several initiatives use internal assessments first, before resorting to external audits and possibly public certifications. Requests to the public authorities are also initiated in order to have the specifications recognized (search for equivalences with the High Environmental Value or HEV label⁵, in particular). Several approaches also use multiple certifications (HEV combined with other claims). The objectivity of specifications, the search for traceability are other means of building this legitimacy. Most of the initiatives show major communication efforts, whether with the profession (trade fairs or events), consumers (advertising), regional authorities (Chambers of Agriculture) or even national ones (Ministry of Agriculture) in the case of largest initiatives. Recognition by public authorities, in particular, seems to be a decisive step.

⁵ The High Environmental Value label ("Haute Valeur Environnementale" in French) is a three-level environmental certification created in 2012 and delivered by the French Ministry of Agriculture.

“We started talking about simplified tillage techniques... we ended up talking about lobbying and politics.” [Case F]

“We are eagerly awaiting public authorities for this work to be done. We need to have this logic of recognition to reinforce [our] CSR position.” [Case E]

This work of legitimation appears difficult, in particular because of the competition within the agrifood sector, even if dynamics of cooperation are also perceptible.

“At the local, regional level... especially Chambers of Agriculture, sometimes it's a tough fight... We need a little education... There are feelings... There is perceived competition.” [Case F]

“We created, we can say, a specific quality... We know that our competitors, afterwards... followed us.” [Case A]

Organic farming also creates implicit competition, by forcing initiatives to an argument that can demonstrate the legitimacy of a “third way” (i.e. an intermediate category).

Function 7 – Governance and coordination

The multiplicity of operators in the value chain, the specificity of each profession, make governance and coordination issues of the first order. Again, our selection presents quite contrasting situations, from relatively small-scale initiatives, where operators meet within the same assemblies, to long-value chain initiatives in which operators do not interact directly, but only coordinate via the specifications. In all cases, the emphasis is repeatedly placed on the need for co-construction of the initiative.

“It's really an initiative that has been co-constructed, it's an initiative that we have built, we are lucky to be in a value chain... We worked together to build something that meets the challenges of both others and which can progress” [Case C].

“We manage to make people work together... Sharing knowledge... with breeders and processors all together, that was quite unusual...” [Case H]

Co-construction dynamics presuppose commercial ethics between partners:

“It's much easier to get into topics around agroecology when you already have a relationship of trust and privileged exchanges with the upstream...” [Case D]

This ethics can go as far as a desire to share the value created and the risks:

“This collective dimension is part of our genes... The advantage of that, and especially in times of crisis, is that we control all the stages, and therefore we try to share wealth and decision in a very collective way.” [Case H]

One of the means commonly used to ensure actors' coordination is contractualization. Annual or pluri-annual production contracts are a way of uniting operators, agreeing on new practices, and stabilizing the value chain over time. Particular attention is paid to the progressiveness of the commitment, so as to respect operators' pace of adaptation.

“We are an operator which anticipates, we look at the long run... The contracts, we do not do them at the last minute... We build lasting relationships.” [Case A]

“The farmer is faced with a lot of issues, and if we want to get him to move in a direction like this, which is difficult, which makes them take risks, well, we have to go at their own pace.” [Case C]

An important issue is the operators' decision-making autonomy (of producers, in particular), which can be hampered if co-construction is not ensured. It happens that suppliers have given up joining the process, for fear of a coercive commitment.

“At the beginning, it's surprising for them when we ask their point of view... because they are used to just undergo... specifications that come from downstream... When they understand the process, they become proactive, in co-construction...” [Case F]

“We don't want to be locked into a system, we want to be masters of our commitments... We finally reworked on a charter that is our own, with real commitments around carbon, around biodiversity, around pesticide-free... One of the keys to the success of an agroecological initiative... is its appropriation by the farmers, that is to say that it is the farmers who decide to respond to current problems, and not that it is imposed on them...” [Case C]

Another issue particularly important for the value chains' agroecological transition and which has been underlined by several operators, is the overcoming of the product-oriented logic in order to build complementarities between productions.

“We would like to be able to have value chain initiatives for all the products that come out of the same farm... When a farmer makes potatoes, for example, in his rotation, he will have cereals, beets, other products, it would be necessary... that there is no longer a value-chain-by-value-chain approach, but that the farm can valorize all these products...” [Case D]

“The intention we have is... to extend the initiative to other crops... We leave the farm plot and go more towards an exploitation charter...” [Case C]

Function 8 – Network development

The incorporation of new partners into the initiative is another recurring concern, whether they are new operators involved in production, or partners who help to carry out other functions. In terms of production in the strict sense, the need to reach a certain critical size seems to be shared by several of the cases studied: this can be explained by the need to produce a minimum volume to integrate distribution systems, to secure supplies, or even by the need to be recognized as a significant player in the sector. It should be noted that certain initiatives are limited in size by essence: this is the case for initiatives relating to a PDO, for example.

With regard to expansion, tensions are reported in certain cases, between actors who wish to integrate new members, and those who prefer to restrict access in order to limit competition. However, the value chains studied seem in general to play the card of cooperation more than competition, for R&D at least.

“We had to make producers aware of the interest of opening up, of expanding...Inviting them to actually see the benefit rather than the risks, even if there may be risks...Especially the benefits of opening more widely, and to have companies that are sometimes competitors...” [Case E]

With expansion, the question sometimes arises of maintaining the initiative's values and its continuity:

“The initiative is built on solidarity and commitment. With economic development, how do we maintain these values?” [Case H]

“What is new for the sector is transmission, that is to say: how we move from a team of pioneers who are completely committed and convinced of the story... to transmission to younger breeders ...” [Case H]

The network extension does not only concern operators, but also various actors from related structures, who often play a decisive role in the process.

“It is not with our... employees that we could have done what we did, if we had not been able to rely on networks...” [Case F]

This network of partners includes various actors, from technical institutes, Chambers of Agriculture, to associations and NGOs.

We also observe the recruitment within the value chain of specialized profiles working at the interface of value chain links (this is the case, for example, of technicians recruited by distributors to ensure dialogue with producers).

4. 2. General findings

Some general lessons deserve to be noted from this study, to reflect on the levers to support such initiatives and more particularly with regard to public support policies.

1. Do dominant regime actors actively contribute to the development of niches?

Overall, it appears that innovation niches often start from existing actor networks who are already involved in other conventional value chains. The initiatives arise from actor networks experimenting with different agricultural practices and who then decide to build a new value chain in order to concentrate resources on a small number of operators before deciding to be developed. This tends to question the canonical separation between the niches and the dominant regime: incumbent actors (from the dominant sociotechnical regime) play an essential role in the emergence of niches, in particular by allocating existing resources (both human and financial) for the niches. This raises the question of the dominant regime's role in the transition and the type of support to be favored by public authorities. The building of a value chain to consolidate alternative agricultural practices also calls for enlarging the support by regulatory mechanisms that are currently focused on the upstream (e.g. EEIGs).

2. Do innovation niches transform the sector or just seek to escape from it?

The logic of market differentiation is predominant in the niches studied. Their development appears at least as much as a means of distinguishing themselves from fierce competition as an opportunity to build a new market. Considering the two strategies 'fit-and-conform' or 'stretch-and-transform' (Raven and Smith 2012), it appears that niches rather seek the first one to move away from the regime, with the purpose of creating market rent – which does not prevent the regime from being involuntarily modified. In general, there is a perceptible 'ripple effect' within value chains: operators perceive that the standards are changing (for instance the public creation of HEV), and so, all are seeking to position themselves in a privileged way vis-à-vis this trend, while protecting themselves from competitors. In this evolution, the role of societal expectations and regulations appears to be decisive.

3. How to deal with the underlying tension between farmer decision-making autonomy and the specifications objectification for consumers?

The need for shared expectations, the concern for co-construction of knowledge and respect for the decision-making autonomy of operators are motives that are widely shared and particularly striking. The wish for certification, with the underlying logic of objectification (imposition of external benchmarks), is also very present, and can constitute a brake on membership if the specifications restrict operators' decision-making autonomy excessively. The fact remains that objectification is essential to build a credible initiative, particularly in long value chains. It should be borne in mind, however, that specifications objectification carries the risk of a standardization of practices which would be detrimental to the agroecological transition, for which a local adaptation of production practices is essential. Certifications that would be based on *results* rather than on *means* that are implemented could be a way to preserve the diversity of practices. The question may also arise of the possibility of changing the forms of certification, for example by peers, which would guarantee the adequacy of the specifications with local specificities.

4. Do the consumers' preferences are a barrier for the development of niches?

If the development of alternative production methods may appear more or less difficult from one initiative to another, everyone seems to agree on the difficulty of gaining a good position on the market. In long value chains, the commercial strategy of the distributor remains decisive in the visibility and accessibility of the product (choice of mode of referencing, highlighting and positioning on the shelves). The question of consumer behavior is also strongly raised by the operators questioned, as well as that, more broadly, of the possibility of a change in diet. The success of the initiatives, and that of the transition, remains conditioned by a purchasing behavior on which the operators feel helpless. Market signal remains decisive here (with the question of possible competition between quality signs, of which one may wonder whether it is beneficial or harmful) and the question of the role of public authorities in the promotion of these initiatives by a uniform sign of recognition is placed.

5. Up-scaling: does the territory is the place to build inter-sector connections?

Most of the initiatives studied keep a 'vertical' product-oriented structure, even if many have also undertaken work to go beyond this specialization logic to build inter-value chains dialogue, with a search for complementarities between productions. We can consider that this change of logic, of which network development can be an expression, is constitutive of agroecology. The question then arises of how to promote it, with a view to accelerating the transition of the sector. One can wonder, in particular, if the territory (understood as a space characterized by common socioecological qualities and significant 'connectivity' between economic actors) could not be the best scale to favor this work of connection. Indeed, the territory scale guarantees a certain socioeconomic proximity (including with consumers) which appears to be a guarantee of trust. In France, the quality of 'local' is a criterion of choice for consumers. One can see there the possibility of overcoming the binary distinction between conventional and organic farming, through a common agroecological transition at the territory scale.

4. 3. Limits and perspectives

We have identified at least three limitations to this study, which could be the starting point for future work:

- 1) As a case study approach, it supposes deploying the analysis to other comparable niches, in the same sectors and in others not yet explored to check the robustness of the conclusions;
- 2) the role of time being essential in the dynamics of innovation, a greater temporal depth would allow a richer and more nuanced analysis of these case studies. The establishment of an observatory of innovation niches in the French agri-food value chains would allow this long-term analysis;
- 3) At this stage, the exact content of the practices underlying the qualification of agroecology or sustainability has not been finely assessed, due to the complexity of such an analysis and production-context dependence, but also to the confidentiality of data and the need for an investigation carried out by the State to access the detailed specifications. Processes that have been analyzed are likely to be dependent on the agroecological 'intensity' of the practices implemented. In the future, examining this issue more deeply would certainly help to qualify the lessons learned.

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Appendix

Table 3 – Overview of case studies for value chains engaged in sustainable agriculture in France with interview details

Study Case	Type of Production	Purpose/Novelty	Strategy	Leading Operator	Size	Launch Year	Types of Stakeholder interviewed and acronym	Function of the Interviewee	Number of Interviews
A	Field crops (dried peas)	Creation of a plant protein value chain based on peas that are produced according to certified sustainable agricultural practices	Production Charter	Processor	ca. 1000 producers	2017	First-step Processor (P)	Global Manager and Public Officer	2
							Organization promoting and certifying sustainable agricultural practices (OC)	Director, French certification	2
B	Field crops (wheat)	Partnership between actors of the biscuit value chain to use wheat that has been produced according to a charter of good agricultural practices	Production Charter	Processor	ca. 1500 producers	2008	Farmer (F)	Farmer	1
							Processor (P)	Project Lead	1
C	Field crops (wheat)	Initiation of a sustainability intern program within an agricultural cooperative, through a set of specifications that leads to an increased remuneration for farmers	Production Charter	Cooperative	ca. 500 producers	2021	Agricultural Cooperative (C)	Trading and Marketing Director	1

D	Fruits and vegetables	Progressive adoption of sustainable agricultural practices within a retailer-led premium quality fruits and vegetables value chain	Production Charter	Retailer	ca. 50000 tons produced annually (ca. 10% of retailer's total sales)	1992	Retailer (R)	Agroecology Task Officer for fruits and vegetables, Head of agroecology project in plant sector, Quality and value chain Manager	2
E	Fruits and vegetables	Quality brand carried by a group of fruit and vegetable producers organized in an association who want to highlight their sustainable practices	Product Specification	Group of producers	ca. 220000 tons produced annually	2004	Organisation promoting and certifying sustainable agricultural practices (OC)	Chief Executive	2
F	Livestock (bovines)	Association for the promotion of a diversified diet in livestock farms, based on a set of specifications, with a view to a qualitative transformation of both the food products and the environmental balance of the farms	Product Specification	Sustainable feed promoting association	ca. 7000 breeders	2000	Organisation promoting and certifying sustainable agricultural practices (OC)	Director and President	2
G	Livestock (rabbit)	Breeders initiative that aims at ensuring a better match between breeding practices and societal expectations	Product Specification	Group of breeders	ca. 20 breeders	2017	Agricultural Cooperative (C)	Head of Activities	1
							Breeders' organization (BO)	Deputy Director, Purchasing and Supply Director, R&D and Marketing Manager	1

H	Livestock (pigs)	Creation of a niche market of premium quality pork that aims at ensuring the conservation of a rustic breed of pig, with implementation of extensive breeding practices	Product Specification	Group of breeders	ca. 50 breeders	1981	Breeders' organization (BO), Processor (P)	Director and President	1
I	Livestock (pigs)	Regional initiative initiated in the pork value chain to introducing responsible practices and match societal expectations	CSR Policy	Group of breeders	ca. 1000 breeders	2019	Agricultural Cooperative (C)	Head of Pork	1
							Processor (P)	Environment and Valuation Advisor	1
J	Wine (Champagne)		CSR Policy	Brand (Producer / Processor)	110 ha	2000s	Farmer (F) and Processor (P)	Vineyard Manager	1
K	Wine (Bourgogne)		CSR Policy	Wine Cooperative	1200 ha	2013	Farmer (F) and Processor (P)	Vineyard Manager	1
Context interviews (not project-specific)									
French Ministry of Agriculture, General Directorate for Economic and Environmental Performance of Businesses							Task Officer		1
Ministry of Economy, General Directorate for Competition, Consumers and Fraud Control							Food Quality Office Administrator, Food Products and Markets Deputy Director, Food Products and Markets Deputy Director Secretary		1
Ministry of Ecological Transition, Department of the Commissioner-General for Sustainable Development							Task Officer		1
National Institute of Origin and Quality							Director, Executive Assistant, Technical Task Officer		1
Inter-branch organization (plant protein)							Deputy Director / Director of Research, Head of Economic studies, Head of downstream activities		1
Inter-branch organization (cereals)							Studies department Director, Regional Officer, Head of SER		1

Inter-branch organization (cattle, meat)	Head of environmental affairs, Head of societal challenges	1
Inter-branch organization (cattle, milk)	Head of environmental affairs, Head of economic forecasting	1
Inter-branch organization (rabbit)	Director	1
Inter-branch organization (pork)	Director	1
Inter-branch organization (wine, Champagne)	Technical Director	1
Inter-branch organization (wine, Bourgogne)	Director of Technology and Quality Department, Sustainability Task Officer	1