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The coexistence of agricultural and food models at the territorial scale: an analytical framework for a research agenda

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Abstract

This article proposes a research agenda for situations of coexistence of territorial agricultural and food models. Indeed, new agricultural and food models are being deployed at the territorial scale in response to criticisms of existing models and to meet new challenges. These new models embody archetypes of observed diversity, actors' projects or standards. We use a bibliographic review and six seminars organized between 2015 and 2017 to propose an analytical framework based on four major dimensions of territorial development: the tension between specialization and diversification, innovation, adaptation and transition of food systems. We show that it is essential to understand the interactions between territorial agricultural and food models (confrontation, complementarity, coevolution, hybridization, etc.), going beyond just the characterization of the diversity of models and the evaluation of their relative performances. We conclude by highlighting the original aspects of the proposed analytical framework, its methodological challenges and the expected consequences for providing support to agricultural and food development in urban and rural territories.

Keywords Agricultural model · Food model · Coexistence · Territory · Territorial development

JEL codes Q01 · R58 · R11

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Introduction

Globalization has failed to standardize agricultural and food models at the territorial scale, despite the spread of these models across the planet, for example during the Green Revolution, the industrialization of food processing and distribution or through the affirmation of agroecology as a shared goal (Pimbert 2018). Thus, some ‘alternative’ models are now being tolerated and sometimes even promoted to overcome the limitations of the dominant models and to meet new challenges (health, environmental, demographic, etc.). This positive reclassification of the alternative has been taking place since the 1990s in a ‘quality turn’ which is leading to a surge in new qualifications of agricultural and food systems (organic, fair trade, geographical indications, vegan, etc.) (Goodman 2003). These agriculture and food models are often examined in a dual way in a binary opposition to the model with which they contrast (conventional vs. alternative, agroindustrial vs. peasant, GMO vs. non-GMO, etc.). This dualism masks the large diversity of models and their interactions within territories.

In this article, we use a bibliographic review¹ to show that while the coexistence of agricultural and food models at the territorial scale is addressed in the scientific literature, it has never been theorized as such, even though it provides a perspective of heuristic analysis of agricultural and food dynamics. The coexistence of agricultural and food models in any territory determines and, at the same time, depends on the answers to the following four major questions: What are the tensions between specialization (productive and/or of space) and diversification? Is innovation the driver and/or the product of the coexistence of territorial agricultural and food models? What are the conditions conducive to the adaptation of agricultural and food systems in a context of uncertainty? Is the transition to sustainability a relevant perspective for designing and supporting situations of coexistence of territorial agricultural and food models? These dimensions are addressed dynamically, as processes (Fig. 1). They are considered both as factors and as products of the dynamics at work in the coexistence of territorial agricultural and food models.

The four dimensions selected (specialization, innovation, adaptation and transition) were identified during a series of 6 seminars called ‘Format’ organized by the authors in France between November 2015 and June 2017. These seminars brought together an average of 25 researchers² per seminar and allowed the study of 19 case studies (7 cases from Europe, 6 from South America, 3 from Africa, 2 from Asia and an international

¹ The literature review was carried out by querying 5 scientific documentary databases (Web of Science, Agritrop, Prodinra, Caim and the HAL open archives) using requests adapted to each of them. As an illustration, these were the queries used for Web of Science: TS=(((intensive or conventional or “high input” or monofunctional or industrial or commercial) near/3 (organic or “low input” or integrated or ecological or fami* or multifunctional or sustainable or agroecology))) near/3 (((farm or farming or agricultur* or crop or food or agri\$food or livestock) near/3 (system or model))))); TS=((alternative or transition* or transformation or reorient*) near/3 ((farm or farming or agricultur* or crop or food or agri\$food or livestock) near/3 (system or model))). The bibliographic material is also based on the expertise of each of the co-authors, who selected the articles which seemed most relevant to them.

² These researchers, mainly from the human and social sciences, are affiliated to 13 research and higher-education institutions in France (AgroParisTech, CIRAD, CNRS, INRA (now INRAE), IRSTEA, Montpellier SupAgro, VetAgro Sup), Argentina (INTA), Belgium (Catholic University of Louvain), Brazil (Instituto Ambiental do Paraná), Japan (Aichi Gakuin University of Nagoya), Portugal (University of Évora) and Switzerland (University of Neuchâtel).

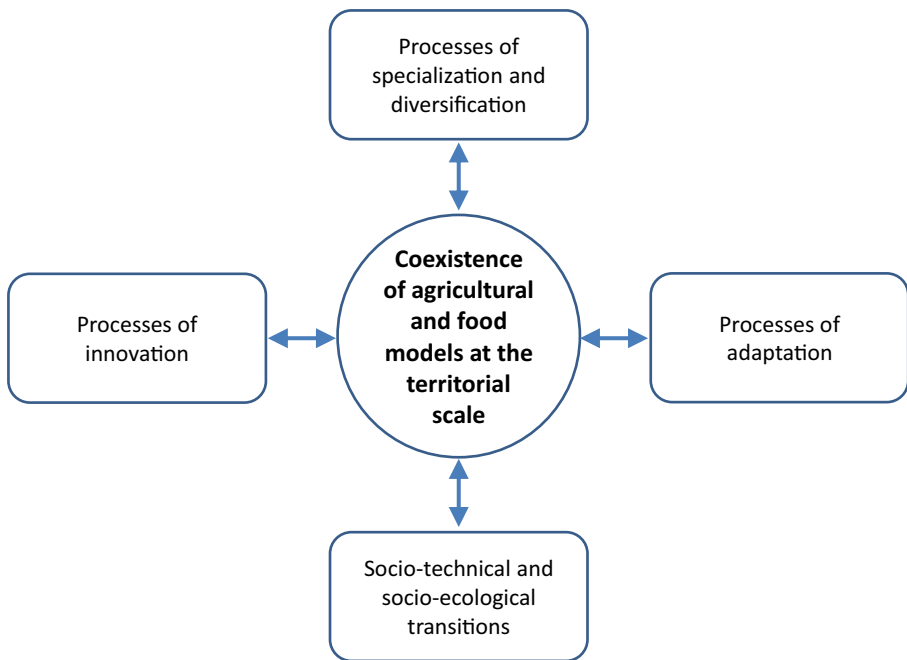


Fig. 1 Framework for analysing the coexistence of agricultural and food models at the territorial scale

comparative approach of 7 dairy basins). These seminars allowed the collective production of a case study analysis grid and revealed the four dimensions proposed in this article. They complement the main focal points of research in the human and social sciences on territorial development during four successive periods (Jean 2008; Pike et al. 2006; Torre 2015): specialization since the 1980s, innovation since the 1990s, adaptation since the 2000s and transition since the 2010s.

After defining the concepts of agricultural and food models and of coexistence, we present the state of current knowledge for each of these four dimensions, and propose several hypotheses and questions for future research. We show that taking into account the coexistence of agricultural and food models according to these four dimensions enriches the conceptual mechanism (Albaladejo 2016; Polge et al. 2018; Torre and Wallet 2016) necessary for the analysis and support of agricultural and food development in rural and urban territories. Taken all together, this constitutes an analytical framework and a research agenda.

What are agricultural and food models and how do they coexist?

The socio-technical³ and socio-ecological⁴ forms observed in agricultural and food systems often differ from what are called models, which are abstract, schematic and

³ Socio-technical forms combine human representations, decisions and practices with biotechnical entities (Bijker 1997).

⁴ Socio-ecological forms refer to the way in which ecological dimensions interact with socio-technical dynamics (Holling 2001).

simplified representations that actors (researchers, agricultural advisers, trade unionists, politicians, etc.) make of a complex reality. The scientific literature uses three acceptations of the concept of agricultural or food model (Gasselin 2019).⁵ First, researchers and experts build models as an archetype of a reality observed either today or in the past in order to characterize diversity and facilitate its understanding and a transformative action. These models are often described in terms of regimes (McMichael 2009), ‘*référentiels*’⁶ (Gisclard and Allaire 2012), agricultural systems (Plumecocq et al. 2018), food systems (Sobal et al. 1998), socio-technical systems (Geels 2010) and etc. But an agricultural and/or food model can also represent a desired future that actors demand, for example peasant agriculture advocated by agricultural unionism or alternative forms of consumption promoted by a movement such as Slow Food. Finally, a model is sometimes defined as a set of standards for action in a certification and evaluation process, such as organic farming or halal food. Depending on which of these three acceptations is used, the concept of the model presents an analytical dimension or a normative dimension which the actors adopt to think and act. These two facets are in opposition and must be clearly laid out, for example to show that the peasant agriculture of Mendras (1967) (an analytical archetype) is not the peasant agriculture of Via Campesina (a desired future).

It is not sufficient to merely characterize the diversity of farming and food models and assess their relative performances; understanding their interactions within territories—defined as the ideal, organizational and material links between societies and their spaces (Lévy and Lussault 2013)—seems to be essential. These interactions can be very diverse: complementarities, synergies, coevolutions, hybridizations and/or confrontations, competitions, marginalizations and exclusions. They are at the heart of territorial development processes and strategies⁷ because they open up the field of possibilities. Considering a ‘situation of coexistence’⁸ of agricultural and food models first requires clarity on which actors or systems interact (producers, production systems, territorial or sectoral actors, etc.) and in what ‘setting’ or in which frameworks of interaction (farm, cooperative, territory, sector, innovation system, governance mechanism, etc.). Furthermore, it is necessary to ask how they interact (conventions, regulations, money or material flows, controversies, power relations, etc.) and around which objects (work, technical systems, prices, natural resources, quality criteria, knowledge, identity, etc.). Indeed, a situation of coexistence can be observed differently at different scales (cooperative, nation, territory): It may seem to be ‘virtuous’ at certain scales but may not be so at others. Similarly, the issues of coexistence vary depending on the problem to be addressed. For example, in a given territory, the issue of coexistence may pertain to competition over resources or the construction of a territorial identity.

⁵ We do not consider here models defined as mathematical formalisms which relate variables included in descriptive, normative or predictive explanatory equations dealing with food and/or agriculture.

⁶ A cognitive and normative framework shared by actors that provides keys for interpreting reality and, as a result, guides public action (Muller 1990).

⁷ This includes all the activities that form part of territorial dynamics, including agricultural and food activities, and concerns all of the territory’s stakeholders, across all sectors of activity (Lardon et al. 2015).

⁸ The case studies presented during the Format seminars were structured around ‘situations of coexistence’ (actors/systems interacting around specific objects in a given setting).

Now that we have defined the situations of coexistence of agricultural and food models, we examine in the following four parts of this article how they are taken into account in the scientific literature on the themes of specialization, innovation, adaptation and transition. The critical analysis of the literature leads us to formulate new hypotheses to test in future research (analytical framework) and which we break down into several questions (research agenda).

Specialization and diversification: the yin and yang of coexistence

The first dimension of analysis of the coexistence of agricultural and food models concerns specialization and diversification. These are two concepts commonly used to qualify the economic or ecological processes that differentiate agricultural and food systems. These concepts can also apply to transformations of a territory, depending on whether the territory evolves towards the domination by a productive activity or, on the contrary, towards a greater plurality of functions. We are able to define a territory's specialization because the vast majority of systems of production and derivation of value from products are part of the same development model. Conversely, the diversification of activities in a territory implies the presence of a plurality of systems which are part of development models with different orientations. We recall below the historical trajectory of the 'specialization vs. diversification' controversy, followed by a discussion of the positive and negative effects of specialization and of diversification at the socio-economic and socio-ecological levels. This review of the debate leads us to conclude that the processes of specialization or diversification are still too little studied through the prism of the situations of coexistence of agricultural and food models, thus raising new questions in the field.

The process of productive specialization was one of the drivers of the modernizing paradigm of agriculture in the latter half of the twentieth century. It was bolstered in the countries of the Global North by price stabilization mechanisms (Allaire and Daviron 2019). The debate between specialization and diversification first emerged in the 1970s with a strong focus on social issues of dependence and of the loss of autonomy of farms and rural spaces (Kayser 1992). However, observing and evaluating specialization require precise definitions and methodological precautions, given the different possible scales of analysis: farms, rural territories and sectoral organization (Mathieu 1985). In the 2000s, the 'specialization vs. diversification' controversy redoubled with the advent of the concept of sustainable development, focusing on a key question: How to reconcile agricultural production with the preservation of natural spaces and land use in a global context of pressure on resources and accelerating biodiversity loss?

At the socio-economic level, the respective merits of the specialization and diversification processes oppose each other (Mathieu 1984). The specialization of rural spaces or productive activities has been advocated in pursuit of economies of scale, economic integration, low food prices or even agglomeration externalities (Antoine 2016). In contrast, diversification is frequently promoted for the sake of the advantages of complementarity and the autonomy or resilience that are associated with it (de Roest et al. 2018; Suryanata 2002). Some observers propose the specialization of spaces and forms of production in order to intensify, while correcting and compensating for the possible negative effects of such a specialization (Pingali 2012). Others prefer instead

the integration of agriculture's multiple functions with a diversification of farms and landscapes (IPES-Food 2016). This debate can be extended to the organization of food production, the organization of rural spaces, ecological intensification and the conservation of the environment.

At the socio-ecological level, two ideal types can be considered to manage a territory and its resources: 'We can distinguish a first model, qualified as "segregationist", separating what can be cultivated from what should not be from the point of view of environmental protection, in which "natural" processes will nevertheless have to be managed. [...] From another point of view, combining the ecological and productive functions of agroecosystems in the same territory is a model that can be described as "integrationist"' (Agrimonde 2009: 31). The first approach divides the territory between spaces dedicated to intensive agriculture, on the one hand, and to the preservation of natural environments, on the other. The second proposes the conception of a diversity and complementarity of forms of agriculture arranged to create ecological mosaics producing various ecosystem services. This debate on the best way to protect nature has been structured around the notions of 'land sparing' and 'land sharing' (Byerlee et al. 2014; Green et al. 2005). The proponents of land sparing hypothesize that high-yield agriculture, based on advanced technology and industrial inputs, is best suited to produce on limited areas and therefore can best preserve large uninhabited nature reserves sustainably (Green et al. 2005). Conversely, the advocates of land sharing do not believe in isolated protected spaces surrounded by regions that are inhospitable to biodiversity. According to them, 'to avoid ecosystem collapse, we must integrate biodiversity conservation throughout the landscape we use' (Kremen and Merenlender 2018). A tension therefore exists between these two types of intervention. However, a compromise was subsequently reached between these streams of thought, according to which the choice of approach would depend in part on the scale (Fischer et al. 2014). Proponents of land sparing agree that 'land sparing and land sharing describe two ends of a continuum of intentional spatial organization of food production and biodiversity conservation: whether separated or integrated' (Phalan 2018). For their part, the advocates of land sharing recognize the importance of the traditional approach to protected areas, but they argue that the range of tools available to maintain biodiversity in more or less anthropized areas must include an agroecological approach to cultivated spaces (Kremen and Merenlender 2018).

This review of the specialization/diversification debate shows that the issues are not framed in terms of the coexistence or confrontation of territorial agricultural and food models, which are nevertheless decisive for processes of domination or diversity, and aggregation or dispersion (actors, productive and/or spatial rationales, etc.). We reiterate that a situation of coexistence or confrontation of agricultural and food models has to be examined in terms of the interactions between actors or systems around particular objects in a given setting. Analysis of these interactions sheds new light on the specialization or diversification processes, which leads us to propose three hypotheses to test in future research and to raise associated questions:

Specialization and diversification are not always in opposition, but can follow one another, combine together or be nested, depending on the scale (spatial, temporal, social) under consideration. Indeed, the issues of specialization and diversification can be expressed differently at the scale of the farm, the territory, the sector, the production basin and etc. The articulation of these scales is essential. How are specialized systems

designed, for the sake of their own sustainability, to take into account and maintain the diversity of a territory's resources? How do successful diversification trajectories borrow elements of innovation from the specialization model? Is the diversification of productive spaces not based on a certain level of farm specialization, for example by relying on acquired professional skills to orient farms towards new activities or new markets?

Diversification and specialization are differentiated by different power relationships. What are the forms of power in territories around agricultural and food issues? Is specialization a process of internal organization or is it a progressive subordination to an organized form of functioning/decision-making? Is diversification underpinned by a plurality of powers in the territory or by the absence of a common project? Does it necessarily lead to a multifunctional balance between activities?

Both for specialization and for diversification, there are intended evolutions, of course, but territorial actors also undergo evolutions. The determinants are not necessarily found at the territorial scale, because the dynamics of markets and of macroeconomic actors (firms, States) shape these processes to a large extent (van der Ploeg et al. 2008). Diversification, for example, can either result from an active and deliberate strategy or, on the contrary, passively reflect the lack of structuring opportunities. While the coexistence of models in a territory can result in conflicts and synergies, it can also lead to ignorance or mutual tolerance. How does competition over resources (land, water, labour) crystallize tensions between these models? What roles do the representations that actors have of specialization and diversification play? In which cases are territories the sole determinants of the dynamics of specialization or diversification?

The multiple interactions between and combinations of specialization and diversification and their territorial effects deserve to be better examined. Thus, taking the coexistence and confrontations between agricultural and food models into account makes it possible to refocus the debate on the opposition between specialization and diversification at the territorial scale. It shows dialectical relationships between these two processes and, above all, it leads to the necessity of better articulating different temporal, spatial and actor-organization scales.

Innovation: seed and fruit of coexistence

The second dimension of analysis of the coexistence of agricultural and food models concerns innovation (Faure et al. 2018). This notion, which was first conceptualized in the twentieth century, refers primarily to a technical and/or organizational process by which something new is invented, built, conceptualized, appropriated and transformed by actors, which immediately calls for an examination of this process's determinants and trajectories (Temple et al. 2018). Innovation is also the result of a system of actors and knowledge, whose 'project' is more or less explicit (Hall et al. 2003; Klerkx et al. 2010; Touzard et al. 2015). Finally, innovation is also the driver of transformations of territories and socio-technical and socio-ecological systems (Allaire and Daviron 2019).

Because of this triple meaning, innovation marks the border between different agricultural or food models, and, in doing so, helps define them. In addition, it transforms the conditions of coexistence and confrontation of agricultural and food

models by impacting the four constituent elements of ‘situations of coexistence’: the actors or systems, their interactions, the specific objects concerned and the setting under consideration. Indeed, innovation in agriculture and food systems, as in other sectors, is never neutral as regards its rationales (productivity, well-being, environment, equity, justice, etc.), its forms and its impacts on territorial development (Torre and Wallet 2013). As a result, innovation gives rise to socio-technical controversies and induces differentiated impacts and arrangements between actors which presage development models (Akrich et al. 2002). Through the paths it takes (which actors involved, what knowledge, which socio-technical and socio-ecological paradigms, which challenges targeted?), innovation helps determine a desired future and principles of action (Coudel et al. 2013). In agriculture and food systems, innovations reflect the specific relationships of actors and of agricultural and food activities with nature, space and societies (Touzard 2018). Thus, they determine and, at the same time, depend on a specific development model, for example a ‘high tech’ farming trajectory or an agroecological orientation (Bonny 2017), and thus configure ‘situations of coexistence’ accordingly.

Consequently, innovations are part of socio-technical regimes which differentiate agricultural research and advisory systems (Vanloqueren and Baret 2009). The debates then shift to innovation’s several dimensions: the nature of the innovations, their purposes, the priority issues to which they are intended to respond, the target actors, the conditions for the emergence and support of innovation and, finally, the modalities of scaling up (Wigboldus et al. 2016). As an illustration, two regimes of innovation in plant genetics have emerged since the Second World War, closely tied to contradictory agricultural and food models (Bonneuil et al. 2006). The first—sectoral, industrial, oligopolistic, linear, integrated and based on the paradigm of the fixed variety—serves a ‘modernizing’ and productivist development model largely backed by mechanization, the use of fertilizers and phytosanitary products, and by food standardization. The second—territorialized, polycentric and participatory—values intravarietal genetic heterogeneity suitable for local ecological and social conditions. It forms part of an economy of quality (Allaire and Daviron 2019) based on the differentiation of products and the leveraging of different qualities (organic farming, geographical indications, reserved industrial varieties, ‘peasant seeds’, etc.). The opposition between these two regimes of varietal innovation structures communities of actors who recognize affinities or oppositions, around models of agricultural and food development which bring together a set of common values and principles of action.

The failures of and crises of confidence in the agroindustrial model have engendered a positive requalification of many innovations as solutions, albeit partial. Thus, starting in the 1990s, alternative food systems began to be developed around innovations which defined these systems, with these innovations marking these system’s differences with other food systems: geographical indications, organic farming, fair trade, short supply chains, urban farming and etc. (Le Velly 2017). While they are in opposition to the conventional food system, the alternative/conventional binary oppositions quickly show their limitations.⁹ In fact, systems are often hybrid in character, for example

⁹ The concept of ‘alternative’ lacks stability and pits in particular the proponents of structuralism against those of agency. It refers to the existence of a social movement engaged in a political conflict (Pelenc et al. 2019) or in demands for justice, to actors’ projects (Le Velly 2017), to niches of innovation on the fringes of the socio-technical system inherited from history, to weak institutionalization, to marginality (social, economic, spatial, etc.) and etc.

due to the ‘conventionalization’ of organic farming or the ‘mainstreaming’ of fair trade. There exist a diverse range of expressions of organic farming, fair trade or short supply chains, necessitating a detailed look at these forms, especially when it comes to assessing their impacts. Indeed, innovations are often intended to respond to certain environmental, social, health or economic limitations of the systems already in place (problem-solving), but often induce negative side effects themselves (social and economic exclusions, damage to the environment or health, etc.). The impacts of innovations therefore imply that it is necessary to politicize their implementation with regard to the risks they may cause (Beck 2001), the purposes they serve (in particular questioning the notions of growth, progress and trade-offs often necessary between economic and environmental issues) and the choice of target actors (creditworthy vs. non-creditworthy, entrepreneurs vs. vulnerable populations, etc.) (Leach et al. 2012).

There are thus two ways to think about innovation in situations of coexistence of agricultural and food models. The first considers that agricultural and food innovations emerge during socio-technical transitions. Several analytical scales have to be examined, in particular that of the niche in which an innovation appears and that of the socio-technical system in which a sector’s operating regime is institutionalized, whether integrating these innovations or not (approach presented in the “Adaptation: necessity as well as project of coexistence” section). The second envisages innovation as a fact inscribed in the territory conceived as a geographic space that is appropriated, organized, managed, lived in and represented by a social group. Furthermore, innovation can be territorial or social. Territorial innovation is concerned, on the one hand, with innovative territories and, on the other, with the territorialisation of innovations (Giraut 2009; Soulard et al. 2018). It concerns new spatial forms (for example, with regard to centre-periphery relationships or interstitial spaces), the emergence of coordination between heterogeneous actors and new tangible and symbolic relationships to places (for example, in the activation of territorial resources and localized production systems). Social innovation, for its part, has three different acceptations in the literature. It can be defined as a process of social change (a transformation of the established order), a new social practice or as an innovation that concerns categories of actors forming a tiny, often marginalized, minority (Chiffolleau and Paturel 2018). Consequently, social and territorial innovations raise the question of the respective places accorded to the various agricultural and food models, and therefore of their coexistence in society and within a territory, in a criticism of technical and productivist progress and with particular attention to actors in situations of social, economic, political and spatial marginality.

This review of knowledge on innovation in situations of coexistence of agricultural and food models at the territorial scale leads us to propose two hypotheses little covered in the literature, requiring testing in future research, and to raise associated questions:

Innovation modifies the conditions of coexistence of agricultural and food models at the territorial scale. Innovation, whether radical, systemic and/or disruptive, exhibits continuity with the old, in a tension between continuity and discontinuity.¹⁰ So how do

¹⁰ Radical, systemic and disruptive innovations necessarily maintain continuity with the old not only in terms of the structures inherited from history (pertaining to land, organizations, markets, public policies, etc.), but also because of the socio-technical and socio-economic interactions that result between disruptive innovation and its social, economic and technical environment.

tradition and innovation coexist, for example in appellations of origin and protected geographical indications? Innovation knows how to remain silent, whether it is ‘discreet’ (Albaladejo 2004) but in a certain conformity with the dominant regime, or ‘ordinary’ (Alter 2000) but transgressive of social norms. Thus, innovation produces bond, emancipation and empowerment, for example in short supply chains or peri-urban land arrangements, as well as exclusion and eviction. As a result, does innovation mark the divide between development models or, on the contrary, does it reconcile oppositions that were believed to be irreconcilable?

The configurations of coexistence of agricultural and food models encourage innovation. Are economic competition or cooperation drivers of innovation, and under what conditions? Are not the conflicting interactions between actors who advocate different models sometimes favourable to innovation? How to overcome the blocking of innovations in situations in which the dominant model imposes its socio-technical regime (Plumecocq et al. 2018)? How to prevent, during scaling up, certain innovations from ‘conventionalizing’ and diluting their ‘promise of making a difference’ (Le Velly 2017) by abandoning certain attributes of their initial proposals?

Thus, research on the coexistence of agricultural and food models renews the understanding of the motivations, obstacles, modalities, targets, challenges and impacts of innovations. In particular, there appears new potential for innovation, for example by hybridizing new elements originating from different models. It then becomes necessary to open up a debate about the territorial development aims inherent in the innovations being promoted by different agricultural and food models.

Adaptation: necessity as well as project of coexistence

The third dimension of analysis of the coexistence of agricultural and food models concerns adaptation. Indeed, the transformations and upheavals of recent decades have only confirmed perceptions of uncertainty in the face of increasing variability and unpredictability (Grossetti 2004) of climatic conditions, market behaviour and even of public policies. Our contemporary history is marked by many sudden, major and unpredictable crises that have put humankind, its activities and its social and environmental structures to the test (Chalas et al. 2009). These crises have concerned food availability (2007–2008), health (AIDS, COVID-19, etc.), financial markets (2007–2009), politics, nuclear energy (Chernobyl, Fukushima, etc.), geopolitical flashpoints (India-Pakistan, North Korea, etc.), climate (hurricanes, droughts, floods, etc.) and etc. Even though some of these crises can be considered global because they concern the entire planet, they have differentiated territorial expressions. Thus, certain world regions and their residents face major uncertainties which condition their practices and decisions, sometimes even their survival. For example, coffee farmers in western Guatemala, exposed to climatic and phytosanitary hazards, grow a perennial crop (planted for 25 years) in a context of high volatility in coffee prices since the collapse of the International Coffee Agreement in 1989, and suffer from continued political instability (36 years of civil war until 1996, public corruption now) and major social tensions (high crime levels, smuggling and drug trafficking) (Bathfield et al. 2013). In these conditions, the adaptability of farmers and territories is as much a necessity as a project (Gasselin et al. 2013).

It is a necessity because the finiteness of exhaustible resources, especially of biophysical ones, reminds us that ‘the world is finite’, in the sense of a closed and controlled space, and above all dominated by humankind (Reghezza-Zitt 2015). Sustainable development, according to the main studies on it, aims at a combination of ecological, socio-economic and territorial performances (in the sense of the results of action) or capacities (in the sense of the means to act) of a system under consideration (the company, the city, the territory, etc.), coupled with a moral responsibility towards future generations (Godard 2005; Villalba 2017). And yet, these scientific and development-engineering studies poorly integrate the capacities of adaptation of the diversity of agricultural and food systems. The competition and complementarities between these systems, at the core of their ‘situations of coexistence’, have not been sufficiently considered factors that determine capacities of adaptation, and thus as major factors of sustainable development.

Adaptability is also a project, because while it is certain that there will be major demographic, climatic, energy, health and environmental changes, we cannot predict them with any precision. The system will have to adapt to these changes, whether by maintaining its coherence, reshaping itself, learning, absorbing shocks or creating new opportunities. A system’s ability to maintain itself in an uncertain context, and therefore to endure, necessarily implies a dimension of adaptability (Ancy et al. 2013). However, this adaptability remains poorly documented in studies to assess the sustainability of farms, activity systems and territories, even though some authors have focused on it (Lairez et al. 2016; López-Ridaura et al. 2005; Vigne et al. 2017; Zaccai and Zuindeau 2010; Zahm et al. 2019), in particular in relation to climate change. Furthermore, the capacity to adapt is the emerging property of certain configurations of coexistence of agricultural and food models, for example when it comes to ensuring a city’s or a nation’s food supply by combining long and short supply chains.

Therefore, adaptation is no longer just a matter of ‘dealing with’ hazards, but also, at the same time, of ‘acting upon’ our practices and societies. The modalities of adaptation implemented or advocated are therefore actual choices of development models (Thérond et al. 2017). Under these conditions, any analysis of the adaptation of agricultural and food systems and of territories has to consider it according to three dimensions: It is a process (which refers to the study of the trajectories of evolution of systems), a property (as the ability of adaptation of agricultural and food models) and, finally, the result of transformations. We present below various ways of adaptation (diversification, complementarity, differentiation) or even hybridization implemented in situations of coexistence of territorial agricultural and food models.

At the farm level, Darnhofer et al. (2010) highlight three types of strategies for developing the adaptive capacity of farms, in particular in forms of collective action: continuous experimentation and analysis of results, flexibility in the organization of activities and diversification to spread out risks. Pinto-Correia and Godinho (2013) use the example of Montado (Portugal) to show that by combining production, consumption and protection, land managers contribute to landscape multifunctionality and the resilience of traditional farms by integrating newcomers and new forms of organization (advances in digital technology, distant urban markets, etc.). As for rural territories, Torre and Wallet (2016) envisage three types of innovation profiles: experimentation and exploration of organizational forms based on local involvement and new technologies, differentiation based on the leveraging of local resources and the development of

integrated projects and complementarity with other territories in the form of cooperation that helps build capacities of adaptation. Thus, these studies show that diversification (of resources, products, production and marketing methods, functions, etc.) and complementarity between production systems and territories are favourable to capacities of adaptation and constitute a lever for territorial development (Lardon et al. 2017).

One modality of differentiation is the case of nested markets which develop away from mass markets managed by multinationals ('empires'). They translate 'the concrete possibilities to counter distance with proximity, artifice with freshness, anonymity with identity and genuineness, standardization with diversity, and inequality with fairness' (van der Ploeg et al. 2012). In this way, the actors transform the conditions of competition by developing voluntary standards and entering into contractual arrangements, for example in organic farming, short supply chains in the countries of the Global North, and fair trade.

Another route to adaptation is hybridization. We consider it here as a process of creating a new form of organization by combining various elements inherited from different types of previous organizations. Hybridization is then not only a factor of adaptation, but also the result of an adaptation process and an innovation process (see the "[Innovation: seed and fruit of coexistence](#)" section). For example, some farmers combine mixed marketing strategies in the conventional long supply chains and in the local and alternative agri-chains (Filippini et al. 2016; Touzard et al. 2016). Hybridization takes place via the hybrid nature of some of the actors themselves who invent their own strategies to respond to challenges and who become part of innovation and learning processes. These actors play a pivotal role in collective action and contribute to territorial development (Amblard et al. 2018) by articulating scales and models (Houdart et al. 2019). This implies paying attention to these hybrid actors and to boundary objects (Trompette and Vinck 2009) in order to articulate the processes from the local level to the global level, in an overall coherence.

This review of knowledge on adaptation in situations of coexistence of agricultural and food models at the territorial scale reveals several favourable processes and strategies (diversification, complementarity, differentiation, hybridization). However, these studies rarely raise the question of scales or those of asymmetries (of resources, incomes, etc.). This leads us to formulate the following two hypotheses, little covered in the literature, and to raise associated questions:

The coexistence of agricultural and food models imparts capacities of adaptation to territories and the systems that compose them because of their interactions. These interactions (cooperation, competition, hybridization, etc.) are only favourable to adaptation under certain conditions: There have to be territorial resources, innovation systems, local institutional and organizational dynamics and etc. Therefore, what are the interactions between agricultural and food models (cooperation, competition, co-evolution, etc.)? How do they transform themselves? Under what conditions does the coexistence of agricultural and food models favour the sustainable and resilient transformation of territories?

Capacities of adaptation vary at different spatial and temporal scales. There is a different combination of issues at different scales, ranging from the local to the global, and a different combination of actors, activities and spaces. What are the socio-spatial configurations of these adaptive processes? How do they relate to local and global

scales? In the end, how can public policies and territorial actors support these processes in order to facilitate the desired adaptation trajectories?

An examination of the links between adaptive processes and the concrete modalities of the coexistence of agricultural and food models can shed light on the trajectories of territorial development and the conditions conducive to the sustainability of agricultural and food systems.

Transition: origin and permanence of coexistence

The final dimension of analysis of the coexistence of agricultural and food models concerns transitions to sustainability. Studies on these transition processes proliferated in the 2010s as a new way of understanding the dynamics of socio-economic and environmental change (Lawhon and Murphy 2012). Transition theories have been applied more recently to the processes of transformation of production, processing and agricultural and food marketing systems, and to the reconfiguration of interactions between actors of these food systems (Hinrichs 2014). In general, these studies not only describe the processes and trajectories of transition to sustainability, but also, in particular, examine their implementation modalities (Hölscher et al. 2018). The question of ‘what has to be done’ has thus led several authors to present the transformation process as the result of the simultaneous appearance of multiple changes converging at different levels and in different societal sectors (technology, economics, institutions and standards, culture, etc.). The work of Geels and Schot (2007) on the transition of socio-technical systems is considered seminal and is often mobilized by researchers in transition studies. For these authors, transitions result from the interactions between several levels (hence the term multi-level perspective, MLP): the *socio-technical landscape*, which encompasses the environment in which society exists; a stable *socio-technical regime* made up of interdependent rules, practices and actors that guide or constrain the actions of operators; and *niches*, which are spaces where more radical innovations are devised. The transition from one socio-technical regime to another is posited to be the result of pressures exerted by the landscape on the regime or of the gradual incorporation into the regime of radical innovations (new rules, new practices). In this approach, niches, considered places of innovation (see the “[Innovation: seed and fruit of coexistence](#)” section), are understood as incubation spaces (Geels 2002) as well as places for learning and for building new economic networks; they are intended to host the construction and consolidation of alternative systems (Meynard et al. 2013). In the visual representation of the socio-technical transition of Geels and Schot (2007), niches gradually tend to absorb the dominant regime by changing its different dimensions (standards, actors, knowledge, etc.). This representation underscores the transformative nature of these innovations, or lack thereof, vis-à-vis a dominant model.

Several studies today use the MLP framework to go beyond the analysis of technological transitions. These new contributions show the benefits of approaching food system transitions through a plurality of complementary objects and themes explicitly included in sustainability issues: global challenges (Hinrichs 2014; Spaargaren et al. 2013), agroecological transition (Bui et al. 2016; Ingram 2015; Lamine 2012; Levidow 2015) and sustainable consumption transition (Van Gasteren et al. 2015; Vittersø and Tangeland 2015). In these studies, there is very often an

implicitness about the presence of two well-stabilized regimes (usually the conventional and the alternative) which coexist in the same place, without explicating either the diversity of situations, nor their specificities (variations) with regard to geographic conditions or their territorial roots. Indeed, MLP often relies on a single dominant regime, which calls into question the modalities of apprehending the coexistence of several socio-technical regimes in the same context. Some studies, however, do address the multiplicity of possible and existing trajectories for the transition of systems to sustainability, suggesting a plurality of possible models and their coexistence (Dumont et al. 2020). El Bilali et al. (2018) show, for example, that different transition pathways are proposed or implemented in pursuit of food and nutrition security. They identify trajectories geared towards efficiency (sustainable intensification), those geared towards restricting demand (constrained demand or sustainable diets) or even those of an in-depth transformation of the entire food system (agro-food transition). According to these authors, these different trajectories translate different visions of what is desirable or achievable in terms of practices, visions that are based on fundamentally different, even opposing, models, ideologies and values. By stating that ‘Food system transitions thus do not have one easy, obvious, or uncontested pathway but will be characterized by a diversity of options, approaches, places, voices, and historical contexts’ (El Bilali et al. 2018:13), they indirectly highlight the issues of the coexistence of different approaches, their specificities, their pluralities according to the contexts in which they are placed and, indeed, the challenges of governing the coexistence of these different models and trajectories (Bui 2015; Bui et al. 2016).

Thus, despite the significant advances in MLP-based research, some authors (Lawhon and Murphy 2012; Murphy 2015) make a number of criticisms, among which is the focus accorded to technological artefacts in MLP studies or to certain categories of actors who shape transitions (leaders, innovators, scientists, government agents) to the detriment of consumers or workers, for example. The spatial-dimensions approach to transitions towards sustainability (scales, places and spatialities) is also considered ‘naïve’ since it avoids any analysis of power games between actors. In this sense, these authors suggest that the modalities of the actors’ interaction and spaces concerned by the transition processes are little addressed.

The geographic dimension has indeed long remained ambiguous, even poorly understood, in MLP analyses. Levels (niche, regime and landscape) are often implicitly confused with specific territorial boundaries (Raven et al. 2012; Truffer et al. 2015): Regimes tend to be presented as national characteristics; the dynamics associated with the socio-technical landscape as those of international scales; and niches are often equated to sub-national, even local, scales. Taking national contexts into account as key elements in which regimes and niches are found, while important, does not lead to an understanding of the territorial differentiations and the complex interdependencies that result from the different forms of institutional embeddedness within territories (Lawhon and Murphy 2012: 362). For their part, Coenen et al. (2012) note that it is essential to take a closer look at the socio-spatial struggles that cause a regime or a niche to scale up beyond its initial boundaries. In the same perspective, the issue of the articulation of scales (relationships and interdependence between actors located at different scales, dissemination of models, transnational networks) is little addressed in efforts to understand how they trigger or prevent transitions of socio-technical regimes. According to Lawhon and Murphy (2012), MLP would benefit from becoming not only more

sensitive to the role of geographical factors, but also ‘more responsible’ by recognizing that ‘power relations’ are a very important factor in orienting or slowing down the dynamics of transition.

All of these criticisms have recently led to the emergence of a body of work in the geography of sustainability transitions (Hansen and Coenen 2015; Longhurst 2015; Murphy 2015; Raven et al. 2012; Truffer et al. 2015). These studies seem to refer only implicitly to the issue of the coexistence of models. It is an emerging field in which research on the geographic dimension of transitions is focusing on three key elements (Truffer et al. 2015): (i) the socio-spatial anchoring of transitions; (ii) taking multi-scalarity into account; and (iii) power relations. The socio-spatial anchoring of transitions aims to identify the territorial conditions that are favourable, and those that are not, to transition processes. This includes determining the transition’s territorial inequalities (which spaces are favoured and which not). Then, taking multi-scalarity into account allows one to see how innovations emerge in different spaces, how these spaces interconnect and how actors located at several scales interact to disseminate these innovations. Finally, these two elements lead to a third, which pertains to unequal power relations in transition processes. According to these authors, the effects associated with transitions must be considered, either from losers and winners, from models, from voices or from interests and their actors, i.e. from the modalities of coexistence of different models resulting from these transitions.

From these contributions on transition processes in situations of coexistence of agricultural and food models at the territorial scale, we propose two hypotheses, little covered in the literature, to be tested in future research, and raise associated questions:

On the one hand, *the coexistence of agricultural and food models can be a prerequisite as well as the result of the dynamics of transition at work in food systems*. What factors trigger these transitions? What type of relationships between the actors drives or hinders these transitions? What territorial conditions stimulate or stifle these processes? What are the proclaimed goals and trajectories of the different agricultural and food models that coexist? How do their paradigms, values and norms diverge?

On the other hand, *the coexistence of models can be understood and governed at the territorial level*. Indeed, the transition processes differ according to territories, their scales, their social and spatial configurations and their trajectories. What are the effects of transitions on the conditions of interaction between the agricultural and food systems within a territory? What new forms of coexistence are produced and at what scales? What actors do they bring together and what is the nature of these actors’ links and/or interactions (passive co-presence, tensions, synergy, complementarity, etc.)? What are the forms of public action, governance and support that make it possible to engage a diversity of actors and systems towards the same goal of territorial development, while respecting the uniqueness of each?

A detailed documentation of the links between transition processes and concrete modalities of the coexistence of agricultural and food models can shed light on the existence or emergence of territorial development models.

Discussion: functionalist coexistence, based on power relations or on a transition perspective

Territories are the matrix and product of new forms of agriculture and food systems, some of which are presented as models, whether they are analytical archetypes, desired

futures or even standards for action. Analysing agriculture in the context of the new food challenges amounts to calling development models into question and considering the coexistence of these models (Hervieu and Purseigle 2015). Indeed, these agricultural and food alternatives emerge and assert themselves as responses to environmental, health, nutritional, economic and social criticisms of a long legacy of productivist growth and strong urbanization. It is therefore not enough to categorize or even compare and support these technical, organizational and institutional innovations as so many independent and juxtaposed figures. In pursuit of territorial development, it is essential to analyse and manage the conditions of coexistence between these agricultural and food models, where coexistence is conceived as configurations not only of competition, confrontation and power relations, but also of co-presence, co-evolution, complementarities, synergies and sometimes even hybridizations. An improved taking into account of the coexistence of agricultural and food models, and in so doing of their interactions at different spatial and organizational scales, favours the recognition and support of combinations potentially beneficial to territorial development.

To this end, we propose a framework for analysing the coexistence of agricultural and food models that is structured around four dimensions: (i) specialization and diversification, (ii) innovation, (iii) adaptation and (iv) transition. Each of these dimensions makes it possible to take a fresh look at agricultural and food transformations, thus constituting a research agenda. To be able to analyse specialization/diversification processes, it is imperative to articulate the scales (time, space and actor organizations) of the agricultural and food models, and, in doing so, to study the relationships between the territory and the scales that encompass it (region, nation, world). It is a matter also of examining the agricultural and food models' relations of domination, even hegemony, and of marginality. Detailed investigation of the innovation processes at work in the interactions between agricultural and food models leads to original insights into territorial and social innovations, and reveals fruitful hybridizations of innovations or, on the contrary, roadblocks to them. Examining the adaptive capacity of agricultural and food systems amounts to analysing the interactions, complementarities or competitions between forms of organization and the ways of combining them, or even of hybridizing them at a territorial scale. But these hybridizations are also sometimes the expression of a 'conventionalization' (Guthman 2004) of innovation niches (see the "[Transition: origin and permanence of coexistence](#)" section) due to the dilution of the actors' initial principles (a process of 'mainstreaming') and of the innovation's original aims. In such cases, hybridizations are implemented for the benefit of actors in positions of power who capture the rents from innovations created by pioneers who are often in a situation of social, economic, territorial and political marginality. It is therefore necessary to maintain a critical eye on the modalities of emergence and functioning of these hybridizations. Forms of political, socio-professional and civic regulation are therefore essential to inform controversies, manage conflicts and preserve the goals of sustainability, ethics and equity. Finally, examining transitions in terms of the coexistence of agricultural and food models that are being institutionalized in science, the political sphere, the market and society (Albaladejo 2009, 2016) allows us to envisage multiple configurations in which various models coexist in a territory, without one suppressing another.

The Format seminars and this literature review have led to the emergence of three transversal issues that underpin territorial development strategies and contrasting epistemological postures in the analysis of situations of coexistence:

- The first family of studies examines the functional complementarities between systems and the properties that result from these interactions. It is a matter, for example, of examining how interactions between agricultural models optimize heterogeneous resources, in particular in territories in which the environmental, planning and social organization conditions vary. Other studies explore how hybridizations between agricultural models contribute to an increase in the number of innovation cores and are—or are not—favourable to sustainable development. Interactions between agricultural models can also build up agricultural systems' adaptation abilities and make territories more resilient, for example in their food supply capacities. In this family of studies, the researcher pursues a functional and systemic analysis of the situations of coexistence of agricultural and food models.
- The second family of studies examines the power relations between actors and the conditions conducive to good governance of a diversity of agricultural and food models. These studies then assess the effects of domination or endeavour to rehabilitate silenced identities and fight against marginalization. They aim to denounce and resolve situations of exclusion through criticisms of power relations (economic, political and social). Here, the researcher adopts a critical approach to situations of coexistence of agricultural and food models.
- And finally, the third family of studies views coexistence as a situation of transition of agricultural or food models. In such studies, the analysis pertains to the trajectories of change that have to be planned and managed. The challenges are then to describe and support changes that are more or less radical (as opposed to adaptative), more or less selective (as opposed to inclusive) and more or less specialized (as opposed to diversified). This type of study examines the management of transitions and the conditions conducive to their good governance. In this family of studies, the researcher endeavours, in most cases, to contribute to the transformations of situations of coexistence of agricultural and food models in partnership with the actors involved.

These three families of studies are complementary in the research agenda that we propose, even if each researcher individually may prefer to position himself in one of them on the basis of the unique relationship that he may have with the actors, action and knowledge.

Addressing these new questions poses methodological challenges. Any analysis of a 'situation of coexistence' of agricultural and/or food models, as defined in this article's introduction, is predicated on determining the actors and/or systems, the nature of interactions, the objects and the 'setting' under consideration. This exercise is necessary to define not only the scales envisaged, but also the disciplines which will be best equipped to answer the questions raised. The ambition to formulate a framework for analysing situations of coexistence of territorial agricultural and food models led us to formulate generic hypotheses. Therefore, they have to be fine-tuned and adapted to the contexts and issues of the proposed fields of study. Subsequently, it is imperative to examine dispassionately each of the agricultural and food models present, something

that many researches find hard to do since they are focused on a single model. Finally, the coexistence of agricultural and food models inevitably brings with it controversies in which different actors ally or oppose each other to legitimize their own choices and often discredit those of others. The characterization and analysis of these controversies are therefore essential to recognize not only what makes a model coherent, but also its divergences and the conditions of interaction with others.

Conclusion

In this article, we undertake a bibliographic review to show that even though the coexistence of agricultural and food models at the territorial scale is addressed in the scientific literature, it has never been theorized as such. We propose a framework for analysing situations of coexistence based on four dimensions (specialization/diversification, innovation, adaptation, transition) with the goal of taking a fresh look at agricultural and food development in rural and urban territories.¹¹

Designing and supporting territorial development by taking the coexistence of agricultural and food models into account reveal new levers of action: favouring complementarity between specialization and diversification at various spatial and organizational scales; combining innovation and the tangible and intangible heritage specific to the various agricultural and food models; building up the capacity to adapt in the complementarity of agricultural and food models; and undertaking a transition to new territorial development configurations. But the coexistence of agricultural and food models also poses the challenge of inventing new modalities of governing territorial development and of building new skills.

Taking the coexistence of agricultural and food models into account amounts to thinking of the place of every individual and of modalities of living together in the territory concerned. It is matter therefore of thinking of development priorities defined by values (ethics, in particular with regard to future generations, and equity, in particular in terms of social, economic and spatial justice) and sustainable-development objectives (peace, food sovereignty, climate change, employment, etc.). The governance of the coexistence of agricultural and food models requires innovations and learning to promote functional complementarities between systems, to come up with innovations conducive to sustainable development, to transcend the disparities of the actors' projects in order to facilitate living together, to rein in the effects of domination and to rehabilitate silent identities and fight against marginalization. Through this article, we place these preoccupations on the research agenda.

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¹¹ A first test of this analytical framework is presented in a book based on the work done during the Format seminars: 'Combinaison des formes d'agricultures et des systèmes alimentaires à différentes échelles territoriales: coexistence, confrontation ou hybridation des modèles?' (Gasselin et al. 2020, forthcoming).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

- Agrimonde (Ed.). (2009). *Agricultures et alimentation du monde en 2050: scénarios et défis pour un développement durable. Note de synthèse (February 2009)*. Paris: Inra - Cirad.
- Akrich, M., Callon, M., Latour, B., & Monaghan, A. (2002). The key to success in innovation part I: the art of intersement. *International Journal of Innovation Management*, 6(2), 187–206.
- Albaladejo, C. (2004). Innovations discrètes et re-territorialisation de l’activité agricole en Argentine, au Brésil et en France. In: Albaladejo, C. & Busto Cara (eds), *Développement local et multifonctionnalité des territoires ruraux en Argentine* (pp. 413–456). Argentina: UNS Departamento de Geografía / IRD UR102 / INRA SAD / Univ. Toulouse Le Mirail UMR Dynamiques Rurales.
- Albaladejo, C. (2009). Médiations territoriales locales et développement rural: vers de nouvelles compétences d’accompagnement de l’activité agricole. Les agricultures familiales dans les transformations territoriales en Argentine, au Brésil et en France. Mémoire d’Habilitation à Diriger des Recherches, Université de Toulouse, Toulouse.
- Albaladejo, C. (2016). Coexistencia en el territorio de diferentes modelos de desarrollo agropecuario: la teoría de los pactos territoriales aplicada al caso argentino. In D. Nieto, P. Carricart, C. Albaladejo, & A. L. de Carvalho Fiúza (Eds.), *Transformaciones Territoriales y la Actividad Agropecuaria. Tendencias globales y emergentes locales* (pp. 27–52). La Plata: National University of La Plata.
- Allaire, G., & Daron, B. (2019). *Ecology, capitalism and the new agricultural economy: the second great transformation*. New York: Routledge.
- Alter, N. (2000). *L’innovation ordinaire. Collection « Sociologies »*. Paris: Presses Universitaires de France.
- Amblard, L., Berthomé, K., Houdart, M., & Lardon, S. (2018). L’action collective dans les territoires. Questions structurantes et fronts de recherche. *Géographie, Économie, Société*, 20(2), 227–246.
- Ancey, V., Avelange, I. & Dedieu, B. (eds) (2013). *Agir en situation d’incertitude en agriculture: regards pluridisciplinaires au Nord et au Sud*. Brussels PIE-Peter Lang.
- Antoine, A. (Ed.). (2016). *Agricultural specialisation and rural patterns of development*. Turnhout: Brepols Publishers.
- Bathfield, B., Gasselin, P., López-Ridaura, S., & Vandame, R. (2013). A flexibility framework to understand the adaptation of small coffee and honey producers facing market shocks. *The Geographical Journal*, 179(4), 356–368.
- Beck, U. (2001). *La société du risque. Sur la voie d’une autre modernité*. Paris: Aubier.
- Bijker, W. E. (1997). *Of bicycles, bakelites, and bulbs: toward a theory of sociotechnical change*. Cambridge: The MIT Press.
- Bonneuil, C., Demeulenaere, E., Thomas, F., Joly, P.-B., Allaire, G. & Goldringer, I. (2006). Innover autrement? La recherche face à l’avènement d’un nouveau régime de production et de régulation des savoirs en génétique végétale. In: Gasselin, P. & Clément, O. (eds) Séminaire INRA - Confédération Paysanne « Quelles variétés et semences pour des agricultures paysannes durables? », Angers, 11–13 May 2005, 2006. INRA, pp. 29–51.
- Bonny, S. (2017). High-tech agriculture or agroecology for tomorrow’s agriculture? *Harvard College Review of Environment & Society*, 4(Spring 2017), 28–34.
- Bui, S. (2015). Pour une approche territoriale des transitions écologiques. Analyse de la transition vers l’agroécologie dans la Biovallée. Mémoire présenté en vue de l’obtention du grade de docteur délivré par L’Institut des Sciences et Industries du Vivant et de l’Environnement (AgroParisTech). Spécialité: sciences sociales, AgroParisTech, Paris.
- Bui, S., Cardona, A., Lamine, C., & Cerf, M. (2016). Sustainability transitions: insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. *Journal of Rural Studies*, 48, 92–103.

- Byerlee, D., Stevenson, J., & Villoria, N. (2014). Does intensification slow crop land expansion or encourage deforestation? *Global Food Security*, 3(2), 92–98.
- Chalas, Y., Gilbert, C., & Vinck, D. (2009). *Comment les acteurs s'arrangent avec l'incertitude. Collection « Etudes de sciences »*. Paris: Editions Des Archives Contemporaines.
- Chiffolleau, Y., & Paturel, D. (2018). Social innovation through short food supply chains: between networks and individualities (Chapter 5). In G. Faure, Y. Chiffolleau, F. Goulet, L. Temple, & J.-M. Touzard (Eds.), *Innovation and development in agricultural and food systems (pp. Unpaginated)*. Versailles: Editions Quae.
- Coenen, L., Benneworth, P., & Truffer, B. (2012). Toward a spatial perspective on sustainability transitions. *Research policy*, 41(6), 968–979.
- Coudel, E., Devautour, H., Soulard, C.-T., Faure, G., & Hubert, B. (2013). *Renewing innovation systems in agriculture and food: how to go towards more sustainability?* Wageningen: Wageningen Academic Publishers.
- Damhofer, I., Bellon, S., Dedieu, B., & Milestad, R. (2010). Adaptiveness to enhance the sustainability of farming systems. A review. *Agronomy for Sustainable Development*, 30(3), 545–555.
- de Roest, K., Ferrari, P., & Knickel, K. (2018). Specialisation and economies of scale or diversification and economies of scope? Assessing different agricultural development pathways. *Journal of Rural Studies*, 59, 222–231.
- Dumont, A., Gasselin, P., & Baret, P. (2020). Transitions in agriculture: three frameworks highlighting coexistence between a new agroecological configuration and an old, organic and conventional configuration of vegetable production in Wallonia (Belgium). *Geoforum*, 108, 98–109.
- El Bilali, H., Callenius, C., Strassner, C., & Probst, L. (2018). Food and nutrition security and sustainability transitions in food systems. *Food and Energy Security*, 8(2), 1–20.
- Faure, G., Chiffolleau, Y., Goulet, F., Temple, L., & Touzard, J.-M. (Eds.). (2018). *Innovation and development in agricultural and food systems*. Paris: Éditions Quae.
- Filippini, R., Marraccini, E., Houdart, M., Bonari, E., & Lardon, S. (2016). Food production for the city: hybridization of farmers' strategies between alternative and conventional food chains. *Agroecology and Sustainable Food Systems*, 40(10), 1058–1084.
- Fischer, J., Abson, D. J., Butsic, V., Chappell, M. J., Ekroos, J., Hanspach, J., et al. (2014). Land sparing versus land sharing: moving forward. *Conservation Letters*, 7(3), 149–157.
- Gasselin, P. (2019). Transformation of French family farming: from diversity study to coexistence analysis of agricultural models (working paper). *The Natural Resource Economics Review*, (March 2019):61–73.
- Gasselin, P., Cloquell, S., & Mosciaro, M. (Eds.). (2013). *Adaptaciones y transformaciones de las agriculturas pampeanas a inicios del siglo XXI*. Buenos Aires: Ediciones Ciccus.
- Gasselin, P., Lardon, S., Cerdan, C., Loudiyi, S., & Sautier, D. (eds) (2020, forthcoming). *Coexistence et confrontation des modèles agricoles et alimentaires: un nouveau paradigme du développement territorial?* Versailles: éditions Quae.
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, 31(8), 1257–1274.
- Geels, F. W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, 39(4), 495–510.
- Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399–417.
- Giraut, F. (2009). Innovation and territories: the contradictory effects of marginality. *Journal of Alpine Research*, 97(1), 6–10.
- Gisclard, M., & Allaire, G. (2012). L'institutionnalisation de l'agriculture familiale en Argentine: vers la reformulation d'un référentiel de développement rural. *Autrepart*, 3, 201–216.
- Godard, O. (2005). Le développement-durable, une chimère, une mystification? *Mouvements*, 4, 14–23.
- Goodman, D. (2003). The quality 'turn' and alternative food practices: reflections and agenda. *Journal of Rural Studies*, 19(1), 1–7.
- Green, R. E., Cornell, S. J., Scharlemann, J. P., & Balmford, A. (2005). Farming and the fate of wild nature. *Science*, 307(5709), 550–555.
- Grossetti, M. (2004). *Sociologie de l'imprévisible. Dynamiques de l'activité et des formes sociales. Collection « Sociologie d'aujourd'hui »* (1st ed.). Paris: PUF.
- Guthman, J. (2004). The trouble with 'organic lite' in California: a rejoinder to the 'conventionalisation' debate. *Sociologia Ruralis*, 44(3), 301–316.
- Hall, A., Sulaiman, V. R., Clark, N., & Yoganand, B. (2003). From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research. *Agricultural Systems*, 78(2), 213–241.

- Hansen, T., & Coenen, L. (2015). The geography of sustainability transitions: review, synthesis and reflections on an emergent research field. *Environmental Innovation and Societal Transitions*, 17, 92–109.
- Hervieu, B., & Purseigle, F. (2015). The sociology of agricultural worlds: from a sociology of change to a sociology of coexistence. *Review of Agricultural and Environmental Studies*, 96(1), 59–90.
- Hinrichs, C. C. (2014). Transitions to sustainability: a change in thinking about food systems change? *Agriculture and human values*, 31(1), 143–155.
- Holling, C. S. (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems*, 4, 390–405.
- Hölscher, K., Wittmayer, J. M., & Loorbach, D. (2018). Transition versus transformation: what's the difference? *Environmental innovation and societal transitions*, 27, 1–3.
- Houdart, M., Baritoux, V., Iceri, V., Lardon, S., Le Bel, P-M, Loudiyi, S. (2019). *The drivers of territorial anchorage of food*. 59th ERSa Congress, Lyon, 27–30 August 2019.
- Ingram, J. (2015). Framing niche-regime linkage as adaptation: an analysis of learning and innovation networks for sustainable agriculture across Europe. *Journal of Rural Studies*, 40, 59–75.
- IPES-Food (ed.) (2016). *From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems*. IPES-Food. p. 96.
- Jean, B. (2008). Le développement territorial. Une discipline scientifique émergente. In G. Massicotte (Ed.), *Sciences du territoire. Perspectives québécoises* (pp. 283–313). Quebec: Presses de l'Université du Québec.
- Kayser, B. (ed) (1992). *Naissance de nouvelles campagnes*. Collection « Monde en Cours »: Editions de l'Aube/Datar.
- Klerkx, L., Aarts, N., & Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: the interactions between innovation networks and their environment. *Agricultural Systems*, 103(6), 390–400.
- Kremen, C., & Merenlender, A. (2018). Landscapes that work for biodiversity and people. *Science*, 362(6412), eaau6020.
- Lairez, J., Feschet, P., Aubin, J., Bockstaller, C., & Bouvarel, I. (2016). *Agriculture et développement durable: Guide pour l'évaluation multicritère*. Versailles: Editions Educagri - Quae.
- Lamine, C. (2012). « Changer de système »: une analyse des transitions vers l'agriculture biologique à l'échelle des systèmes agri-alimentaires territoriaux. *Terrains & Travaux*, 20(1), 139–156.
- Lardon, S., Albaladejo, C., Allain, S., Cayre, P., Gasselín, P., Lelli, L., et al. (2015). Dispositifs de recherche-formation-action pour et sur le développement agricole et territorial. In A. Torre & D. Vollet (Eds.), *Partenariats pour le développement territorial*. Collection "Update Sciences et Technologies". Versailles: Éditions Quae.
- Lardon, S., Houdart, M., Loudiyi, S., Filippini, R., & Marraccini, E. (2017). Food, an integrating element in the urban agriculture system of Pisa? In C. Perrin, C. Soulard, & E. Valette (Eds.), *Toward sustainable agricultural-urban relations: innovation, integration, governance*. Springer – Urban Agriculture Book Series.
- Lawhon, M., & Murphy, J. T. (2012). Socio-technical regimes and sustainability transitions: insights from political ecology. *Progress in Human Geography*, 36(3), 354–378.
- Le Velly, R. (2017). *Sociologie des systèmes alimentaires alternatifs. Une promesse de différence*. Collection Sciences Sociales. Paris: Presses des Mines.
- Leach, M., Rockström, J., Raskin, P., Scoones, I., Stirling, A. C., Smith, A., et al. (2012). Transforming innovation for sustainability. *Ecology and Society*, 17(2), 11.
- Levidow, L. (2015). European transitions towards a corporate-environmental food regime: agroecological incorporation or contestation? *Journal of Rural Studies*, 40, 76–89.
- Lévy, J., & Lussault, M. (2013). *Dictionnaire de géographie et de l'espace des sociétés*. Paris: Belin.
- Longhurst, N. (2015). Towards an 'alternative' geography of innovation: alternative milieu, socio-cognitive protection and sustainability experimentation. *Environmental Innovation and Societal Transitions*, 17, 183–198.
- López-Ridaura, S., Keulen, H. V., Ittersum, M. K., & Leffelaar, P. (2005). Multiscale methodological framework to derive criteria and indicators for sustainability evaluation of peasant natural resource management systems. *Environment, Development and Sustainability*, 7(1), 51–69.
- Mathieu, N. (1984). Mécanismes et limites des processus de spécialisation, diversification de l'espace rural. *Économie Rurale*, 162(1), 31–32.
- Mathieu, N. (1985). Un nouveau modèle d'analyse des transformations en cours: la diversification-spécialisation de l'espace rural français. *Économie Rurale*, 166(1), 38–44.
- McMichael, P. (2009). A food regime genealogy. *The Journal of Peasant Studies*, 36(1), 139–169.
- Mendras, H. (1967). La fin des paysans: innovations et changements dans l'agriculture française. Paris: S.E.D.E.I.S. Collection « Futuribles ».

- Meynard, J.-M., Messéan, A., Charlier, A., Farès, M., Bail, M. L., Magrini, M.-B. et al. (2013). *Freins et leviers à la diversification des cultures. Etude au niveau des exploitations agricoles et des filières. Synthèse du rapport d'étude*. Paris: INRA - Délégation à l'Expertise Scientifique, à la Prospective et aux Etudes.
- Muller, P. (1990). *Les politiques publiques (coll. « Que. sais-je? »)*. Paris: PUF.
- Murphy, J. T. (2015). Human geography and socio-technical transition studies: promising intersections. *Environmental Innovation and Societal Transitions*, 17, 73–91.
- Pelenc, J., Wallenborn, G., Milanese, J., Sébastien, L., Vastenaekels, J., Lajarthe, F., et al. (2019). Alternative and resistance movements: the two faces of sustainability transformations? *Ecological Economics*, 159, 373–378.
- Phalan, B. T. (2018). What have we learned from the land sparing-sharing model? *Sustainability*, 10(6), 1760.
- Pike, A., Rodríguez-Pose, A., & Tomaney, J. (2006). *Local and regional development*. London: Routledge.
- Pimbert, M. P. (2018). Global status of agroecology. *Economic & Political Weekly*, 53(41), 52–57.
- Pingali, P. L. (2012). Green revolution: impacts, limits, and the path ahead. *Proceedings of the National Academy of Sciences*, 109(31), 12,302–12,308.
- Pinto-Correia, T. & Godinho, S. (2013). Changing agriculture—changing landscapes: what is going on in the high valued montado. In: Ortiz-Miranda, D., Moragues-Faus, A.-M. & Arnalte-Alegre, E. (eds), *Agriculture in Mediterranean Europe: between old and new paradigms* (Vol. 19, pp. 75–90), Research in Rural Sociology and Development. Bingley (UK): Emerald Group Publishing Limited.
- Plumecocq, G., Debril, T., Duru, M., Magrini, M.-B., Sarthou, J. P., & Therond, O. (2018). The plurality of values in sustainable agriculture models: diverse lock-in and coevolution patterns. *Ecology and Society*, 23(1), 21.
- Polge, É., Torre, A. & Wallet, F. (2018). Coexistence et hybridation des modèles agricoles en Amazonie orientale. L'exemple la production laitière dans deux villages de la « commune verte » de Paragominas. *Économie Rurale*, 366(4), 41–60.
- Raven, R., Schot, J., & Berkhout, F. (2012). Space and scale in socio-technical transitions. *Environmental Innovation and Societal Transitions*, 4, 63–78.
- Reghezza-Zitt, M. (2015). De l'avènement du Monde à celui de la planète: le basculement de la société du risque à la société de l'incertitude. Mémoire d'habilitation à diriger les recherches en géographie. Volume inédit, Université Paris 1- Panthéon Sorbonne, Paris.
- Sobal, J., Khan, L. K., & Bisogni, C. (1998). A conceptual model of the food and nutrition system. *Social Science & Medicine*, 47(7), 853–863.
- Soulard, C.-T., Perrin, C., Scheromm, P., Chia, E., Clément, C., Michel, L., et al. (2018). Territorial innovation in the relationships between agriculture and the city (Chapter 7). In G. Faure, Y. Chiffolleau, F. Goulet, L. Temple, & J.-M. Touzard (Eds.), *Innovation and development in agricultural and food systems (pp. Unpaginated)*. Versailles: Editions Quae.
- Spaargaren, G., Oosterveer, P., & Loeber, A. (Eds.). (2013). *Food practices in transition: changing food consumption, retail and production in the age of reflexive modernity*. New York: Routledge.
- Suryanata, K. (2002). Diversified agriculture, land use, and agrofood networks in Hawaii. *Economic Geography*, 78(1), 71–86.
- Temple, L., Chiffolleau, Y., & Touzard, J.-M. (2018). A history of innovation and its uses in agriculture (chapter 1). In G. Faure, Y. Chiffolleau, F. Goulet, L. Temple, & J.-M. Touzard (Eds.), *Innovation and development in agricultural and food systems (pp. Unpaginated)*. Synthèses. Versailles: Editions Quae.
- Thérond, O., Duru, M., Roger-Estrade, J., & Richard, G. (2017). A new analytical framework of farming system and agriculture model diversities. A review. *Agronomy for Sustainable Development*, 37(3), 1–21.
- Torre, A. (2015). Théorie du développement territorial. *Géographie, Économie, Société*, 17(3), 273–288.
- Torre, A., & Wallet, F. (2013). Innovation and governance of rural territories. In E. Coudel, H. Devautour, C.-T. Soulard, G. Faure, & B. Hubert (Eds.), *Renewing innovation systems in agriculture and food : how to go towards more sustainability?* Wageningen: Wageningen Academic Publishers. (pp. 147–164).
- Torre, A. & Wallet, F. (2016). *Regional development in rural areas: analytical tools and public policies*. Springer Briefs in Regional Science. Switzerland: Springer.
- Touzard, J.-M. (2018). Agricultural and agrifood innovation in the 21st century: maintaining, erasing or reshaping its specificities? In G. Faure, Y. Chiffolleau, F. Goulet, L. Temple, & J.-M. Touzard (Eds.), *Innovation and development in agricultural and food systems (pp. Unpaginated)*. Synthèses. Versailles: Editions Quae.
- Touzard, J.-M., Temple, L., Faure, G., & Triomphe, B. (2015). Innovation systems and knowledge communities in the agriculture and agrifood sector: a literature review. *Journal of Innovation Economics & Management*, 2, 117–142.

- Touzard, J.-M., Chiffolleau, Y., & Maffezzoli, C. (2016). What Is local or global about wine? An attempt to objectivize a social construction. *Sustainability*, 8(5), 417.
- Trompette, P., & Vinck, D. (2009). Revisiting the notion of boundary object. *Revue d'anthropologie des connaissances*, 3(1), 3–25.
- Truffer, B., Murphy, J. T., & Raven, R. (2015). The geography of sustainability transitions: contours of an emerging theme. *Environmental Innovation and Societal Transitions*, 17, 63–72.
- van der Ploeg, J. D., van Broekhuizen, R., Brunori, G., Sonnino, R., Knickel, K., Tisenkopfs, T., et al. (2008). Towards a framework for understanding regional rural development. In J. D. van der Ploeg & T. K. Marsden (Eds.), *Unfolding webs-the dynamics of regional rural development* (pp. 1–28). Assen: Koninklijke Van Gorcum.
- van der Ploeg, J. D., Jingzhong, Y., & Schneider, S. (2012). Rural development through the construction of new, nested, markets: comparative perspectives from China, Brazil and the European Union. *Journal of Peasant Studies*, 39(1), 133–173.
- Van Gameren, V., Ruwet, C., & Bauler, T. (2015). Towards a governance of sustainable consumption transitions: how institutional factors influence emerging local food systems in Belgium. *Local Environment*, 20(8), 874–891.
- Vanloqueren, G., & Baret, P. V. (2009). How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations. *Research policy*, 38(6), 971–983.
- Vigne, M., Avadí, A., Corson, M. S., Vayssières, J., & Wassenaar, T. (2017). Chapter 32. Assessing the capacity of cropping systems to respond to challenges of sustainable territorial development. In P. Caron, E. Valette, T. Wassenaar, G. Coppens d'Eeckenbrugge, & V. Papazian (Eds.), *Living territories to transform the world* (pp. 199–209). Paris: Editions Quæ.
- Villalba, B. (ed) (2017). *Appropriations du développement durable: émergences, diffusions, traductions*. Villeneuve d'Ascq: Presses Universitaires du Septentrion.
- Vittersø, G., & Tangeland, T. (2015). The role of consumers in transitions towards sustainable food consumption. The case of organic food in Norway. *Journal of Cleaner Production*, 92, 91–99.
- Wigboldus, S., Klerkx, L., Leeuwis, C., Schut, M., Muilerman, S., & Jochemsen, H. (2016). Systemic perspectives on scaling agricultural innovations. A review. *Agronomy for Sustainable Development*, 36(3), 46.
- Zaccai, E. & Zuindeau, B. (2010). Équité territoriale et développement durable. In: Zuindeau, B. (ed), *Développement durable et territoire* (pp. 97–107). Villeneuve d'Ascq: Presse du Septentrion.
- Zahm, F., Alonso Ugaglia, A., Barbier, J.-M., Boureau, H., Del'homme, B., Gafsi, M., et al. (2019). Évaluer la durabilité des exploitations agricoles. La méthode IDEA v4, un cadre conceptuel combinant dimensions et propriétés de la durabilité. *Cahiers Agricultures*, 8(5), 1–10.

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