From genetics to marketing (… and through complex connexions and interdependencies): an integrative approach of the ecologisation of fruit production

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Abstract: This paper discusses a systemic analysis of the changes in the peach and apricot industry since the 1960s, based on a sociological framework anchored in transition and actor network theories, with a specific focus on the place of genetics and breeding strategies in this trajectory, an aspect which indeed is often neglected in the literature. We show how, along with a process of specialization and intensification of fruit production at the farm and regional levels, breeding strategies mainly focus on improving yield and technological fruit quality and on extending the production period (from 3 to nearly 6 months for peach production) to offer retailers a continuity in each product type over this entire extended season through "varietal series". These objectives are thus market-driven and neglect the environmental aspects (even though substantial work has been done for decades on resistant cultivars) and the fruit production constraints, and they lead to create and then market fruits that are easy to store and transport, but often disappointing in terms of taste and quality. These changes are due to the constraints which affect all the socio-technical system up to the breeding process criteria and to a deep reconfiguration of the network of institutions and actors dealing with fruit production in general (research institutes, breeders, producers' organizations, retailers, etc.). In this paper, we also try to adopt a reflexive perspective about the way we discuss with the projects' members and partners (researchers from various disciplinary backgrounds, producers' organizations, marketers and advisors) some key issues that are central to the construction of more ecological and resilient transition pathways at the scale of the agrifood system.

Keywords: fruit industry, agrifood system, socio-technical transitions, cultivar resistance, breeding impact, ecologisation

Introduction

The fruit sector in general is characterized by a high international competition and strong marketing constraints that are both contradictory and interdependent with consumers' and societal expectations. For example, consumers want fruits free of pesticide residues and the society wants a more ecological agriculture as well as diversified landscapes, while retailers impose diverse constraints regarding fruits' appearance and storage properties, which in turn are only achievable with input intensive agricultural practices.

In the region under study, that is the middle Rhône Valley (namely Drôme and Ardèche French Departments), the economic context of repeated and then structural crises since the early 1990s, caused a sharp decrease in peach cultivated surface areas and production. In the Drome alone, the peach orchard surface area was divided by 3 and decreased from 6400ha in 2000 to 2100ha in 2010. Peach has been partially substituted by apricot in some farms, and in the same period the apricot orchard roughly maintained its surfaces (7000ha and 6400ha in 2000 and 2010, respectively) (Recensement agricole 2010). Another reason for these decrease and partial transfer relates to sanitary problems such as sharka, a quarantine virus disease which led to uproot some Prunus infested trees, even though this disease seems to have had a more indirect than direct impact on the orchard.

This presentation is based on the first results of an ongoing research project which studies the lock-in effects and the transition pathways towards sustainability within the peach and apricot industry in this region (Prunus, 2013-2015). This project brings together sociologists, economists, agronomists and geneticists, as well as research and experimental units, in a systemic and integrative analysis combining studies at different scales of the agrifood system (plot, farm, territory, and the agrifood system at large).

The situation described above raises several research questions at the crossroads of our disciplines, which structure our research project: does this partial transfer from peach to apricot go along with changes in technical practices and does it give way to possible input reduction? What is the impact on farm and sector viability? Does the genetic offer adapt to the new context and how? More generally, how can the sector adapt to both a context of increasing competition and an increasing demand for sustainable practices? This paper focusses on this question and is based on the first phase of the project, devoted to a socio-historical analysis of the changes in this sector since the 1960s and more specifically to the place of genetics and cultivar breeding in this trajectory.

The current breeding strategies mainly focus on improving yield and fruit technological quality for packaging, storage and transport, and on creating "varietal series" to offer retailers continuity in each product type over a production period which has been extended from 3 to nearly 6 months for peach production. These objectives neglect the environmental aspects (even if substantial work has been done for decades on resistant cultivars), and lead to create cultivars and then market fruits that are easy to store and transport, but often disappointing in terms of taste and nutritional quality. On their side producers are obliged, despite high production constraints, to follow the turn-over and plant the cultivars that will allow them to remain on the market. Why did these changes occur and why public policies could not act and change this situation?

To explore these questions we adopted a framework inspired by transition theories and actor network theories which will be presented in the first section. Then we will describe the trajectory of the peach and apricot socio-technical system in the middle Rhone Valley and the interdependencies which characterize this trajectory. This will lead us to show that these changes are due to the constraints which affect all this socio-technical system from the quality criteria up to the breeding process criteria, and to a deep reconfiguration of the network of institutions and actors dealing with fruit production in general (research institutes, breeders, producers' organizations, retailers,

etc.) and of the modes of coordination which link them together. We will then discuss the role played by the landscape and the niches in the trajectory of this socio-technical system, and in the regime change which seems to be acknowledgeable. In the last part we will adopt a reflexive perspective on the process of co-construction we are trying to set up with our partners (researchers from different disciplinary backgrounds, producers' organizations, marketers, advisors) and point out some key issues which already come out of this process such as the necessary articulation of time spans.

State of the art and theoretical framework

Regarding the fruit industry in general, few approaches consider the issue of sustainability transitions or ecologisation of practices (or of their difficulties) under interdisciplinary perspectives, even though there is a common acknowledgment of the necessity to integrate different disciplines in order to tackle such issues (Ricci et al., 2011). Regarding peach and apricot more specifically, research projects carried out in the early 2000s in the same region had already investigated the interactions between technical, social and economic aspects by bringing together agronomists, economists and sociologists (Pluvinage et al., 2005). In our project which started in 2013, we added genetics as a new dimension to this interdisciplinary and integrated approach. Indeed, the role of genetics and breeding strategies in the ecologisation (or intensification) of practices is an aspect which is often neglected in agrifood system approaches in social sciences and interdisciplinary works.

Social scientists have mainly investigated the effect of the concentration process within fruit production and distribution (less and larger farms and market operators) and the changes in modes of coordination in the foodchain, focusing on the production and marketing stages. Different theoretical backgrounds can be identified in this literature: some authors adopt an actor network theory perspective (Collet and Mormont, 2003) or an approach based on the analysis of coordination and organizational forms (Dubuisson-Quellier et al., 2006) in order to describe the combined processes of concentration, industrialization and standardization, while more recent works have investigated some emerging (or re-emerging) alternative pathways such as short circuits and/or acknowledged the development of a "new economy of variability" (Bernard de Raymond, 2013; Praly and Chazoule, 2013).

However these studies do not really investigate the role of genetics and breeding strategies in the ecologisation (or intensification) of practices in fruit production, to the exception of rare interdisciplinary approaches such as one regarding the case of apple breeding (Vanloqueren and Baret, 2004) which highlighted the necessity to consider socio-economic aspects and the existence of alternatives in the evaluation of transgenic varieties. Other authors combining their disciplinary backgrounds and applying sociology of science to genetics in the case of durum wheat argue that conventional breeding methods do not generally provide fitting responses to the diversity of both environmental conditions and end-users' needs (Chiffoleau and Desclaux, 2006). Wheat has also been the focus of a historical analysis of breeding strategies and of the role of power struggles in impeding the development of more environmental-friendly breeding schemes (Bonneuil and Hochereau, 2008; Bonneuil and Thomas, 2009). These social scientists question the ability of "conventional" breeding programs to ensure agricultural sustainability, because they do not take into account genotype X environment interactions especially if the socio-economic dimensions of the environment are to be taken into account.

In previous interdisciplinary work carried out at the European scale about the case of apple, we developed a systemic approach to analyse the conditions of transition towards more sustainable crop protection practices at different levels of the agri-food system: farmers' practices, interactions between farmers and advisors, retailers' strategies, governance of research and extension,

and involvement of civil society. We adopted a path dependency approach (Dosi, 1982). This theory suggests that an innovation trajectory may become dominant and strengthened by the feedback of its implementation, despite the existence of alternative innovations which could have offered a better sustainability on the long run. It has been adapted by several authors to analyse the difficulties to shift from current crop protection practices towards Integrated Pest Management due to lock-in effects (Cowan and Gunby, 1996; Wilson and Tisdell, 2001; Vanloqueren and Baret, 2009). Based on the application of this path-dependency approach to the case of wheat, we also demonstrated through a socio-historical analysis the coherence of the agri-food socio-technical system and the irreversibilities created by the specific and interdependent trajectories of its different components (Lamine and al., 2010; Lamine and al., 2012).

We will rely on all this literature and previous work in our analysis and combine a transition theory approach with an actor network approach to build up our socio-historical analysis of the changes within the socio-technical system linked to the peach and apricot production.

A socio-historical analysis debated with stakeholders

Based on the analyses of the changes over the last 5 decades at the different levels of the agri-food system, we have described the trajectory of the socio-technical system of the peach and apricot sectors. This analysis has been built on the basis of professional and technical documents, interviews with key actors and scientific literature. It has been elaborated collectively by the researchers of the project (who brought their specific scientific competences) and discussed and partly re-constructed with the partners of the project. From the 1960s until today, this collective work led to identify 4 phases (Lamine et al., 2014):

- until the 1970s, the peach and apricot industry was strongly structured by close and rather direct relationships between its stakeholders. Marketing processes were rather short in terms of intermediaries and time, and these intermediaries, such as wholesalers or brokers, would very well know the products, their specificities and the various cultivars.

- like in other food industries, the 1980s were the decade of the intensification turn, characterized in our case by a large extension of cultivated areas (partly in new regions and largely due to big public land planning projects such as Rhone valley dams), an extension of the production period and a strong increase in the diversity of planted cultivars, while the corporate retailing sector was starting its development.

- in the early 1990s the fruit sector entered a structural crisis due to this restructuration of the retailing sector and its consequences (detailed in the next section) and to the growing competition of imports mainly from Spain (after it joined the European Community) and Italy. To adapt to this new context, producers had to provide retailers with a safe and consistent flow of fruits over a longer season which in turn made the breeding industry develop “varietal series” to guarantee enough continuity in each type of product over this extended season.

- in the current period (from the late 2000s onwards) we can acknowledge both a reinforcement of the previous trends and a diversification of farming and marketing systems which lead the stakeholders wonder whether the economic, social and environmental sustainability of their sector may rely on a combination of complementary pathways.

Over these decades, the processes of concentration and industrialization of fruit production and distribution have progressively made it necessary to standardize the products and make them suitable for long distance transport and long storage as well as for simple marketing procedures, which in turn has led to a profound redefinition of quality criteria. This dynamics has been exacerbated by the lasting crisis which has affected the sector since the early 1990s. However, if this

sequence seems almost natural and evident to most stakeholders, it is necessary to understand what made these changes possible. In this aim, we will analyse (i) the progressive redefinition of quality criteria; (ii) the changes in innovation models in the breeding sector; (iii) the reconfiguration of the network of actors, which allows and supports all these changes in the socio-technical system.

How the concentration processes led to a redefinition of quality criteria

The whole food sector is characterized by combined processes of intensification (of production techniques), of concentration (of the production and even more of the retailing sectors) and of distance lengthening from production to consumption. This has been well described in the literature (Allaire and Boyer, 1995; Friedmann and McMichael, 1989) and of course also applies to the cases of peach and, although to a lesser extent, of apricot.

These combined processes have led progressively to a redefinition of quality criteria. While until the 1950s peaches from the middle Rhone Valley were picked ripen, carefully packed and quickly and directly transported to the big markets and cities where they would be sold just one day after being picked (Praly, 2010), nowadays they are picked unripen and often sold several days later after having transited through several platforms. To adapt to these changes the main criteria today are related to marketing issues: resistance to shocks, storage aptitude, appearance (including fruit caliber and color) and firmness, besides the usual production criteria (mainly yield and regularity). Regarding taste, as it is a composite criterion and difficult to assess objectively, it has progressively been codified into measurable criteria, such as sugar content or acidity rate, along with the development of measurement tools. These criteria have been imposed to the producers through market intermediaries and through material procedures such as contracts and fruits' control at the collecting stage. In the vocabulary of the Actor-Network Theory, market demands and criteria redefine growers' practices through a process of *alignment* of a series of practical *intermediaries* and technical instruments (Callon, 1986) such as those used to grade the fruit or to measure the sugar content or the firmness (Haynes et al., 2010). These instruments allow market intermediaries to assess the fruits' quality and to assign them to specific categories and set the prices. The need for a flexible fast supply of fruit and its transport and distribution on the market requires specific organizational forms. New types of coordination are established between the actors and new components or entities enter the system (Collet and Mormont, 2003). In the terms of the economy of conventions (Thévenot, 1994), these phenomena can also be analyzed as a change in the *convention* which links the actors and a shift from a domestic convention to a market one, from a *regime of familiarity* to a regime characterized by long-distance transport and standardized quality assessment. In the framework of the transition theories, we could say that the rules that link the actors of the socio-technical systems are redefined, and we will see later on that we can also talk of a *regime* shift.

How the concentration processes impacted breeding strategies: changes in innovation models

What we want to emphasize here is that these changes have not only impacted the production and marketing sectors but also turned central for the breeding strategies and thereby redefined the orientations of the private breeding sector (which is also subject to powerful processes of competition and concentration and has to put new cultivars on the market as quickly as possible to remain competitive) but also of the public research. The increasing competition at all levels of the socio-technical system led to an extension of the peach and apricot season and production period (from 3 to nearly 6 months for peach production) and to a segmentation of the products types (white/yellow peach, nectarine/brugnon etc.). In turn this led the breeding industry to develop early and late cultivars and "varietal series" and to the current situation of an endless "race for

innovation", where 80% of the peach cultivars proposed for the registration and development are removed before the end of their agronomic evaluation phase.

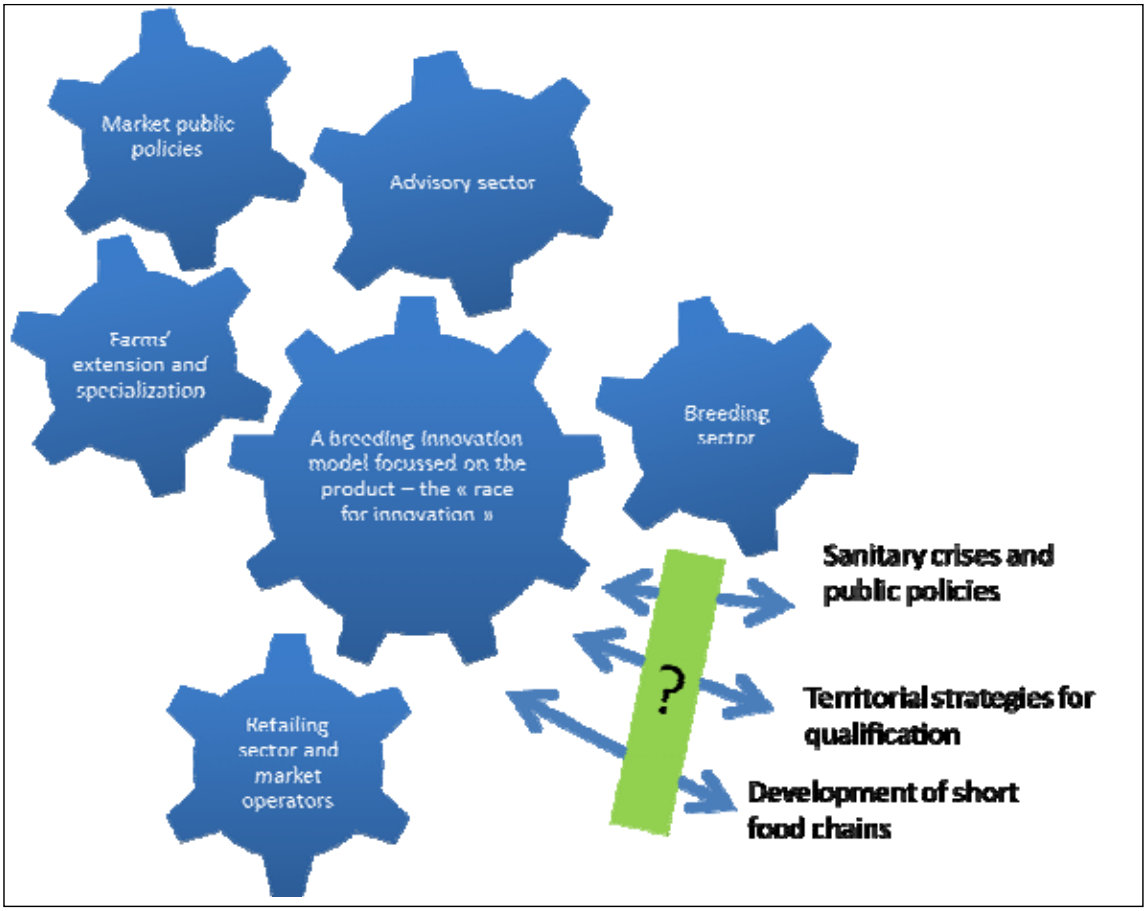
These changes in the socio-technical system (redefinition of quality criteria, segmentation of the types of products, extension of the period of production) entirely redefined the objectives of breeding strategies over the last decades. Therefore we can say there was a shift from a genetic innovation model based on criteria linked to the production stage (regularity, yield) to an innovation model based on the marketing stage and the characteristics of the product (sugar content, acidity rate, appearance and firmness) and its aptitude for transporting and storing (e.g., resistance to shocks, post-harvest behavior). The main point here is that environmental criteria such as the adaptation to low-input practices as well as some agronomic criteria such as production regularity have been neglected within private breeding strategies. A few public research institutes have been working on resistance criteria, with first results being published as early as in the late 1980s, but until recently this was not really considered by the professional actors. Moreover, some of the new cultivars, especially the late harvesting ones, require more intensive practices and pesticide use. First, the period of risks of damage is longer, which requires to protect fruits along an extended period against pests and diseases. Second, levels of pest populations (e.g., lepidopteran pests such as tortricids) and disease inoculum (e.g., brown rot due to *Monilia* spp.) increase along the season with pest generations and disease (re)contaminations and are difficult to control with alternative methods to chemicals. Lastly, most biocontrol pesticides are altered by high temperatures and solar radiations, which limits their use during summer.

A deep reconfiguration of the network of actors

All the above-described changes, about both quality criteria and breeding strategies, were made possible by a progressive and deep reconfiguration of the network of actors corresponding to the peach and apricot socio-technical system, and to the modes of coordination which link them together. It was because over the 1990s and up to the late 2000s the producers got increasingly organized in producers' groups (an obligation to benefit the public subsidies linked to the European market organization) that they were urged to adopt new cultivars and especially the new "varietal series"… or at least to limit their choice to a definite list established by these producers' groups. Another sign of this reconfiguration of the socio-technical system is the emergence in the breeding sector of a new profession, that of mandataire ('éditeur' in French), involved in the cultivar development. While nurseries used to achieve both edition and multiplication of new cultivars, more recently another type of actor emerged with the development of grafting platforms specialized in glasshouse multiplication and able to market small plants in about 6 months instead of usually 2 years.

This socio-technical system and its trajectory which we have described above are determined by a range of interconnected *interdependencies* that generate *lock-in effects*: here above we focussed on the organization of marketing and the offer of cultivars ("varietal series"), but we also mentioned the interactions between land planning and the intensification of agriculture (in the 1970s and 1980s) and the links between the restructuration of the advisory system and this intensification of practices (with a large transfer of intensive practices in the 1980s, and then from the 1990s onwards a weakening of the public advisory sector, that might have been keener on developing environmental-friendly practices). Of course, these interdependencies (and others) do not only link one element of the socio-technical system with another one, but they rather tie all the elements together, as suggested by the figure below. And of course, some landscape pressures (due to sanitary crises or changes in public policies) or niches (such as territorial strategies or short food chains) might also influence this system or fail to do so, as we will see below.

Figure 1: Conceptualisation of the agri-food sytem and identification of the interdependencies between the diverse actors



Back to the transition theories (…and forth!)

A comparable approach to ours had been applied to the case of wheat by G. Vanloqueren and P. Baret (2008) who focused on the issue of the adoption of multi-resistant cultivars: why are multi-resistant wheat cultivars (already available since the late 1980s) slow to develop commercially? The "yield cost" of disease resistance in plants, as advocated by some specialists, cannot be the only explanatory factor, and these authors argue that this situation is the consequence of a set of intertwined factors at different levels of the agrifood system (farmers, market, extension services, research, public regulations and policies). More generally, the "pesticide lock-in" described by Vanloqueren and Baret (2008) in the case of wheat is also applicable to the fruit sector. From the 1960s onwards, the availability of a large range of pesticides combined with a cultural advocacy of productivity (historically justified by the need for self-sufficiency after World War II and progressively by new arguments such as the need to feed the world, in more recent periods) has led to a focus on yield rather than resistance in breeding priorities. Moreover existing breeding programs have focused mainly on vertical rather than horizontal, polygenic resistance, and on single-pest rather than multi-pests approaches.

How did the growing concern for environmental issues impact this socio-technical system? If we adopt a grid based on transition theories (Geels, 2004), we can explore this question in three steps: how did the *landscape* influence the trajectory of this socio-technical system, have some *niches* either influenced the whole thing or been left aside and marginalised because of these strong interdependencies, and what kind of *regime* changes do characterize this trajectory?

Let us first consider how the changes in the *landscape* might have influenced – or not - this trajectory. A first element is that until recently, more attention was given to other challenges such as food security and food traceability than to pesticide reduction. It is quite recently that the societal demand for more environmental practices really started to be influential. In this "new" context of

environmental concern, and noting that in France the breeding activities are still relatively controlled by the State, both through the importance of public research in genetics and through the system of certification and registration of new cultivars, we could have expected public authorities to ease the inclusion of more environmental-friendly criteria in the breeding sector, such as the adaptation to low-input practices. However, public research in genetics has withdrawn from many species and fields (the INRA for example has concentrated its forces on 6 fruit species today as opposed to 19 in the 1980s). Regarding the system of cultivar registration, it has been a constant issue of conflict between the stakeholders, even though it is one of the main channels through which public authorities may act (Bonneuil and Thomas, 2009), and some changes towards the integration of sustainability (low input) criteria have indeed been implemented recently for some species.

Moreover, another major element of the landscape probably had a greater impact on the socio-technical system and its actors and institutions than the societal demand for sustainability: the sanitary crises that deeply impacted the peach sector, due to bacteriose (from the 1960s onwards for peach) and sharka (especially in the 1990s). Even though the decrease in the peach orchard surface area is only partly directly due to those crises and to the public sanitary policies (uprooting obligations), the indirect impact of sharka has probably been much higher and still has to be assessed and analysed. Anyway, from the 1960s onwards, these sanitary issues urged the public research to develop programs about resistant cultivars, with first results being published in the late 1980s and the first apricot resistant cultivars being marketed in the late 2000s.

From the other side of the system, how did *niches* emerge and successfully influence the whole system, or how were they marginalized? In the fruit and vegetable sector in general, the recent period is characterized by an emerging diversification of marketing outlets with a renewal of short food chains, and new combinations of short and long circuits, often but not always in link with a conversion to organic farming (Lamine et al., 2012; Praly and Chazoule, 2013). However, these trends mainly remain at an individual (farm) level or at the level of informal (and small) producers' groups who try to market their products in alternative ways (producers' shops, box schemes, and other forms of alternative food circuits). Several attempts to develop territorial strategies based on AOC/PGO have failed in the last decade (Praly, 2010), largely due to a lack of alliances between producers and other market actors.

In the breeding sector, alternatives might also have been marginalized. In the case of wheat for example, the professional media were for long reluctant to publish articles showing the economic advantages of multi-resistant wheat cultivars cultivated in low-input systems, and the development of multi-resistant wheat cultivars, often presented in France as a success of public agricultural research, depended mainly upon the persistence of a few scientists who were recognized only in the late 1990s… when the wheat price fall made people look at the results differently (Vanloqueren and Baret, 2008). In the case of peach and apricot, there seems to be a stronger interest of the production sector in resistant cultivars, linked to the above-described sanitary context, but the weight of market criteria and market operators might slow down the adoption of resistant cultivars (an aspect which we will explore in the next step of our project). Finally, while like for other species, local cultivars might subsist and even be developed in some alternative networks, they have not really impacted the production level until now.

Let us now consider the last key concept of the transition theories, the notion of *regime*. In our case, can we talk of a regime shift? All the changes that we described in section 2, i.e., in the norms and rules which govern the peach and apricot socio-technical system, in the innovation model which prevails in the breeding sector, and in the network of actors and in their modes of coordination, indeed suggest a regime shift from a *regime of proximity*, prevailing until the early 1980s, to a *regime* characterized by both *distance and intensification*, as already assessed in the case of wheat (despite important differences, mainly due to time scales, between annual and per-

ennial crops). However, this current regime is increasingly questioned and we also observe some recent trends of diversification at different levels of the socio-technical system, which might set up different bases for a future regime.

Co-constructing an analysis of the current situation in order to work on the future: a reflexive insight

Could we turn the lock-in effects we have described into positive levers? Is it conceivable to reconcile the needs of producers (to sustain their activity and adopt lower input practices for example) with those of marketing operators and breeders, based on the fact that all of them are enduring the same lasting crisis? Can this lasting crisis be also creative and allow a transition to a more sustainable *regime*?

In our project, partly relying on lessons from our former projects (Pluvinage, 2005; Ricci et al., 2011) as well as on other colleagues' experience in participatory breeding programs (Chiffoleau and Desclaux, 2006), we intend to proceed in three steps: 1) co-construction of a shared analysis of the current situation and of the trajectory that led to it (which is the object of this paper); 2) identification and discussion of the positions and efficiency-criteria of the different stakeholders; 3) definition of future breeding objectives and experimental protocols.

Here the notion of co-construction encompasses both interdisciplinarity and stakeholders involvement. Agricultural scientists are often considered by social scientists to be keener on analytical one-factor type research than on multi-dimensional approaches and also to be reluctant to integrate other disciplines and especially social scientists for more than assistance in transferring their innovations ("*how should we talk to farmers so that they adopt our innovation?*"). However, we should notice that the integration of various disciplines was the challenge of the SAD (for Agrarian Systems and Development, today Sciences for Action and Development) department, created within the INRA as soon as in 1979. Still, few interdisciplinary approaches really lead critical analyses of the organization and activities of the agrifood system, and these have long remained the realm of social scientists working "alone" (especially within Marxist and political economy approaches of corporate food systems, see Friedmann and McMichael, 1989). In our project, we claim to involve all the disciplines concerned by the issues at stake as well as the different stakeholders also concerned by these issues.

Both "enrolments" (of different disciplines and of different stakeholders), to use Actor Network Theory's terminology, have specific consequences we have to be reflexive about. First of all, trying to elaborate a shared analysis of the current situation, and of the trajectory that led to the present situation, with the actors who were and are involved in this trajectory and in this situation means that some persons, either scientists or stakeholders, might be hurt by or disagree with some of our interpretations. Therefore it is necessary to track and assume possible controversies both on the field (in the real world) and in our network of concerned scientists and stakeholders. This is why part of our research is also devoted to a sociological analysis of the diversity of positions and strategies and of the controversies within the socio-technical system of peach and apricot production.

Keeping in mind this attention to controversies, our approach aims at connecting historical trajectories, immediate experience and possible futures in a form of interaction that is less centered on the provision of proof than on mutual commitments towards a common future (Collet and Mormont, 2003). For example, we would consider farmers not as victims of changes taking place at other levels of the agrifood system, but as stakeholders who can get involved, along with stakeholders of the other levels/components, in a redefinition of the whole system. We could here refer to the idea of a redistribution of responsibilities towards a civic mindedness (Boltanski and Thévenot, 1991).

To achieve this, we do not start from nothing, and rely on already existing processes (and this probably makes our approach not reproducible in any situation!). For example, there was already a close and trustful relationship between some scientists and the regional stakeholders we involved. Besides, some professional stakeholders were increasingly claiming a more collective organization of the sector with stronger links between producers, advisors and other actors, and diverse forms of coordination had been created in the last years in this aim.

Could these interactions between disciplines and between stakeholders allow us to redefine common objectives towards more ecologized practices? Our aim is that at the end of the project, these partners might play an active role in the definition of research objectives and experimental protocols, e.g. through seminars aiming at identifying important breeding traits and to design innovative orchards to be tested. Here of course we have to be conscious that our approach presents many shortcomings, not least because it tends to involve leaders instead of trying to involve a larger range of the "concerned" actors (Barbier et al., 2013). But we hope that our choice of a somehow 'small' territory will allow an exhaustive approach of the peach and apricot socio-system complexity and specificity, which will be discussed and shared with various other stakeholders in further developments of the project. Moreover, a recent public commitment of the INRA towards the fruit industry stakeholders seems to be in line with this perspective ("*Let us work together towards the co-construction of a sustainable fruit production*", Journée FNPF, 31/1/2014); and the challenge indeed is to translate such a commitment into constructive partnerships.

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