Technical and commercial change during transition to organic farming: towards a methodological approach based on the scope of the leaps forwards

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Abstract: Over the last few years there has been increasing concern about the transition towards organic farming (OF). Depending on the case, this transition is said to be progressive, rapid or abrupt, compared to a given conventional system. Yet few tools are available for us to analyze and represent the mechanisms of the changes made in the production system when farmers convert to OF. Varying degrees of differences exist between conventional and organic systems, especially when it comes to their technical and commercial aspects. We posit that it is possible to characterize the processes of transition by analyzing the extent of technical and commercial changes between conventional and organic systems. The present study is based on the empirical results of surveys on cash crop farmers, and on available knowledge on collecting firms' strategies in the Île-de-France region surrounding Paris. We develop an analytical framework to evaluate conventional farmers' technical and commercial proximity to OF, and the changes potentially to be made in the case of a conversion to OF. To analyze farmers' technical practices, we suggest a scoring system with principle-based indicators concerning the components of the cropping system. The analysis of commercial proximity to OF is based on relevant criteria concerning the organizational dimension of markets for organic produce. Results show the diversity of the size of the technical and commercial leaps to make to reach OF. In the region studied, we observed a majority of medium and large potential leaps by conventional farms, which highlighted the difficulty for conventional systems to technically and commercially attain OF. Taking into account the interactions between farmers' practices and commercial strategies, this methodological approach is complementary to the existing theoretical frameworks of transition to sustainable agriculture. From an operational point of view, it could be useful to adapt the OF development programs in a specific region by identifying the technical and commercial barriers and opportunities.

Keywords: organic farming, proximity to organic farming, scoring system, leaps to reach organic farming, technical practices, commercial strategy, and barriers of conversion

Introduction

Organic farming (OF) is generally presented as a model of sustainability and a prototype within ecologized forms of agriculture (Bellon and Penvern, 2014). The notion of conversion to OF has gained currency in recent years and can serve to analyze structural processes of change in farming systems. Conversion to OF is a multidimensional change that modifies not only technical practices and reference frameworks, but also the relationship to nature, food and consumers (Lamine and Bellon, 2009). The literature on conversion to OF has however focused primarily on analyzing the effects, in terms of processes, of conversion and the reasons for it. Many agronomic studies examine systems after conversion, comparing entire organic and conventional systems against various technical, economic and environmental performance criteria. The social sciences have investigated mainly the incentives and barriers in farmers' conversion to OF.

In terms of mechanisms of change for the purpose of conversion – which for farmers means reconfiguring their farming systems – there are few tools for analysis and representation. We often remain at a superficial level, considering that conversion to OF can be gradual, rapid or sudden, in relation to a conventional system. Bonnaud et al. (2000) contrast "organic as a continuity", where an existing commitment and production methods close to OF are reinforced by certification, and "organic as a break", where the farm veers away from previous practices very different to those of OF, even if certain antecedents can facilitate the transition. We may assume that farms which are "close to organic" are more inclined to convert to OF, but that is not always the case. Some farmers qualified as "almost organic anyway", "effectively organic", "semi-organic" (Sutherland, 2011) or "half-way there" (Harris et al., 2008), claim that they use few inputs but do not wish to adopt the production methods of certified OF.

The changes to be made to convert to OF may differ from one farm to the next. Conventional farming practices vary, ranging from an unlimited use of inputs to integrated production methods. In France this gradient has been formalized in the Ecophyto R&D expertise, in terms of levels of change in a farm's crop-protection strategies and use of pesticides (Butault et al., 2010). Even though we can consider that within conventional systems there are already substantial changes, in relation to which we can analyze the trajectories of changes of practices (Chantre, 2011), it seems that conversion to OF is a different type of break. It implies the departure from most former practices – not only technical but also commercial practices, linked to social networks – and as such is a real "leap" towards another mode of production. While the notion of a leap towards OF has not really been conceptualized, it aptly reflects the radical nature of this conversion, the interruption in the ongoing and gradual advancement of phenomena, and the risks and difficulties surrounding such change.

There are thus varying degrees of difference between practices in conventional agriculture before conversion, and after conversion. Depending on the farm, the leap that will have to be made to convert to OF will differ. This proximity/distance of farms with regard to OF constitutes a new field of exploration, for example regarding the challenges of preventive management of water quality (Gratecap et al., 2013) or the maintenance of specific agricultural systems in rural areas (Mena et al., 2012). The differences between conventional and organic farming can be measured by the antecedents which are technical, social – inclusion in organic networks before conversion – or global – contracting of public policy tools. From the point of view of technical practices, the boundary between organic and conventional farming can be relatively porous, even if some aspects constitute major differences (such as the use or not of synthetic chemical inputs). Overall, OF is characterized by an organization of technical systems based on systemic, preventive management implemented on the scale of crop sequences. This type of management is not per se incompatible with the conventional system, but in practice it is found very little.

Among the multiple changes inherent to conversion, we have chosen to explore those of a technical and commercial nature, which seem relevant to the issue of transition in agrifood systems.

Our aim is to develop a methodological framework to analyze the proximity to OF, in order to evaluate the extent of potential or real technical and commercial leaps by farms towards organic farming. The framework serves to evaluate (i) the extent of leaps to be made by conventional farms and (ii) a posteriori the transitions towards OF accomplished by conventional farms that are now doing OF. This framework was developed and tested in the Île-de-France Region, which is characterized by systems that make relatively intensive use of inputs, and where field crops prevail over other systems of production, especially livestock.

Materials and methods

To analyze the transitions of farming systems, with particular regard to the technical and commercial changes at the farm level, we adopt an agronomic approach focused on farm management. We apply agronomic survey methods to analyze the technical decision-making rules that farmers use. We consider the relations between farmers and their commercial operators, and the territorial dimension of this coordination. First, we examine farmers' technical and commercial systems, by analyzing: (i) the organization of crop systems, decisions on the technical aspects of crop production (choice of crops, crops' location, crop sequences and technical management of these crops) and the farmers' logics (Aubry, 2007) and (ii) their commercialization strategies in relation to certain farm resources (equipment, storage). Second, on the side of commercial operators, we use some information about the modes of organization of farm produce collection and the territorial localization of these actors. By integrating farming practices in a spatial dimension and by considering interactions with commercial operators, our approach can be linked to an overall geo-agronomic one, focusing on interactions of farms with other activities and land uses. In this latter approach, geographical theory is mobilized through the objects of agronomy (Deffontaines, 2006).

Surveys on farmers in the Île-de-France region

We carried out interview surveys on 20 farmers whose main activity was field crop farming. Of these, 16 were doing conventional farming and 4 were converting to OF at the time of the survey (Table 1). The interviews were held between 2010 and 2012, via the phone and/or face-to-face. Ten conventional farmers (C1 to C10) were selected on the basis of changes in their practices that indicated their proximity to OF, such as various forms of reduced use of inputs and the fact that they had signed "Enjeu eau" contracts concerning agri-environmental measures (AEM)[235].

[235] The AEM on water-related challenges in conventional field-crop systems, focus on the reduction of the use of chemical pesticides and fertilizers. These financial incentives can be offered through contracts in local territories to target the objective of reducing the impact on the quality of water of diffuse pollution of agricultural origin.

Table 1: The sample of farmers surveyed

Surveyed farmers' code	Type of production	Date of conversion	Criteria of proximity to OF
C1	Cash crops without livestock	Ø	Qualified as integrated farming ("agriculture raisonnée"
C2	Cash crops without livestock	Ø	AEM "water"
C3	Cash crops without livestock	Ø	Integrated production
C4	Cash crops without livestock	Ø	Integrated protection
C5	Crop-livestock combination (sheep and poultry farming)	Ø	AEM "water"
C6	Cash crops without livestock	Ø	AEM "water"
C7	Crop-livestock combination (pig farming)	Ø	AEM "water"
C8	Cash crops without livestock	Ø	AEM "water"
C9	Cash crops without livestock	Ø	AEM "water"
C10	Crop-livestock combination (sheep farming)	Ø	AEM "water"
C11	Cash crops without livestock	Ø	Ø
C12	Cash crops without livestock	Ø	Ø
C13	Cash crops without livestock	Ø	Ø
C14	Cash crops without livestock	Ø	Ø
C15	Cash crops without livestock	Ø	Ø
C16	Cash crops without livestock	Ø	Ø
Conv1	Cash crops without livestock	2009	Ø
Conv2	Cash crops without livestock	2009	Ø
Conv3	Cash crops without livestock	2010	Ø
Conv4	Cash crops without livestock	2010	Ø

C1 to C16: conventional farmers; Conv1 to Conv4: farms undergoing administrative conversion to organic farming at the time of the interview (all four had converted to OF on the date indicated)

An analytical framework to evaluate the technical and commercial proximity to organic farming

In this section we present the analytical framework designed to evaluate farmers' technical and commercial proximity to OF (see framework in Annex). As exposed in the introduction, proximity/distance of farms with regard to OF constitutes a new field of exploration and two recent papers contribute to this issue with different methodological choices. Mena et al. (2012) propose a global index of organic livestock proximity in relation to an organic model, consistent with "true organic farming", and the integrity of which can be evaluated by means of structural criteria (Darnhofer et al., 2010). Gratecap et al. (2013) argue that no technique peculiar to OF exists, meaning that all techniques can be implemented in a conventional system or in an organic one and that some "organic techniques" can be used in conventional farms with different objectives. They therefore compare the principles underpinning the action of conventional farmers with those implemented by organic farmers before their conversion to OF (effective conventional versus previous conventional). Our approach is at the interface of these two approaches since we compare conventional systems to organic ones, considering a meta-model of OF without characterizing organic farming styles precisely. Our methodology, the design of the analytical framework and the choice of indicators are based on an empirical ground, considering the farming systems in the region studied. More precisely, we adopt a pragmatic approach, considering the conventional systems in place (mainly intensive cash crops farms without livestock, some of them implementing integrated farming to varying degrees) and the organic ones (prevalence of cash crops without livestock) which were studies specifically in Petit (2013).

Technical proximity is evaluated by means of a scoring system with principle-based indicators concerning the components of the cropping system (cropping plan/crop rotation and crop management sequences). The scoring system enables us to obtain a final score out of 20 points, that can be divided into sub-scores: 5 points for cropping plan-sequence indicators (respectively 2 and

3 points[236])and 15 points for technical crop management indicators (4 respectively for the weed control, fertilizers and pest/disease control; 3 for wheat management). Within the technical crop management we distinguish between preventive techniques, aimed at anticipating agronomic risks, and which are implemented primarily on the scale of crop sequences, and corrective techniques related to current crop management (weeding, fertilization, pest and disease control).This matrix is designed to assess the gap between practices in conventional farming and those in organic farming, considering (i) the agronomic underpinnings of OF (no use of synthetic chemical inputs; farming based on living ecological systems and cycles, working with them, emulating them and helping to sustain them – IFOAM norms); (ii) the key techniques emphasized (crop rotation, management of soil fertility, etc.) and (iii) a preventive approach in technical management. Indicator design and selection of variables are based on scientific literature and expert knowledge. The values and thresholds of the variables have been adapted to the sample of farmers surveyed. Each variable is informed according to the techniques implemented by the farmer, and the scores are attributed manually rather than being calculated automatically. This makes it possible to weight, if necessary, according to the real importance of certain technical orientations mentioned in the survey. The lower the score, the more the technical system presents a configuration close to those typical of OF.

To assess the commercial proximity to OF, we retain several criteria which are relevant to the organizational dimension of outlets for OF and we use results obtained on previous works concerning collecting firms. These works aimed at analyzing the modes of organization of farm produce collection. On the one hand, interviews were held with the heads of 11 collecting firms, mostly cooperatives in the grain and protein-oil industry, whether they collected organic produce or not. The typology of these operators and details on their firms have been examined in a previous paper (Petit and Aubry, 2014a). On the other hand, two operators in the dehydrated alfalfa industry were considered with regard to their relations with Île-de-France farmers (Petit and Aubry, 2014b). This information on collecting firms' modes of organization enabled us to identify local opportunities for sales outlets for farmers' organic produce, that is, possible outlets for farmers that correspond to their geographic position in relation to the collecting firms in the territory.

Four criteria were selected to assess the commercial proximity to OF: (i) the absence of crops under quotas or contracts (sugar beet, high-protein wheat, potatoes) in cropping plans that are restrictive with regard to a plan to convert to OF; (ii) opportunities for commercial outlets for OF produce within the farmer's network of buyers; (iii) the existence of a storage capacity on the farm; (iv) commercialization in short supply chains and the existence of a potential value derived from the OF label. The way in which a farm meets these criteria, or not, is evaluated. Their absence constitutes impediments to conversion to OF.

Results and discussion

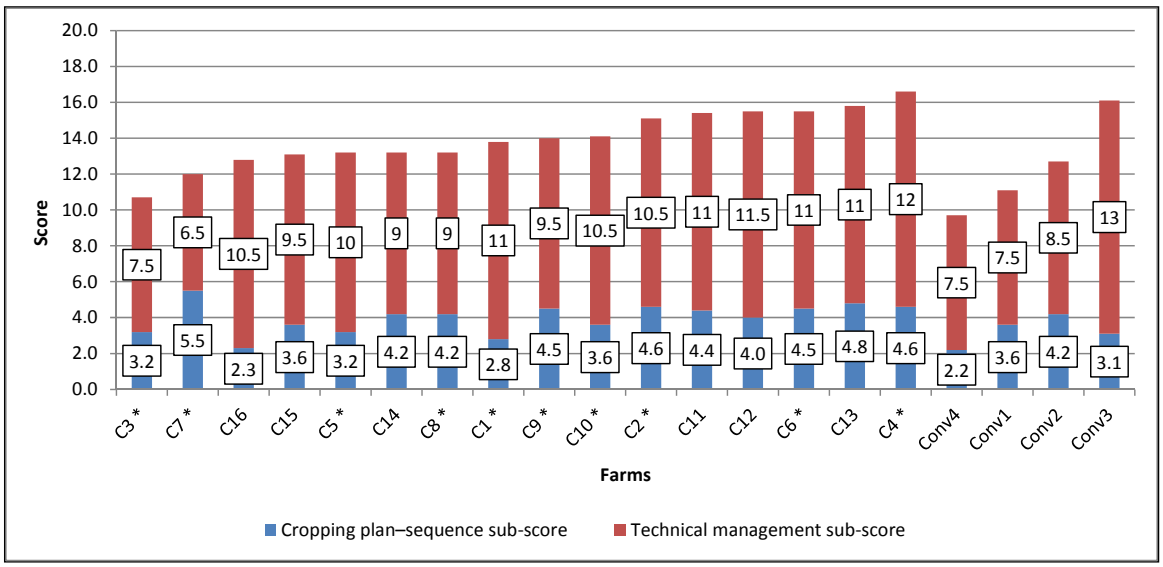
Result of the evaluation of technical proximity to OF in terms of overall scores

Figure 1 shows a range of scores for technical proximity to OF, from 10.7 to 16.6 for conventional farms, and from 9.7 to 16.1 for conventional systems before conversion. The farmers initially identified as "closest to organic" who have implemented changes in their technical practices are not distinguished from the others with regard to their proximity to OF, especially those who have "water challenge" AEM. These farms reach their objectives in terms of reduction of the treatment frequency index (TFI), without significantly reconfiguring the cropping plan, sequences and technical crop management, and without implementing more preventive agronomic management

[236] With the application of a surcharge of 0.5 points in cases where the farm has a sugar beet quota, a score of higher than 5 points can nevertheless be obtained.

techniques. This is consistent with the literature on the evaluation of European agro-environmental policy. It shows the poor effectiveness of these measures, which do not facilitate real changes of practices and which often remunerate existing practices (Bonnieux, 2009). On the other hand, certain farmers in the sample obtain relatively low scores without their farming practices corresponding to these patterns of change (C14, C15 and C16). In the following section we analyze the breakdown of overall scores, which we then use to propose differing degrees of potential leaps to make or leaps made, in relation to the extent of commercial leaps.

Figure 1: Distribution of technical proximity scores for the farms surveyed. C*: farmers selected on the basis of changes in their practices that may reveal a proximity to OF.



Analysis of the extent of technical and commercial leaps towards conversion to OF

Even if the final scores prove to be too global to qualify proximity to OF, they do nevertheless have the advantage of being able to be broken down according to the two components of the cropping system. This enabled us to analyze the coherence between the choice of crops, their sequence, and the technical management applied to them. We then made choices to establish the different types of leap made by the farmers surveyed. These choices were based on the scores and on an expert reading of the technical systems: (i) the cropping plan-sequence scores are mainly intermediate values reflecting the fact that very few farms are close to OF when it comes to the choice of their crops and crop sequences, but scores up to 3.2 reflect slightly more diversified systems than others; (ii) the low scores for technical management ranging from 6.5 to 9 correspond to combinations of practices that are close to OF (green manures and cover crops, mechanical weeding and organic fertilizers, substantial reduction of TFIs, etc.). Three possible combinations thus appear to classify the farmers surveyed: (1) intermediate crop plan-sequence score/low technical management score; (2) high crop plan-sequence score/low technical management score; (3) high crop plan-sequence score/ high technical management score. These three combinations correspond to three levels of technical score informed in Figure 2. No farmer is in the "low level of technical leap" modality, and most farmers are spread across the "medium level of technical leap – technical management" and "high level of technical leap" modalities.

The sample of farmers surveyed enables us to identify two types of technical proximity to OF. The first type presents more diversified cropping plan-crop sequences than do the others (case of C1, C5 and C16, with a diversity of crops and/or presence of alfalfa). The second type has made changes to their technical management practices (case of C3, C7, C8, C14 and C15, with a gradient of techniques aimed at reducing inputs: reduced doses, organic fertilizers, green manures and cover crops; only C3 and C7 combine these strategies with regard to their technical management of weeds, fertilization, pests and diseases). But no farmer combines crop plans – diversified se-

quences and a preventive technical management with little use of inputs. Hence, the technical proximity to OF that was found was only partial. This is consistent with the findings of Gratecap et al. (2013). We are therefore witnessing a poor match between the choices of crop plans, sequences, and technical management. Moreover, these farmers who are closest to OF are not envisaging conversion to OF. This is consistent with the analysis of changes of practices by trajectory of farmers proposed by Chantre (2011), who showed that a very small proportion of farmers have converted to OF (after changes in farming practices or not) and the vast majority remained at step of integrated farming at different levels.

To analyze the commercial proximity to OF, four criteria were selected (cf. § 2.3). Three modalities were defined to denote small, medium or large degrees of commercial leaps corresponding to the number of barriers (respectively none, fewer than two, or more than two). No farmer was found under "small commercial leap", which means that they all had at least one barrier, whether this concerned: their storage capacity, their use of short supply chains without any potential for deriving value from the OF label on the retail market, or crops under constraints regarding commercialization or opportunities for organic outlets in the farmer's network of buyers. The latter two are the most frequent barriers on the farms surveyed.

Figure 2:Cross-comparison of size of technical and commercial leaps, and position of the farmers surveyed.

	Small technical leap	**Medium technical leap (cropping plan - sequence)***	**Medium technical leap (technical management)****	**Large technical leap**
Small commercial leap	∅	∅	∅	∅
Medium commercial leap (cropping plan - sequence)	∅	C1, C5*, C16,	C3, C8*, C15, Conv1, Conv2, Conv4	C2*, C4, C9*, C11, C13, Conv3
Large commercial leap	∅	∅	C7*, C14	C6*, C10*, C12

* corresponds to an intermediate cropping plan–sequence sub-score and a high technical management sub-score. ** corresponds to a high cropping plan–sequence sub-score and a low technical management sub-score.

The technical changes are closely linked to the commercial changes, even if some changes in technical practices that reduce inputs are deliberately adopted by certain farmers. These forms of lock-in, in the broad sense, have been studied extensively in the literature (Lamine et al., 2010; Meynard et al., 2013; Vanloqueren and Baret, 2008, 2009). Among the farms surveyed we also find that certain technical practices have to be related to constraints, obligations or conditions of commercialization (e.g. commercial commitments on volumes of production, seed contracts, etc.). Moreover, in the particular case of organic farming, conversion implies the need to find outlets for organic produce and in the case of field crops this may mean changing to different operators. Previous research has enabled us to identify operators that function differently in their collection of organic produce (Petit and Aubry, 2014a). We identified four types of operators: (i) those who are dedicated to organic produce, (ii) conventional-based operators with an internal integration of organic activity and (iii) conventional-based operators pooling resources to organize the collection of organic produce and (iv) operators without collection of organic produce. Depending on these different types, farmers will have more or less opportunities to sell their produce in the organic chains directly in their network of operators. Usually, the fact of changing operators is a strategic choice, especially when the modalities of coordination (commercial contracts, technical advice, etc.) differ from one operator to the next. When the farmer's commercialization system is complex, with several operators of different kinds, it is the strategy as a whole

that has to be modified. Of the 16 conventional farmers surveyed, a large majority has no opportunity for outlets for organic produce in their network of operators. Only three have possibilities, but only with certain operators.

Other elements related to the size of the commercial leap should also be mentioned. The conversion to OF generally implies a major change in cropping plans and in agricultural contexts without livestock, and the introduction of pulse fodder crops like alfalfa is highly recommended. Outlets in the dehydration market are more advantageous as large surface areas can be put under crops. We have shown that the dehydration factories' radius of collection is very limited in Île-de-France, and that they strongly determine the presence of alfalfa in the cropping plans of organic farmers (Petit and Aubry, 2014b). Conventional farmers situated outside of the collection area of these factories would thus have limited outlets for alfalfa if they converted to OF.

Finally, singular commercialization strategies such as short supply chains (i.e. on-farm bread-making, oil mill, meat boxes, etc.) have implications for a conversion to OF. Although it is not possible to conclude on a strong correlation between commercialization in a short supply chain and proximity to OF, we find that this type of commercialization creates added value on current crops. This leaves more leeway technically, by relaxing demands on productive performance. For all farmers in short supply chains (C1, C3, C5, C10, C7 and C11), this mode of commercialization is however rather an element contributing to the farmer's disinterest in OF. They value what is "local", and conversion to OF would require a modification of their sales strategy, as well as acceptance of additional and costly control, which some of them clearly do not envisage (C1 for example).

A posteriori analysis of farmers in the process of converting to OF

The four farmers who converted to OF had relatively different conventional systems before the conversion. These differences are reflected in the range of scores for technical proximity to OF, from 9.7 to 16.1. They made medium to large technical leaps, which supports the hypothesis of a quick, sudden transition. However, while their cropping plans and sequences were not substantially different from those of conventional farmers, in the case of three farmers (Conv1, Conv2 and Conv4) we find a relative anteriority in the change of practices (organic inputs, mechanical weeding on traditionally hoed crops, reduced treatment, reduced fertilization, green manures, innovative techniques such as intercropping and localized fertilization). But these practices were implemented largely autonomously, outside of the farmer networks, on reduced inputs and integrated production facilitated by agricultural development agencies (e.g. Chambers of Agriculture). In contrast, the case of Conv3 shows that a major technical reconfiguration for conversion can be achieved by certain farmers.

As regards commercialization, the four farms made medium leaps as they all had at least one facilitating factor, especially concerning organic outlets and storage. The change was however disruptive for all of them, to varying degrees, as these farmers had to adjust to new operators and types of relations (types of price, technical support, etc.).

Discussion and conclusion

In this paper we propose a methodological framework to evaluate technical and commercial proximity to OF, based on an analysis of the scope of the leaps forwards, towards this goal. This enables us to examine the interactions between technical and commercial systems in the specific framework of OF. The issue of proximity to OF is complex, and a detailed analysis of the actual or potential transition processes shows that facilitating and impeding factors are entangled on farms. These factors depend strongly on the farmer's relations within the territory, especially with collecting firms. The dynamics of transition appear to be hybrid, between progressive change and a radical turn. Yet, in the context studied, we find no cases of close proximity of conventional farms to OF. Reconfiguring cropping plans and sequences, and reducing the use of inputs while adopting preventive management seem hardly feasible in a conventional system, especially with field crops in Île-de-France, and all the more so since these actions are not rewarded by the market.

The issue of proximity to OF is also complex because even if the techniques identified a priori as being organic may be used in conventional farming as said by Gratecap et al (2013), the action logics are generally different (e.g. organic inputs used to increase the level of organic matter in the soil and not to reduce the use of fertilizers; hoeing to work the topsoil and not to weed, etc.). Here, we based our methodological framework of technical proximity to OF on the agronomic underpinnings of OF, on the key techniques emphasized and on a preventive approach in technical management. But concerning some variables, we note finally few connections between conventional and organic farming. This is the case for the sowing techniques: in conventional system, to reduce the use of chemical inputs, it is recommended for winter cereals to delay the sowing date and to lower the sowing density. Conversely, in OF, farmers would rather sow early with high density to promote the crop development (generally to anticipate losses during mechanical weeding in spring). The variable “no tillage/tillage” is also debatable. We considered tillage as a criteria of proximity of OF since tillage is often presented as a major lever for weed management. But OF is fundamentally based on respect of soil’s life and in this perspective, reflections on no tillage in OF is expanding.

A basic criterion to assess the effectiveness of our framework of proximity to organic farming would be to consider the share of conventional farmers evaluated as closest to OF who effectively convert to OF. On this point, we show mixed results since farmers in conversion of our sample made medium to large technical leaps despite a relative anteriority in the change of practices. We also show that conventional farmers evaluated as closest to OF do not intend to convert to OF at the time of the survey. We probably need to have perspective to see how they have evolved on this point. Hence, identifying "close to organic" technical systems does not necessarily mean proximity in farmers' action logics. This difference between practices and the logics underpinning them is a subject that would warrant further research. Qualifying a farm's proximity to OF does not enable us to estimate directly a potential for conversion, neither on an individual scale nor on a territorial one. This point reveals indirectly the presence of other factors that may intervene in the choice of conversion to organic, foremost socio-psychological factors, even if we did not focus on them in this study.

If our framework of proximity to OF does not always and in all cases measure closeness between conventional and organic, it enables us to identify forms of distance of conventional farmers compared to a mode of production without limitation of the use of inputs. It identifies if changes are in progress in farms with alternative techniques and specific learning. It is a way to examine in greater depth the nature of changes that farms need to make and to identify precisely the impediments and technical and commercial levers that need to be activated to engage in transitions. Our methodology is therefore a complement to existing theoretical frameworks, e.g. efficiency-

substitution-redesign approach (ESR) (Hill and MacRae, 1996) and characterization of trajectories according to this ESR framework (Lamine, 2011).

From a more operational point of view, the analysis of the size of technical and commercial leaps, the conceptual representations of systems of practices, and spatial modeling (results not presented here) are potentially interesting material for territorial dialogue between different types of actors. By identifying the technical and commercial barriers and opportunities in a specific region, it could be useful to adapt organic farming development programs.

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