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THEME 4 – FOOD SYSTEMS, NETWORKS AND POWER STRUCTURES

Agri-food systems are among the most important human-environmental systems that shape our society. The sustainability of food systems is essential for food security and nutrition. Today, many of the current food systems have lost their connection with nature and/or with society and their sustainability is threatened by diverse challenges such as climate change, price volatility, food safety and consumer mistrust. To tackle these challenges, systemic changes in structure (e.g. networks and power structures), practices (e.g. rules and habits) and culture (e.g. norms and values) are required.

Creating spaces for collective action seems to be an effective strategy in reducing uncertainties and increasing transformative capacity. This requires collective action, which current governance structures and power are often restraining. Although agri-food networks are emerging and can be successful at a small scale, these networks often fall short of reaching their goal to bring about change at agri-food system level. Among the possible barriers is the fact that both practice and research remain focused on how innovations and sustainability practices are shaped at individual firm level, while agri-food systems and networks – as dynamic complex systems – are strongly interconnected. Furthermore, the urban-rural fringe is a still existing dichotomy in food systems studies. We need to find systemic approaches to look beyond these dichotomies and to realise new and re-connections. This is required not only in research but also in policy and practice. The challenge is also to learn how conventional food systems can (re)connect with nature and society in order to increase their transformative capacity.

CIVIC FOOD NETWORKS AND SUSTAINABILITY TRANSITIONS: THE EXAMPLE OF ORGANIC REGIONS AND ANTI-PESTICIDE MOVEMENTS IN THE BELLUNO PROVINCE, ITALY

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Abstract

In a context where the unsustainability of mainstream agri-food systems is increasingly evident, initiatives to promote sustainable agriculture and food systems localization have been multiplying. However, sustainability transitions require systemic changes in terms of practices, culture and structures (such as networks and governance systems). There is growing evidence of the role that civil society plays in creating or supporting sustainability-oriented innovations in agri-food systems, but in the context of territorial agri-food system governance, civil society organizations haven't been receiving much attention. The paper focuses on the Belluno Province, in the north-eastern Italian Alps. This area is similar to other marginal mountainous areas in Europe, where dynamics of agricultural abandonment are being addressed by increasing agricultural multifunctionality and a turn towards organic and other forms of environmentally friendly farming. At the same time, however, new dynamics of agricultural intensification are also emerging, driven by outside interests and potentially damaging for the local population and environment. The research explores two strategies created in response to this phenomenon and aimed at promoting territorial-level changes in agri-food system sustainability: the first is the creation of an organic district, and the second is a social movement mobilizing to decrease agricultural pesticide use. The research draws upon interviews conducted with organic farmers, local administrators, agricultural experts and consumer organizations to explore how civil society action was one of the key factors in the success or failure of each of these strategies.

Introduction

Agri-food systems are among the most important social-ecological systems shaping our world. Contemporary industrial-based models of food production, distribution and consumption, however, are coming under increasing scrutiny for their multiple dimensions of unsustainability. In addition, challenges such as climate change, environmental degradation and growing consumer mistrust have been intensifying (McDonagh, 2013). Despite the considerable attention that the concept of sustainability has been receiving in the past two decades, the development trajectory of agri-food systems remains on a largely unsustainable track (Abson et al., 2016). Sustainability transitions require systemic changes in terms of practices, culture and structures (such as networks and governance systems). In the case of practices and cultural change, and also in the case of networks, there is much evidence of the role that civil society plays in creating or supporting sustainability-oriented innovations – particularly social innovations – in agri-food systems (Kirwan, Ilbery, Maye, & Carey, 2013). When it comes to agri-food system governance, however, research has focused mainly on the role of policy and market actors in steering sustainability transitions, with civil society and social movements receiving considerably less attention (Andree, Clark, Levkoe, & Lowitt, 2019). Moreover, while the role of civil society in influencing the 'food' end of agri-food networks (see the literature on alternative/local food networks) is well-established, the role of civil society and social movements in steering changes in farming practices has received less attention.

This study focuses on civil society organizations' (CSOs) and social movements' efforts aimed at decreasing pesticide use in agriculture, especially those playing out at the municipality and territorial level. Such efforts have been multiplying across Europe (PAN, n.d.). The conceptual framework used in this paper seeks to bring together the concept of civic food networks (CFNs) (Renting, Schermer, & Rossi,

2012) arising from the Alternative Agri-food Networks (AAFN) literature, and the literature on the role of civil society and social movements in sustainability transitions. Despite having developed as separate disciplinary fields, AAFN and sustainability transition research have many common aspects: from a sustainability transition perspective, AAFNs have been described as niche innovations with the potential to foster socio-ecological transformations within the dominant food regime (see e.g. Lutz & Schachinger (2013)). Moreover, in both literatures there has been increasing attention for the role of civil society and social movements in developing initiatives that can facilitate sustainability transitions in agri-food systems (Köhler et al., 2019; Renting et al., 2012; Seyfang & Smith, 2007).

In addition to the above, changes in agri-food system governance are being influenced by the shift towards decentralized forms of government and by the growing demands placed upon peripheric areas to manage their own development (Darnhofer, 2015). This implies a need for increased civic participation and direct democracy processes. In this sense, multi-actor governance approaches are increasingly recognized as important strategies to promote sustainability transitions at a territorial level (Koopmans, Rogge, Mettepenningen, Knickel, & Šūmane, 2018).

Based on these considerations, the paper sets out to answer the following research questions: 1) how do social movements/CSOs influence the creation of policies oriented towards agri-food system sustainability (specifically related to pesticide reduction in agriculture? Particularly, in what circumstances do they establish themselves as significant players in agri-food system governance transition processes? And 3), does this have wider implications for sustainability transitions?

The article is structured as follows. Section 2 introduces the conceptual framework, which draws upon sustainability transitions, civic food networks and multi-actor governance literature. Section 3 describes the research methods and the study area. Section 4 first gives a narrative chronological description of the development of the case study and then presents the research findings. Section 5 discusses the findings in relation to the theoretical lenses and suggests implications for further research.

2. Conceptual framework

2.1 The local dimension and multi-actor governance

Research on the role of governance in sustainability transition has been shifting from national- to subnational-level processes and policies. But while the city level is received much attention, configurations that are either smaller (e.g. smaller municipalities), or that are defined according to other types of geographical (non-administrative) boundaries are less represented. Large scale urban areas also tend to be more represented compared to more rural settings. In this sense, cross-fertilization with AAFN literature, which has been historically more rooted in the 'local' – and to a large extent 'rural' – context can address this shortcoming. At the same time, the focus in sustainability transition literature on meso-level change (Geels, 2004), can help AAFN literature to shift away from the very 'localized' kind of analysis that has been the source of much criticism (DuPuis & Goodman, 2005; Köhler et al., 2019; Winter, 2003).

Moreover, the increasing withdrawal of the national state calls for non-government actors to take upon themselves new roles and responsibilities in defining local agri-food and rural policies (Renting et al., 2012). In this sense, multi-actor governance approaches are increasingly recognized as important strategies to ensure the co-creation of knowledge between all involved stakeholders and promote collaboration, potentially supporting the expansion of technical and/or social innovations at multiple scales (Koopmans et al., 2018; Pigford, Hickey, & Klerkx, 2018). The increased focus on sub-national governance levels in sustainability transition research may be partly due to the fact that at these levels the "devolution (or abdication) of state responsibility under neoliberalism opens space to do things differently" (Andree et al., 2019, p. xii). One compelling reason to focus on grassroots action (in agri-food systems and beyond) emerging from local CSOs is that it can potentially be more effective than

top-down policies in delivering sustainability benefits. CSOs can draw upon contextualised knowledge about what is important to local people, including how to present sustainability issues in ways that are more relevant and meaningful to them. This in turn can lead to solutions that fit the local context better (Seyfang & Smith, 2007). ‘Grassroots innovations’ have been described as “networks of activists and organisations generating novel bottom–up solutions for sustainable development; solutions that respond to the local situation and the interests and values of the communities involved” (Seyfang & Smith, 2007, p. 585).

2.2 The role of CSOs in agri-food sustainability transitions

Sustainability transitions are multi-dimensional and multi-actor processes, encompassing a range of elements and actions performed by a variety of actors and involving different kinds of agency and co-evolution. They are also characterized by a “dialectic relationship between stability and change” (Köhler et al., 2019, p. 2), where impulses for radical change are counterbalanced by attempts to maintain the status quo promoted by entrenched systems of power, ‘lock-ins’ and path dependence mechanisms. Finally, they entail a normative directionality, because sustainability has the characteristics of a public good and therefore private actors and the market often have no incentive to address it. These aspects point to the role that public policy (rather than the market) play, as well as the need for a dialogue among different actors, including CSOs. The role of the latter in steering the transformation of systems of production and consumption (including the agri-food system) is being increasingly recognized (Köhler et al., 2019). CSOs and social movements can influence sustainability transitions according to three major pathways: 1) by building public support for transition policies; 2) by creating protected spaces for the development of grassroots innovations (Seyfang & Smith, 2007); and 3) by promoting broader cultural shifts and redefinitions of values and beliefs that can drive changes in the preferences and everyday practices of both consumers and producers (Köhler et al., 2019).

2.3 Civic Food Networks

While early research on AAFNs mainly focused mainly on their potential to contribute to farm multifunctionality and rural development, more recent works have also explored the role of AAFNs in bringing about deeper and wider transformations in the organization of agri-food systems (Kirwan et al., 2013; Lamine, Renting, Rossi, Wiskerke, & Brunori, 2012). In parallel, the importance placed on citizens playing an active role in agri-food system governance (beyond being mere consumers) has also been growing, as demonstrated by concepts such as ‘food citizenship’, ‘food democracy’ and ‘civic agriculture’ (Lyson, 2005). This paper adopts the ‘civic food network’ (CFN) concept proposed by Renting et al. (2012) in an attempt to specifically address the role of civil society and to engage with the idea of citizens (producers and consumers alike) attempting to bring food democracy into agri-food systems. “The concept of food democracy is especially relevant as it “ideally means that all members of an agri-food system have equal and effective opportunities for participation in shaping that system, as well as knowledge about the relevant alternative ways of designing and operating the system” (Hassanein, 2003, p. 83).

CFNs influence agri-food system change in two ways: 1) by being a source of grassroots innovation and 2) as emerging governance mechanism (Renting et al., 2012). This is similar to the role of CSOs in sustainability transitions described in the previous section. In reclaiming influence over the way food is produced, distributed and consumed, civil society-based initiatives create spaces for innovation through processes of social learning and capacity-building. In turn, these innovations may pave the way for novel arrangements in agri-food governance mechanisms and create new negotiation spaces to interact either with market actors or with public administrations (Renting et al., 2012). While AAFNs literature has often focused on aspects concerning changing relations in market exchanges and food provisioning, the nexus between CSOs and public institutions has received less attention. Moreover, the cases that

have been explored along the civil society-(local) government axis mainly fall into the category of local food policy councils and public procurement schemes. Cases such as these illustrate how CSOs can work together with local administrations to improve agri-food system sustainability (Renting et al., 2012). However, they focus primarily on the 'food' end of the agri-food system, while there are fewer documented cases of the role of civic food networks in steering policies aimed at changing local agricultural practices. Two emerging examples are the movements towards the creation of organic districts (Stotten, Bui, Pugliese, & Lamine, 2017) and social mobilizations fighting for stricter regulations of pesticide use within municipalities or in (sub-)regional contexts.

Organic Districts

Organic districts (also called 'organic regions' or eco-regions), have been defined as territories 'naturally devoted to organic, where farmers, citizens, public authorities, realize an agreement aimed at the sustainable management of local resources, based on the principles of organic farming and agroecology' (IN.N.E.R, 2017). So far, organic districts have been established mainly in Italy (where 32 exist so far) and to a lesser extent in other European and non-European countries. Although most organic districts across Italy and Europe are still in their infancy and research on their development is still scarce, interest in these experiences has been growing, particularly in relation to their holistic and meso-scale (territorial) approach, which promises to be a way to scale-up agri-food system sustainability in a way that other forms of AAFNs are not able to do. The creation of organic districts has been described as a process driven by cooperation among various territorial actors and based on participatory approaches open to all civil society representatives. A review of the existing literature on the development organic districts, however reveals a common array of challenges and bottlenecks in this sense (Lamine, 2015; Stotten et al., 2017). A major issue is that in practice the wider local community is often only marginally involved in the organic district creation process, which remains primarily projects driven by producers' organizations, market actors, or local institutions. This translates into a lack of citizen understanding of the potential of organic districts and into a lack of interest in actively supporting them.

Municipal bylaws on pesticide use

Cases of municipal-level laws regulating pesticide use have been documented in academic literature for Canada (Pralle, 2006) and to a lesser extent for Europe (Kristoffersen et al., 2008). There is evidence that in Europe this is an issue of increasing concern. Europe's Pesticide Action Network (PAN)'s campaign 'Pesticide Free Towns', which tracks the progress of municipalities across Europe in banning pesticide use in public areas (PAN, n.d.) In most of these cases, however, the laws refer to non-agricultural pesticide use, such as the use of herbicide to manage weeds in urban public areas or in residential settings. Less researched is the topic of local-level mobilization against agricultural pesticide use at municipal level. The most notorious example is the municipality of Mals in the South Tyrol region of Italy, the site of an ongoing grassroots mobilization against large-scale, agrochemical-intensive agriculture (Ackerman-Leist, 2017). In Mals, a diverse group of citizens came together to establish the *Promotorenkomitees für eine pestizidfreie Gemeinde Mals* (Advocacy Committee for a Pesticide-Free Mals), demanding stricter municipal laws to protect citizens' health, promote sustainable agriculture and completely ban agrichemical use within municipal boundaries. Their campaign won an uprising of public support, including from the mayor. While this is the most famous case, also due to its success, similar cases have been occurring in other parts of Italy, including in the Belluno province (located not far from Mals) which is the subject of this paper.

3. Methodology

3.1 Study area: Belluno Province

The Belluno province (3672 km²) is located in the northern part of the Veneto region, Italy. Despite being the largest province in the region, it is almost entirely mountainous, and sparsely populated. Most of the 61 municipalities of the province have less than 5000 inhabitants, and the population is concentrated in the southern part of the province (Valbelluna), where the two largest municipalities (Belluno and Feltre) are located. The province hosts the Dolomiti Bellunesi National Park and the largest portion of the Dolomiti Unesco World Heritage site, and as such is recognized as an area of high natural and scenic value. The agricultural sector is mainly organized around the dairy supply chain, with dairy farms representing 52,9 per cent of the total as of 2010. Most of the agricultural land is used for fodder production (hay and maize), and as such does not require intensive pesticide use (De Pin, 2014). Similar to other mountainous areas in Europe, agricultural abandonment is a widespread phenomenon, as demonstrated by a 63 per cent decrease of the number of farms over the 2000-2010 period (Giupponi, Ramanzin, Sturaro, & Fuser, 2006). In addition, the dairy sector has been suffering as a result of milk liberalization policies.

Against this backdrop of agricultural decline in the conventional sector, two new trends have been emerging: first, the increase of multifunctional and diversified agricultural activities that combine agriculture, local food production and tourism. Environmentally friendly farming, localized food supply chains and tourism-oriented activities are increasingly being recognized as a way to support the local economy, in recognition of the fact that intensive models of agriculture are not suitable for the area and would not be competitive due to geographical constraints (Camera di Commercio Treviso e Belluno Dolomiti, 2017).

The second trend playing out in the province, particularly in the southern part, is the establishment and expansion of large scale intensive agricultural operations, especially vineyards. This kind of development has been driven mainly by entrepreneurs from the nearby provinces (such as Treviso and Trento), attracted by the lower land prices in the Belluno province. The areas where new vineyards have been implanted are expanding at a fast pace, partly driven by the so-called 'Prosecco rush'. Prosecco, a kind of sparkling wine, has gained enormous popularity globally, leading to the massive expansion of viticulture within the zones designated as traditional Prosecco production areas, where there is now virtually no more land available for new vineyards. While the original production area was limited to a few municipalities in the neighbouring Treviso Province, in 2009 it was expanded to include almost all the Veneto region, including the southern part of the Belluno province. This caused an upsurge of concern from local people, worried by the health and environmental problems linked to pesticide use in conventional viticulture and by the threat of the destruction of local biodiversity and landscape (Basso, 2018). Since 2008, various municipal-level resident groups have been organizing independently to protest this kind of agricultural development. The expanding scale of the phenomenon, however, prompted the creation of the provincial-level CSO 'Terra Bellunese' in 2014, which one year later launched the campaign 'Liberi dai Veleni' (Free from poisons). The campaign was supported by a large number of CSOs in the Belluno province, ranging from Solidarity Purchasing Groups (*Gruppi d'Acquisto Solidale*, GAS), environmental organizations, and the local organic farmers association (Dolomitibio).

This case study is noteworthy for several reasons: the first is the co-occurrence of the two rural and agricultural development dynamics described above, which point to two different visions of agri-food system sustainability and to two different rural futures. Second, it relates to contemporary debates about the sustainability of marginal rural areas and to new processes such as land consolidation and land grabbing by outside interests. Third, the area is both the site of a large-scale social mobilization against pesticides and of a proposed provincial-level organic district project, which are a direct response of the above dynamics. Finally, the case does not involve a single municipality, as in Mals, but a larger geographical area that encompasses several municipalities, and therefore can be seen as a large-scale effort towards agri-food system change.

3.2 Research methods

Data for this research was gathered from semi-structured interviews, focus groups and document analysis. While the study was conceived as a research project on newcomer organic farmers, and therefore it originally focused on individual and farm-level dynamics, it soon became clear that wider territorial-level dynamics were influencing the choices and actions not only of organic farmers, but more generally of the more environmentally-conscious local administrations and civil society organizations. As a result, additional interviews with non-farmer actors were undertaken in order to gain a broader understanding of these dynamics and the interplay among different actors.

A total of 33 interviews were conducted in July 2018 and August 2019, plus one focus group in August 2019. Among the interviews, 26 involved organic farmers, selected purposively to a) include a variety of farm types and b) to include individuals involved in the *Liberi dai Veleni* campaign and in the organic district project.

Two interviews were conducted with local administrators (representing the Feltre municipality and the Provincial government respectively) and two with agricultural experts. These institutional respondents were specifically selected because they took part in the organic district project and, in the case of the Feltre municipality representative, because of their outright support for the *Liberi dai Veleni* campaign. Finally, three interviews were conducted with spokespeople from local consumer groups – one fair-trade cooperative and two of the six GAS of the Belluno province. The focus group was conducted with 15 members of a third local GAS.

Interview questions addressed the topic of networks and participation in CSOs and projects addressing local agri-food system issues, and views on the future direction (imagined and desired) of the province in terms of rural development and agri-food system configurations. The interviews, ranging in length between one to three hours, were conducted in Italian and subsequently transcribed and translated into English. Interview data and field notes were then analyzed using thematic analysis (Braun and Clarke, 2006): the content was first coded, and then the codes were organized and grouped to identify patterns (themes) within the dataset. Secondary data, particularly press articles from local newspapers, were also used to reconstruct the timeline of events related to the organic district project and the anti-pesticide movement.

4. Results and Discussion

The ‘battle against the vineyards’: the birth of the organic district project and of the *Liberi dai Veleni* campaign

In 2014, the Dolomiti Bellunesi National Park (which had previously developed some initiatives to support organic farming within its territory) launched the idea of creating an organic district in the whole Province (Parco Nazionale Dolomiti Bellunesi, 2014). Even at this early stage two aspects were clear: the first was the emphasis on the Province’s high natural value, which made it ‘naturally’ suitable for the creation of an organic district; and the second was the organic district could be used to contrast the dynamics of agricultural intensification that were starting to occur in those same years. At the time, however, the proposal – aimed at local farmers, agricultural associations and other relevant stakeholders – failed to attract any substantial interest and was eventually shelved.

The idea was revived in 2017 through an EU-funded project that involved public and private partners: the local agricultural high school, the municipality of Feltre, the University of Padua, AveProBi (the regional organic farmer association), the Dolomiti Bellunesi National Park and one large-scale organic farm). The stated aims of the project were to gauge interest in the creation of the organic district and to construct a network to support the spread of organic farming in the Belluno province. Despite the

area's 'vocation' for organic production, organically farmed areas are limited, lower than the regional and national averages. The project therefore aimed at building linkages between research, industry and farmers and to understand the kind of technical support needed to encourage the conversion to organic. Over the course of the project, nine open focus groups were held, each with a different focus, mainly technical (growing organic cereal crops, aromatic herbs, soil fertility). Some focus groups also discussed public procurements and group certification (SITIABB, 2018). After the end of the two-year project, however, no further announcements were made about the creation of the organic district or about future developments of the idea.

In 2014, roughly at the same time as the first organic district proposal, citizens' growing opposition to the 'pesticide threat' coalesced around the civil society movement '*Terra Bellunese*'. Aware that the only way to impose stricter rules on pesticide use in a timely manner was to intervene on municipal regulations, the movement decided to focus on changing the municipal *Regolamento di Polizia Rurale* (Rural Police Regulations, RPR) (Poli, 2018). RPRs are municipal bylaws that regulate agricultural and land use practices within the municipal territory, including agrochemical use. As the existing RPRs in most municipalities were obsolete and inadequate to protect citizens' health and the environment in the face of new agricultural dynamics, *Terra Bellunese* drafted a new version. This RPR proposal was the concerted effort of the movement organizers, all local people from diverse professional backgrounds (teachers, organic farmers, lawyers and architects among others). Operating strictly on a volunteer basis, they researched the issue and drafted a proposal for more stringent regulations on the use of agrochemicals (stricter than the current national level regulation). Rather than prohibiting specific chemical substances or products, the new proposal bans specific hazard statements, thus making it automatically applicable to any new product released on the market. This initial draft was sent to all municipalities of the province for discussion. Furthermore, as part of the *Liberi dai Veleni* campaign *Terra Bellunese* organized several events, among which a signature collection, information sessions with doctors and scientists to inform the public about pesticide-related issues, and several public protests and marches. The goal of these activities was to show the opposition of the local population, influence public opinion and encourage municipalities to take a clear stand on the matter by adopting the new RPR.

Opposing the vineyard threat: 'land grabbing' and the emerging of a common identity oriented towards organic farming

The concern caused by the expansion of intensive cultivations clearly emerged from the interviews with farmers and institutional stakeholders alike. This concern takes two forms: apprehension for the increase in pesticide use, and frustration towards the idea of 'outsiders' buying up land. These two processes are both perceived in a strongly negative way and amplify each other. Significant in this respect are the words used by respondents to describe this process: 'invasion', 'colonization' and even 'land-grabbing'.

"There are some local entrepreneurs, but the majority is from Treviso, and they are really buying up – without most people knowing – hectares upon hectares of land. And after they buy, they can do whatever they want."

"We need to educate local people not to sell their land, otherwise it will be a disaster like in those places in the Treviso area. [...] The problem really exists, and in some places here it is turning into an emergency. In [place name] they are spraying [pesticides] twice a week"

"There are continuous attempts on the part of entrepreneurs from Treviso of snatching up land, and we will become a place to be conquered ("terra di conquista"). Because their land is very expensive while here people are willing to give it away for cheap, and we'll have Prosecco everywhere"

This sense of urgency is shared by consumer groups as well. In the GAS focus group and interviews, vineyards were indicated as the most urgent local issue on the topic of agriculture and environmental sustainability. Non-farmer respondents frequently highlighted the need to supporting organic farming to contribute to safeguarding the territory from these dynamics. There was also a consensus around the growing awareness level among the general population, attributed to the *Liberi dai Veleni* campaign.

At the same time, the idea of creating an organic district emerged over and over from different stakeholder interviews. The Belluno province was consistently portrayed as being uniquely biodiversity-rich, characterized by a high natural value and relatively wild and pristine landscapes. The comparisons with the two neighbouring provinces of Trento and Treviso, where monocultures have simplified the landscape and polluted soil and water (and where the 'land grabbers' come from), further contribute to the perception that the Belluno province is 'different' and 'naturally suitable for organic farming'.

"The Valbelluna is one of the most biodiversity-rich areas in Italy [...] and where there is already a high level of natural biodiversity, organic farming finds its 'natural habitat'. It's much easier to do organic here."

While many of the established organic districts in Italy have a sub-provincial territorial extension, in this case the organic district is always imagined and discussed as encompassing the whole provincial area. This strengthens the sense of distinctiveness compared to the neighbouring provinces, an image that is tied to its higher naturalness and lack of intensive farming. In one of the respondents' words: *"The organic district would be a good way to make the Belluno Province shine like a jewel, to stand out further from the neighbouring provinces of Trento and Treviso"* (20).

The establishment of organic regions in marginal areas is sometimes facilitated by specific territorial characteristics that can make the establishment and clustering of organic farms easier (Lamine, 2015). In some cases, organic districts were developed using the discourse of "a region left out by modernity" (Stotten et al., 2017, p. 147). This kind of narrative emerged often from the respondents' words, and was used to symbolically reclaim the dignity of the province. Despite having historically lagged behind compared to its richer neighbours, a newfound awareness is emerging of how this 'underdevelopment' might be beneficial in the perspective of a 'different' model of territorial development.

"In our misfortune we have been lucky: our poverty meant that we didn't engage in the large-scale destruction of our land, which is still relatively uncontaminated. So we should avoid poisoning it now, and later having to clean it up how they're doing in Trentino. Let's make organic the obvious choice for the Province."

"Until recently we envied the neighbouring provinces their economic dynamism. But if we go and look at those provinces, much richer than us from a purely economic standpoint, we'll see that they are based on unsustainable models of development."

It is possible that the recent dynamics of land acquisition and intensification may have strengthened this narrative, leading to the creation of a stronger identity in this sense.

The failure of the organic district project implementation

If the vineyard issue is perceived as such an urgent matter and the organic district is constructed as the obvious solution, why was its creation unsuccessful? The analysis of the respondents' interviews reveals four major issues: a) the limited agency of local organic producers; b) the unwillingness of farmers' unions to support the project; c) the lack of involvement of many of the local administrations; d) the lack of provincial-level coordination; and e) the lack of public participation.

The first issue was the inability on the part of local organic farms to play a significant role in moving the process along. Despite the involvement of the regional organic farmers' association (AveProBi), the project did not originally include the provincial organic farm association (DolomitiBio) in the project. In

the words of one of its members, *“a group promoting an organic district that doesn’t have the representatives of local organic producers as one of its main promoters is an anomaly. It sounds very top-down”*.

This is the consequence of several weaknesses within the association: the member farms are for the most part small scale family farms, with very few resources (human and financial) to invest in the project. Furthermore, the association almost exclusively includes organic farms in the southern part of the Province, revealing a territorial disconnection with the farmers in the northern part. Finally, farms without the organic certification cannot join, which results in the further under-representation of the number of organic farms in the province. This inability of presenting a united front is an element of intrinsic fragility that played a major part in holding back the establishment of the organic district.

This fragility is recognized by organic producers and by non-farming respondents alike and can be further connected with the second issue: the unwillingness of farmers’ unions to support the project. Agriculture in the province is strongly specialized around intensive dairy farming and lacks diversification, and farmers’ unions are unwilling to actively endorse organic farming. The attitude of the various farmers’ organizations and unions – which represent mainly conventional farmers – was defined as ‘overly cautious’ at best and as ‘openly against’ at worst. From their standpoint the organic district should be limited to one of the northern districts, where a small cluster of organic dairy farms is already established. Even though a provincial-wide district is regarded as important to steer the future development of the area in a sustainable direction, sectorial interests work against its establishment. One of the institutional representatives described the attitude of farmers’ unions as such:

“The farmers’ unions do not care about it [the organic district] because most of their social base is afraid that talking about ‘organic’ means, indirectly, to talk in a negative way about conventional. They should understand that having organic farms nearby can benefit them too. But if we wait for them, nothing will ever happen.”

The inability or unwillingness to act that characterizes the various counterparts within the agricultural sector and the lack of dialogue between organic and conventional is mirrored by the inertia of most local administrations. Farmer respondents noted a general unwillingness to concretely support initiatives aimed at increasing agricultural sustainability at the municipal level:

I think they should express more clearly their support for organic practices, something that they don’t do for political reasons. [...] very few are willing to do this, and [...] to go against the status quo.

The issue that is perhaps the most critical from a public administration standpoint is the lack of a strong provincial-level leadership which could steward the creation of the organic district and bring local administrations together. This is a consequence of the application of the 56/2014 Law (Delrio) which, in an attempt to give more power to municipal administrations, essentially stripped provincial governments of decisional powers and financial resources. However, while this may be beneficial for larger metropolitan areas, in a sparsely populated territory with no large cities to take on a coordinator role the lack of a Provincial government proved to be one of the biggest reasons why the organic district project did not progress to the implementation phase.

Finally, there was very little involvement of civil society groups in the definition of the organic district project, which was essentially the result of ‘closed door’ decisions taken by the project partners. And while the general public was invited to the public meetings, the project failed to inspire widespread support among the civil society. In this case the co-production aspect, where stakeholders define a common narrative and work towards identifying common problems and goals, was overlooked. While this common narrative was clear to the promoters of the project, it failed to involve the local population and therefore to gain public recognition and support.

The Rural Police Regulation approval: a model for a 'bottom up' organic district?

Comparing the organic district project to the way the RPR were created (and ultimately approved) can shed some light on how a more successful transition may occur, as the RPR can be considered as a more successful example of co-production and cooperation. The most interesting case is that of the municipality of Feltre. When the RPR proposal by Terra Bellunese was sent to all municipal administrations of the province for discussion, Feltre did something unusual: let its citizens discuss the matter and decide whether they wanted to approve it. This was constructed as a direct democracy experiment held as a part of the 'citizenship labs' promoted by the municipality. During the meetings, open to everyone who wished to participate, the proposal was collectively discussed and modified. The process started in October 2015 and ended in October 2016 with the approval of *Terra Bellunese's* proposal. One of the *Terra Bellunese* founders described it as:

[...] the result of one year and half of work. It started from the bottom up, and it was surprising because in the end several [other] municipalities adopted it. Feltre was incredible, we held 11 meetings and at the beginning we encountered the opposition of conventional farmers and of farmers' associations, because they felt it was too limiting, but in the end it was approved.

The most notable aspect of the RPR is that it was fashioned through a process of co-creation involving a close cooperation between civil society and the municipal government. It also highlights citizens' willingness to become involved first-hand in decision making process regarding their territory and its future development, especially when faced with urgent threats to public health and the local environment. Eventually the RPR was approved without significant changes by Belluno and by other 12 municipalities of the province (without undergoing the same participatory process as Feltre). Although the new RPR does not automatically ensure farmers' compliance (although municipal personnel are being trained to carry out inspections), it is playing a significant role in mitigating the spread of new intensively managed vineyards. In one of the new vineyards created in the territory of the Feltre municipality, for example, the original plan to plant Prosecco grapes was abandoned, and the owners switched to resistant grape varieties which require less treatments.

The RPR experience therefore demonstrated what a committed citizenship could achieve when paired with a supportive administration, and the ripple effects created in the surrounding municipalities. Respondents often spontaneously compared the RPR creation to the organic district project, emphasizing the bottom-up aspects of the former to the distinct top-down flavour of the latter. The creation of an organic district 'from the bottom-up' was often mentioned as one possible path to revive the organic district project. The following quote shows the organic district being conceptualized as a collective, civil society- and citizen-led approach:

" there are some new efforts being made by the various GAS in the province, which are starting to network among themselves and talk about [the organic district]... if we could spread this organic district idea at a more popular level, if it were something in which citizens believe in as well, then it would become much easier. [...]

Further steps forward came again from Feltre. The local administration decided to support organic farming directly by renting municipally-owned land to organic farmers, and also promoted citizenship labs on issues such as green mobility, renewable energy use and waste management. These meetings are a further attempt to create spaces where perspectives of a more sustainable future can be imagined, shared and discussed. From this point of view, and through the involvement of a wider group of citizens, the organic district can become more than a territorial economic development strategy promoted by farmer groups (as it is often the case): it can be re-imagined as a comprehensive framework that encompasses environment and biodiversity protection, public health, local food systems, transportation, energy use. This goes in the direction indicated by similar experiences, most notably the Drome Valley in France (Lamine, 2015). Striving to create this kind of organic district, one that goes

beyond territorial branding and promotion, might eventually give a deeper significance to the concept of organic district itself:

“Creating an organic district is very easy... since there is no reference law yet, me and you could even create one right now. [...] There are 29 of them in Italy, but nobody knows about most of them. It’s nothing but a self-proclamation. [...] they are not active, and we would like ours to truly support change among farmers, but also to stimulate a transformation in the direction of sustainable energy, ecotourism, transportation... it’s a bit of a visionary project, really.”

While the focus of organic districts is usually on agriculture and food production, this case study offers an example of a strategy to involve citizens more directly in processes of sustainability transitions at the local and territorial level, and how the concept of organic district may be redefined to include broader sustainability concerns. It is not only the system of production and marketing/distribution that needs to change, but the behaviour of citizen-consumers as well (Lamine, 2015). In the words of one respondent:

“it’s easy to tell [farmers] what to do. The kind of attitude like “It’s okay to do organic, but you, farmer, should do it... I, consumer, will keep using my car, shopping at the supermarket” ...an organic district should be a place where farmers grow organically, and citizens also behave accordingly. And therefore, [a place] where they think about sustainable transportation, localizing consumption and all those other aspects.”

Moreover, while the creation of the organic district has so far failed because it aimed at reaching an a-priori consensus among a narrowly-selected group of stakeholders, the way forward might be found in a model closer to that of the RPR and of citizenship labs. This might involve drafting a proposal with the participation of all civil society actors willing to be involved, and then trying to reach a consensus through an open process of co-creation. When thinking about the possible scenarios of change and transition towards sustainability in the Belluno province, a future where the constellation of existing stakeholders and group of stakeholders come together to create a network of small, concrete initiatives from the bottom up starts to emerge. For example,

“places where organic farmers can bring their products, but not just a sales point, something more innovative... open to new ideas about food, environment, maybe even tourism [...] places that keep nurturing the chances for farmers to cooperate among themselves, and to expand these interactions to the wider society.”

One final issue is the fact that the decision to promote direct democracy processes depends on local administrations. For example, the municipality most affected by the expansion of vineyards did not accept the new regulations, despite widespread protests from its citizens. While this could have been an opportunity to display a common stance on the topic of territorial sustainability, it was not embraced by all local administrations. This points once again towards a lack of territorial cohesion, where specific interests prevail over the common good. This is perceived as a pervasive issue, starting from organic farmers (who have not been able to come together in a formal group) to civil society associations (often divided by ideological differences despite having similar visions about territorial sustainability) to local administrations. As summarized by one of participants,

“One of the greatest limitations [...] is the lack of a common vision, the idea of moving ahead together. A sort of ‘common good’ (bene comune) idea, of doing things together because eventually everyone will benefit from them.”

Conclusions

It has been recognized that systemic change in agri-food systems unfolding at territorial level requires not only the cooperation between public and private sector organizations, but also inclusive

participation and bottom up involvement of civil society groups (Favilli, Hycent, & Barabanova, 2018). However, this rarely happens, as this example and the experience of other organic districts show. This paper explored how the grassroots campaign *Liberi dai Veleni*, born out of local CSOs and social movements, was able to act as an agent of change on local agri-food regulatory systems by actively and successfully engaging in redefining local regulations. This success is related to the movement's capacity to mobilize public action by focusing on transversal issues that strongly resonated with the local population. This is also in line with the principles of multi-actor governance processes, which involve dynamics of co-production, co-management and co-governance between private and public sector, the identification of common problems and of shared strategies to address them (Koopmans et al., 2018). In this paper, a successful case (the RPR and its approval process through citizenship labs) and an unsuccessful one (the organic district project) were described and compared. The RPR case demonstrates the effectiveness of a truly bottom-up approach in fostering the emergence of a common vision centred around sustainability values. In conclusion, initiatives aiming at territorial agri-food system change cannot become real vectors of transformation unless they strive to involve citizens from the beginning and to facilitate structural and behaviour changes. Collective and direct democracy-based action is necessary to ensure a sustainable agri-food future.

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LINKAGES BETWEEN AGRICULTURE AND FORESTRY IN FOOD PRODUCTION: BUILDING RESILIENCE OF RURAL COMMUNITIES

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1. Introduction

Agriculture and forestry represent two key types of land use in rural areas. Land use represents a broad field of academic research addressing questions related to land use conversion, conflicts associated with land use, land use management, land use and landscape management, and others. However, there is little evidence, apart from discussions related to traditional landscapes and biodiversity, explaining the interlinkages and factors linking the two most common land use types. The scarce evidence available on the ways how the two types benefit one from another illustrates that the separation between agriculture and forestry and the studies addressing the separation might be overlooking some essential aspects of the relations between the two. To be more precise, addressing the mutual interlinkages enabling the two sectors might help to engage with issues like rural development, regeneration of ecosystems, empowerment of local communities, improved sustainability, circular economy, improved economic performance and possibilities. Additionally, this might help to better understand the overall processes shaping agriculture and forestry.

Furthermore, the fields that do recognise these interlinkages and address the two land use types as supplementary have already illustrated the benefits of the approach. Most commonly these benefits are acknowledged in the context of maintaining biological diversity, for example, in the form of the rich mosaic of habitats associated with traditional agriculture of local communities (Guadilla-Sáez et al. 2019), in the form of greening payments and green infrastructure. Researchers have been reporting that there is a geographical overlap between the areas with the highest biological diversity and areas managed traditionally (Guadilla-Sáez et al. 2019). Traditional rural landscapes are associated with low intensity of anthropocentric disturbances, higher presence of traditional species and higher diversity of habitats. Europe, a continent that is almost entirely shaped by human intervention, serve as an illustration for this – biodiversity is almost exclusively dependent on traditional practices. Still, a set of socio-economic drivers are pushing these practices out. There is also evidence of agriculture and forestry being linked to improved household livelihoods by ensuring households access to different resources, through agricultural practices like agroforestry or through the potential of these interlinkages to ensure resilience. Thus both land-use types offer mutually supplementary economic, social and environmental possibilities, that can be fully apprehended only when they are interpreted in association one with another. Finally, there are also clear cultural interlinkages tying the two together. This dimension appears as traditional culture being embedded in a place and manifesting itself through a place. These interlinkages are apparent both at the micro-level – where people residing in a place manage their daily routine in a way that reacts to their surroundings as one total and at the macro-level – where global drivers of change always push the two land use types closer.

This paper discusses specifically the linkages between two of the land use types – agriculture and forestry. This paper suggests studying relations between agricultural and forested lands to develop new ways to conceptualising land use that would be more appropriate for the contemporary challenges associated with the two land use types. However, addressing people in place (an approach that would allow capturing the full spectrum of interlinkages) would be too broad to address the task this paper raises. Thus, a more specific empirical focus is selected - the paper looks at cases when people use food production, processing or distribution to link the two land use types. The paper illustrates that by linking the two types rural inhabitants diversify the production and structure producers' relations to consumers, improve their livelihoods and ensure the subsistence of communities, and even improve

farmers' position in the agri-food supply chain. On numerous occasions, the people engaged with agriculture or forestry link the two types to enhance their prospects and current social position.

Although recognising that relations between agriculture and forestry should be reassessed at all levels, this paper concentrates on micro-level practices – on the daily experiences and management strategies of inhabitants of rural spaces. The paper relies on evidence gathered in Latvia. In Latvia, both high share of land is covered with forests and with agriculture. Furthermore, although the ownership of agriculture and forested land is continuously concentrating, a high share of smallholders remains both among forest owners and owners of agricultural land. Furthermore, evidence also illustrates that among owners of agricultural land, there is a higher share of owners of forested land. Thus there are natural ownership interlinkages that can be used as a starting point for the article. The article is not discussing the issues related to the domestication of wild products.

This paper starts with a short methodological overview. It then proceeds to discuss typical ways how the two land use types are linked and the conflicts observed between agriculture and forestry.

2. Methodology

The paper is based on data collected through several projects addressing ways how rural communities engage with wild products (TRUST: Innovations in Non-timber Forest Products: Towards Rural development and Sustainability), the role of small farms in regional food systems (SALSA: Small farms, small food businesses and sustainable food and nutrition security), and the institutional arrangements structuring agricultural markets (SUFISA: Sustainable finance for sustainable agriculture and fisheries), the role of innovations in creating sustainable production and consumption (SINFO: Social Innovation in Food Provision: Pathways to Sustainable Production and Consumption). None of these projects was addressing relations between forestry and agriculture directly. However, this was a theme that kept to be reappearing through the in-depth interviews conducted for these projects. This paper combines evidence from these projects and presents them to illustrate how the two land use types are interlinked. Specifically, it looks at the explanations provided in these interviews and uses them to build a coherent explanation of the relations between the two land use types. Additionally, each of the projects addresses a somewhat different target group – TRUST among other things discusses both small and large firms benefiting from wild products; SALSA engages with small farms and small food businesses; SUFISA allows engaging large farms; SINFO covers innovative food initiatives. Together these projects offer a broad overview of the way how forestry and agriculture are linked by a large set of actors.

3. Merging the two land use types

From the interviews conducted with farmers and actors who have built a business out of engagement with wild products, we identify four strategies that are used to link forests and farming. The strategies presented here are those that are allowing actors engaged with forests and agriculture to profit from the connections between the two land use types. This means that the cultural connections linking the two land use types farmers might have presented during interviews are not considered here. However, there is a need to discuss the cultural connections at least superficially. Mainly this is because how widespread these practices are. Most of the farmers interviewed if not all were also suggesting that they have been harvesting some non-timber forest products from the wild. Foraging is a common practice in society in general – to collect wild products. It is even more widespread among farmers. The same thing can be said about people interviewed for their engagement with foraging – all of them were reporting to have at least a small plot where they were growing food for household consumption. Thus, being engaged with both is deeply rooted in the culture and meals served on the tables of rural inhabitants are continuously linking the two land uses. Any interpretations of the interlinkages

agriculture and forestry might have, should take into consideration the deep cultural rootedness farming and foraging hold in society.

When it comes to commercial ties between the two land use types, two axes captures the difference between the various strategies how the two are interlinked. The first axis is the regularity of the connections. The second axis illustrates the commercial significance of established connections. Thus, some of the identified strategies choose to link the two land use types irregularly, and the connections are not economically significant to actors linking the two. In other cases, the opposite happens - rural entrepreneurs choose to link the two regularly, and this linkage is crucial for their business. Two additional things have to be mentioned here. First, the interpretation of connections presented here is just one of the way how these interlinkages can be presented. Second, the paper does not provide information on how widespread the strategies are.

3.1. The four strategies of connecting forestry and agriculture

The first group to mention here are those irregularly connecting agriculture and forestry while the connections they are creating are of low importance - the connections between the two land use types could be broken, and that would have only a marginal effect on the enterprise. Most typically, this is the case when the connections between the two land use types are established for marketing purposes. Some of the respondents selling harvest from their garden were also offering seasonal products from the wild to their customers. Interestingly, the same thing could be observed among foragers as well. People professionally engaged with wild product foraging and selling were using products from their gardens to diversify their offer. These were, however, mainly small farmers or small-scale wild product traders. However, their motivations are something worth discussing. For some of them, this was a marketing opportunity – a possibility to present a more diversified set of sold products.

Furthermore, in an interview with a restaurant owner, the respondent stated, that they would expect that the small farmer who was selling them their homegrown products, would also supply the restaurant with seasonal wild products as well. Thus, we might assume that the diversification of products is not so much a traders marketing imagination, as it is reflecting consumers' expectations. For consumers, all that is perceived as local produce comes from one source – a rural farmer. Consequently, we could suggest that this particular way of doing business is representing a cultural image of what does it mean to be a small commercial farmer or forager.

The same strategy, however, is used by a group of less sophisticated traders as well. Those that are using the whole diversity of the products available to them for marketing purposes in most cases have well developed commercial channels to sell their products. They know their customers and have a clear grasp of their needs. However, there are also those actors who benefit from agriculture and forestry in a less organised fashion. This group of actors have low income and does not have the means to introduce a permanent income source. They are fighting this by looking for all the possibilities of trade that emerge to them. For example, some of them were selling wild products using roadside stalls, they used the same stalls to sell midsummer wreaths during the time of summer solstice, or they are selling excess produce from their gardens. Yet they are not looking for how to convert their trade into something stable. It is rather sporadic. It also seemed that this group was more reliant on wild products. Probably, it can be explained with the nature of wild products – they are openly available, and even when engagement with these products are regulated, it is still hard to monitor how are these regulations implemented.

What characterises this group is that the engagement with forests is unstructured. It is impossible to be unstructured about farming. Nevertheless, it is possible when it comes to engagement with forests – one can benefit from forests without building complicated social structures to do so. Also, typically, land use is profoundly affected by infrastructure and population density. These interlinkages between the two are not affected by the two factors. Finally, these relations are not putting the two land use types in conflict.

The second type of strategy to mention here is characterised by irregular relations, which nevertheless are crucial for actors connecting the two land use types. The first thing to mention here is that in the empirical material, there are no cases, where relations as just described would have been introduced by actor, whose primary interest is forestry. All of the relations in this group were initiated by farmers. In fact, this should not come as a surprise, because agriculture and forestry operate in two very different time frames, and while forestry can be associated with the irregularity of engagement, agriculture demands regular attention. In this case, the significance of the relations is not associated with the products forest can provide, but with the particular services, forest grants access to. There are three ways how we observed these relations in our inquiry. First, infrastructure crucial to agriculture might be located on forested land. For example, melioration systems commonly are crossing land covered by forests. This ensures that in farmers mind the two land use types interrelate. Second, forest operates as a cash reserve accessible in difficult periods or when investments have to be made. Thus, instead of looking for a bank loan, farmers use forests as cash deposit that they withdraw when needed. This approach allows farmers to become more resilient. Furthermore, this allows farmers to be more independent from financial institutions.

Additionally, there are few opportunities for small or medium-sized farmers to access funding. In most cases, actors providing funding to farmers are working with large farms ignoring the smaller ones. On top of that, it seems that many farmers are preferring to distance themselves from taking loans. Consequently, having a forest that can be capitalised and invested in the farm is both a way how to overcome the cultural distance smaller farmers has towards burrowing as well as a way to overcome structural challenges observed in relations between banks and farmers. Finally, the third way how this strategy plays out is through the conscious use of ecosystem services, the other land use type provides (such as protection against sudden rainfalls or winds).

The third strategy to be discussed here is characterised by regular interlinkages that are of crucial importance to people maintaining these interlinkages. In practice, this though can mean very many things. For example, some small farmers reported that they benefited from the particular surroundings of the farm – either by using materials from the forest on the farm (such as firewood), or by using landscape in the advantage of farming. Some other farms used closeness of wooded areas to structurally and permanently diversify their business. There are cases of farmers who have opened guesthouses using their nearby forests to introduce additional activities for guests. There is also evidence of the opposite – where the farm mainly sells wild products while the farm is just space that can be rented to tourists willing to enjoy the rural landscape. Also, among the interviewed people, there are respondents, who have benefitted from the closeness of forest by introducing new farming practices. For example, a respondent mainly working with arable crops some years ago decided to introduce goat farming. He used the wooded areas nearby as pastures for the goats. The farmer claimed that wheat farming, although highly profitable, is also unpredictable and thus, income diversification was crucial to him.

However, probably the most critical group using this strategy are farmers, that have up-taken farming in order to introduce a commercially successful wild product trading enterprise. The most obvious evidence of this connection comes from people working with herbal teas; however, other cases exist as well. These people domesticate what they can and gather from the wild what is either impossible or too challenging to domesticate. Consequently, they have farms that simultaneously operate as conventional farms, yet that is also looking for a way to harvest from the wild. The employees of these herbal tee farms are trained to harvest what has grown on the farm as well as the products that grow in the wild. On one occasion, the farmer was supplementing these arrangements with an apiary he held on the farm. Because of the herbal teas, he had many flowers surrounding the farm. Farmer used the unique surroundings of his farm to diversify their income sources further. It is worth noting here, that those who have decided to pursue this way of operating on their farm shows high competency in the way how the market works and how they can sell their products. Although in broad terms they could be classified as small or mid-sized farms they are exceptionally well connected to global markets, many of them are certified and sell only organic produce, they also show deep knowledge of ways how to market their

product to customers and – many of them have managed to install in farm at least some processing equipment, that allows them to sell the product for higher price.

Finally, some linkages are regular but with low significance for actors' overall performance.

4.2. Conflicts emerging between the two land use types

The closeness of the two land use types is not just manifesting through positive experience – it can cause tensions as well. Many of the possible conflicts have been widely discussed in the literature addressing land use. However, the presented interlinkages between agriculture and forestry should be used to add a layer of meaning to the tensions described in the literature. The following examples should be seen as an illustration that the conflicts that might seem to be illustrating a crack between the two major land use types in Latvia are not always there. The observed conflicts are instead an attempt to change the behaviour of particular groups. Furthermore, often, these groups that are meant to be persuaded are standing far from real engagement with agriculture or farming.

The first tension to be presented here is associated with conversion from one land use type to another. Availability of land and especially agricultural land has been an aspect stressed in interviews with farmers. Although to be fair, this claim has rarely been raised by smaller farmers. Instead, it has been often raised by large farmers who, as mentioned before, has much easier access to credit. The argument goes that much of the land is slowly taken over by shrubs and consequently are taken over by forests. This argument fits well with pan-European discussion on land conversion. However, as illustrated by data, most of the farmers own at least some forested land; thus, probably they do not have any objections towards wooded land per se.

Furthermore, Eurostat Land Use data is showing a decrease in the share of land used for agricultural purposes, yet only marginal increase can be observed for the share of land used for forestry. Instead, the fastest growth can be observed in the share of land unused and abandoned (Eurostat, 2019a). On top of that, it is not the land used for crop farming that has shrunk during the last decade. On the contrary, this particular land cover has grown its share in Latvia. Instead, the most notable decrease of share can be observed for grassland (Eurostat, 2019b) – a land cover that usually is associated with a smaller scale of activity and herbivore farming. The decrease of grassland can be associated with a substantial decrease in the number of small dairy farms observed during the last decade. Consequently, the real conflict is not so much between forestry and agriculture, as it is between the group using rural areas for production and those, that are not doing that.

The second conflict between agriculture and forestry is associated with the presence of wildlife. Forests, being a home of wild animals, are often presented as a threat to farming. The argument suggests that if left unchecked, the population of wild animals will reach a level, where it will become a threat to local businesses. Farmers were claiming that due to the wild animals, farmers are losing their harvests (an argument that can be heard everywhere where farming has to coexist with forestry). Thus, in this regard, the closeness of the forests is presented as a threat to farmers' commercial interests. In some interviews, this question is also interpreted in the light of possible diseases wild animals might be carrying around. Global food scandals and the recent outbreak of African swine flu in Latvia have just strengthened these arguments. Still, even in this case, the accusations are not as much an attack against forests, as it is an attempt to reshape the overall attitudes towards various models of forest management. Furthermore, as it will be shown in the following paragraph, it was not even a clash between governing institutions responsible for the two sectors – the same Ministry overlooks both forests and agriculture. It was instead a clash between groups regarding rural territories as a source of income and those, that are supporting greater environmental protectionism.

Data on wildlife as presented by Ministry of Agriculture illustrates that indeed after Latvia regained independence, the number of wild animals in Latvia's forests started to grow (Ministry of Agriculture,

2019). Furthermore, the quota for animals that allowed to be hunted during the last decade of the 20th century and the first decade of the 21st century was growing much slower than the number of animals. This led to farmers vocalising their challenges. This outcry was amplified by farmers organisations, the Ministry and the spread of the African swine flu. Yet it was directed only towards public opinion and environmentalist groups. There was no common response from forest owners. However, since then, the situation has changed drastically. Although the population of some animal species have continued to grow – some have witnessed a sudden sharp drop in numbers. Meanwhile, those species whose population have continued to grow, in most cases have also witnessed a significant increase in hunting quota (equivalent to the growth rate in absolute numbers). However, for a number of species, the number of hunted animals does not catch up with the quota. Thus, although the preconditions to maintain the wild animals' populations have been introduced, it is the social aspects that limit their successful implementation.

With that being said, it is not the intention of this paper to discuss the optimal number of wild animals in Latvia's forests. Instead, the previous paragraph should be interpreted in the light of relations between forestry and agriculture. It shows that the challenges associated with the wilderness is not a challenge agriculture poses to forestry. It is instead a challenge posed to forest management approaches, an attack on environmentalist groups and an attempt to engage the hunter community. It is an attempt to reshape the ways how broader society perceives the best management models for forests.

Finally, the third issue of generating tensions is the use of infrastructure. On the one hand, this is related to melioration that has been discussed earlier. On the other hand, this is related to roads located around rural areas. There have been public accusations regarding who causes more damage to public infrastructure. Many actors, including farmers, have been pointing fingers at enterprises logging timber. Clearly, these actors are not without a fault. Still, farmers as well have large machinery that moves across the public roads much more often than the machines operated by logging enterprises. It can be suggested, that both sectors are putting stress on public infrastructure that the infrastructure cannot hold. However, it must also be recognised that much of the problem is associated with the low quality of the roads – and insufficient public budget allocated to the maintenance of road infrastructure. Furthermore, the public bodies responsible for forestry has allocated a notable share of their budget to build and rebuild roads. Again, it is worth to remind that the article is not giving a judgement on how to assess the intensive road-building initiative in Latvia's forests maintained by the department responsible for forests. There have been strong arguments for and against it. The article is instead aiming at illustrating that the critique each sector might have one for another (the aspects of critique that are illustrated by interviews) are not really as straight forward as they might appear. This conflict should probably be interpreted as an illustration that nobody is willing to take the blame for the bad condition of rural public roads, yet everybody willing to point out that something needs to be done with the issue.

The three presented aspects of portrayed conflict should be interpreted in the light of the fact that farmers are more commonly forest owners than society in general. They are benefiting from both sectors, and thus they are not inclined to facilitate conflict between the two. Furthermore, as this sub-chapter illustrates, although some of the issues characterising relations between the two sectors could be framed as a conflict, most likely, it is not. It is rather a conflict with some other groups of actors. The interests of the two sectors are too intertwined.

Acknowledgements

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FOOD SECURITY IN THE MEDITERRANEAN BASIN WITH AN ANALYSIS IN MACHINE LEARNING

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INTRODUCTION

The Mediterranean region is a biome of specific richness of world importance (Underwood et al., 2009), where population is constantly growing (from 446M in 2000 to 570M in 2025 – geoconfluences, 2014)⁵⁸, urban development increases, while only 14 % of the region can be devoted (consacré) to agriculture and food production (118 millions of hectares – Zdruli, 2014).

The problem is complex, Mediterranean agricultural systems are heterogeneous (from single-species industrial production to traditional small farms), faced with the necessarily that determine the developments of the agricultural sector (market conjunctures, national and international policies of regulation of uses or production standards), makes the consensus needed for public action more difficult (Smith, 2009; Lambin and Meyfroidt, 2011).

Today, urban policies need to incorporate food security considerations and focus on building cities that are more resilient crises. There is a growing recognition of intra and peri urban agriculture and forestry as an important strategy for climate change adaptation and disaster-risk reduction (Lwasa, Dubbeling, 2015). But for the moment food insecurity is still a major global concern for example in sub-Saharan Africa, the number of people suffering from hunger is estimated at 239 million, and this figure could increase in the near future (Albert Sasson, 2012)

In this way, to try to understand all this system, there is a need a tool for representation multi-scalar analysis to determine the evolution of agricultural systems at the local territory level and their constraints.

In this perspective was established a spatial database at the INRAE d'Avignon (Ecodéveloppement) with high resolution (8-10km), homogeneous on the Mediterranean basin: between 2005 and 2015 or are detailed the topography (slopes, altitudes, etc.), land use (urban area, vegetation, crops, bare soils, forests), bio-climatic elements (temperatures, rainfall, etc.) and socio-economic elements (population, agricultural practices, etc.).⁵⁹

we will ask ourselves the question: which variable the most representative of the database explains the production of wheat?

METHODS

Borders

In the first place, defining the border or borders in the Mediterranean is an arduous study, and differs according to the research disciplines. We can mention some examples of work in ecology for the environmental stratification in Europe (Metzger et al., 2005) (cf. figure 1) and in geographically oriented with (Malek, Ž., & Verburg, P, 2017) (cf. figure 2).

⁵⁸ <http://geoconfluences.ens-lyon.fr/actualites/veille/parutions/world-urbanization-prospect-2018>

⁵⁹ <https://hal.archives-ouvertes.fr/hal-01907477>

Ž. Malek, P. Verburg

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Figure 1 : The méditerranéan border in Géography of Malek and Verburg.

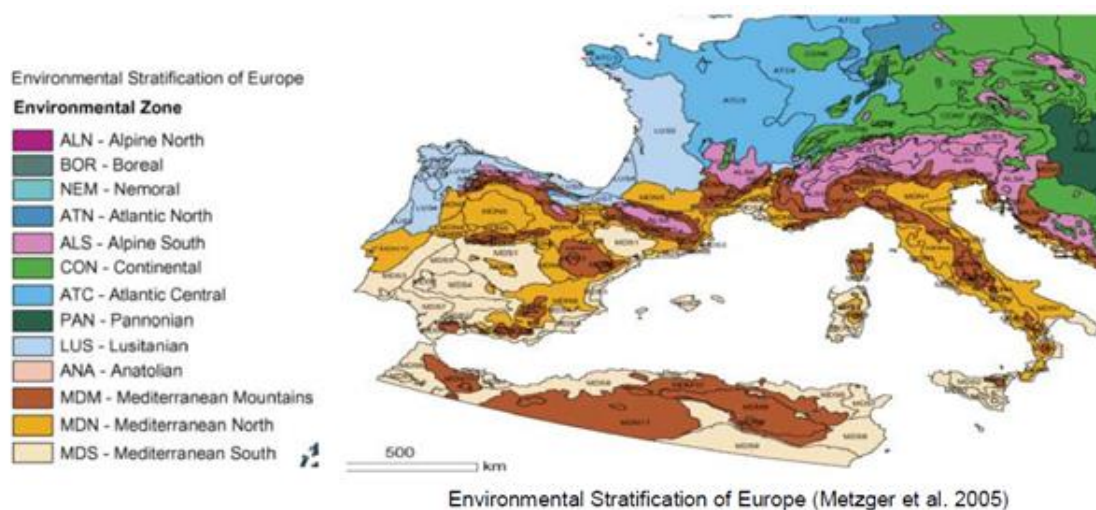


Figure 2 : The méditerranéan border in Ecology of Metzger et A.l

In our case, the Mediterranean has been redefined in three area.

In first, for the North, the border is based on the recent work of the research project « Divercrop⁶⁰ », by using the definition of the European environmental zones made by Metzger et al including the Southern Alpine zones located in continuity of the Mediterranean zones except the Carpathian Mountains. On the South, approximately, we have focused on the arid zones using the map of rainfall (zones < 25 mm (Icarda,2011), (cf. figure 4). This area is interesting subject to extreme climate temperatures

⁶⁰ THE DIVERCROP research project (N° ANR-16-ARM2-0003-01) funded by Arimnet2 program (FP7 – ERA-NET no. 618127; Mediterranean Agriculture .

Finally, in red color we name the «Intermediate zone» (cf. figure 3) between North and South on the southern and eastern edge of the Mediterranean, with slightly more favourable rainfall than in desert areas (cf. figure 4).

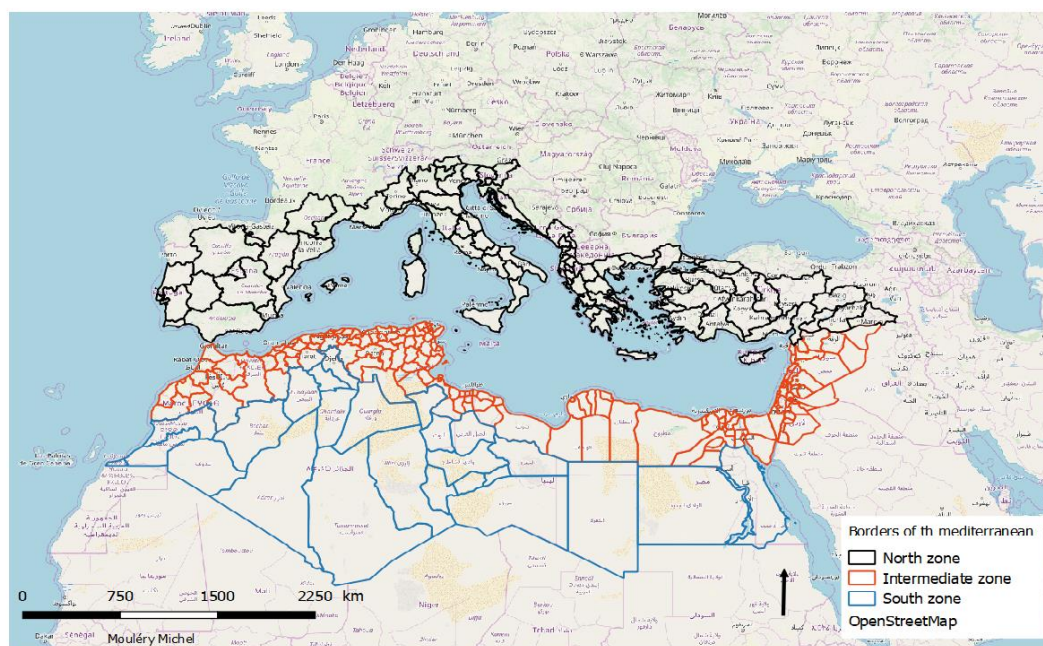


Figure 3 : Mediterranean border

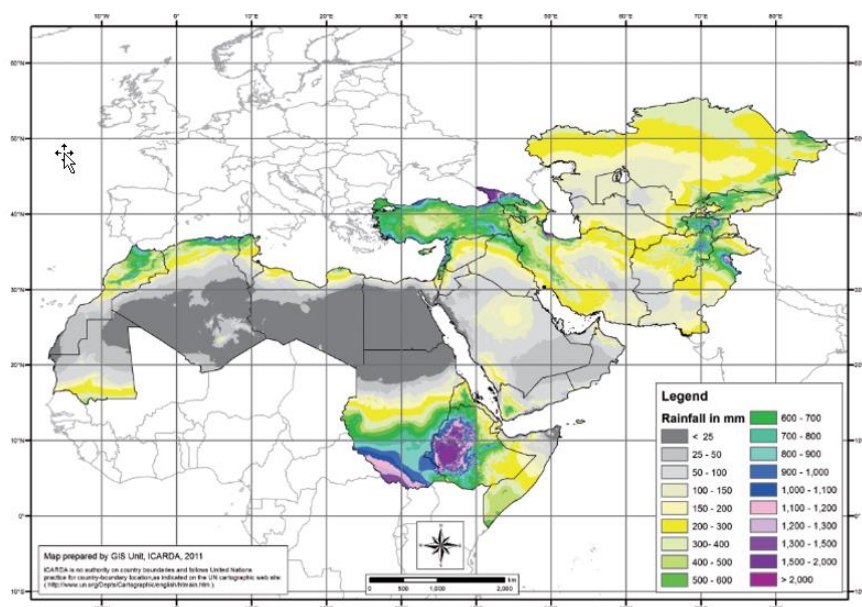


Figure 4 : Rainfall zones of CWANA region

Once we have roughly defined the borders, we have built up a homogeneous database⁶¹ at the same resolution based (Mouléry, Napoléone, Martinetti, Sanz Sanz, 2019) on data sources such as :

⁶¹ This database is owned by INRA (France), issued from the DIVERCROP research project (N° ANR-16-ARM2-0003-01) funded by Arimnet2 program (FP7 – ERA-NET no. 618127; MediterraneanAgriculture); see <https://hal.archives-ouvertes.fr/hal-01907477>. For all dissemination and use, contact

The SPAM agricultural land use data (You et al. 2014), which is based on agronomic models, estimates crop distributions within pixels at a 10 x 10 km grid-cell resolution. For each crop class (around 40) are attached indicators informing practices (intensity of irrigation, use of inputs), as well as information (including the past dynamics of agricultural uses) from national agricultural statistics from the various countries around the Mediterranean.

FAO⁶² data on livestock.

With regard to the city and natural areas, we used information from the Modis land use at the University of Leuven (300 meters resolution) and the mapping of protected areas proposed by the IUCN. We have supplemented these sources with the HYDE database (Klein Goldewijk, 2011) which provides information on the distribution of the urban and rural population and LANDSCAN on the general population in a more precise way.

Field variables have been integrated for soil quality with the Harmonized world soil database source or with slope topography and elevation (Global Digital Elevation Model) variables.

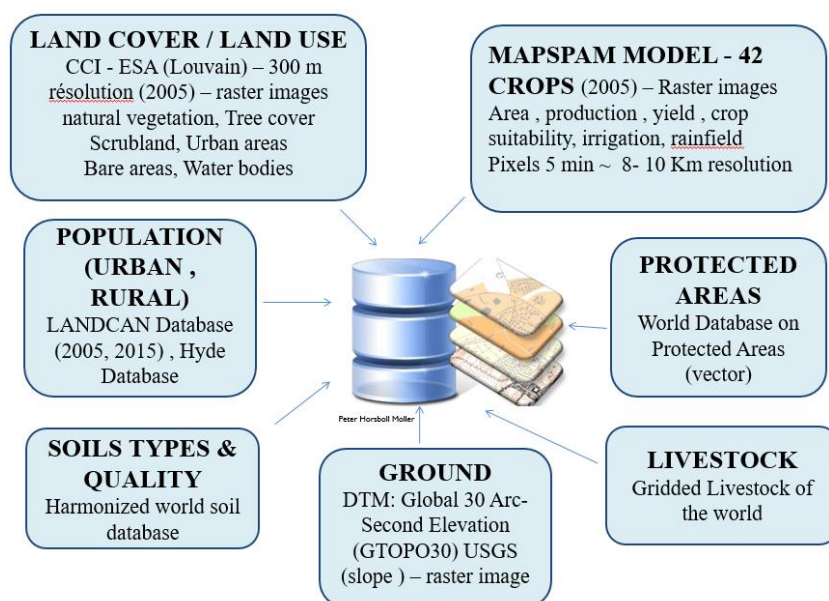


Figure 5 : Divercrop database

We have overlaid and split the database informations (cf. figure 5) on each border, before to launch the work in machine learning.

Machine Learning

Thanks to the computing power of computers, it is now possible to generate more and more efficient calculations, with large amounts of information in a database. In statistics, models in machine learning are increasingly used and are based on statistical approaches to give computers the ability to “learn” from data, that is improve their performance in solving tasks without being explicitly programmed. In

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⁶² Food and Agriculture Organization of the United Nations

our case to explain the wheat production, we used the library MLR ⁶³ (Machine learning) with the software R, it encapsulates different statistical models.

We have selectionned five statisticals regression models the most known: Network neural, Support vector machine (SVM), Earth (regression splines), Random Forest, PLS (Partial Least Squares). Each border (North, South, intermediare zone) contains the topography, the bio-physical, land use, bioclimatic, socio-economic information of the divercrop database. In machine learning, for referenced the target variable wheat production, and integrated all the data, we used a calibration function makeRegrTask. For the configuration of the statistical models, we use the function makeleaner , that reference the name of the statistical models. To have a better quality in our model, we used a permanent train-validation splitting (function makeResampleDesc), a dataset can be repeatedly split into a training and a validation datasets. This is known as (CV) cross-validation (cf. figure 6) with 5 itérations. This sequence below has been executed for each border.

```
task_train_subset <- makeRegrTask(id = "best model",data = North_data, target = "p_ta_whea")
rdesc=makeResampleDesc("CV", iters = 5 , stratify = FALSE)
lrns2=list(makeLearner("regr.earth"),makeLearner("regr.ksvm"),makeLearner("regr.randomForest"),m
akeLearner("regr.lm"), makeLearner("regr.nnet"), makeLearner("regr.plsr"))
bmr = benchmark(lrns2, task_train_subset, rdesc,show.info = FALSE)
```

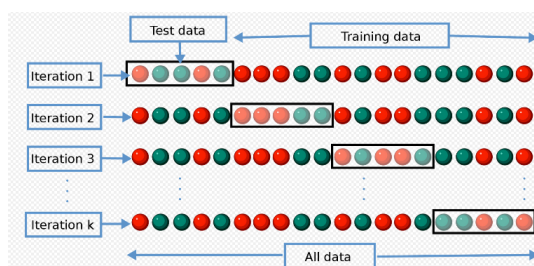


Figure 6 : Cross Validation [https://en.wikipedia.org/wiki/Cross-validation_\(statistics\)](https://en.wikipedia.org/wiki/Cross-validation_(statistics))

Finally, the function benchmark determinate the best model (variable bmr), looking at the variable MSE (mean squared error), below in this case for the intermediate zone. The lower the MSE the better (cf Table 1)

Model	Leaner	Mse.test.mean
regression splines	regr.earth	4 882 362
Support vector machine	regr.ksvm	16 306 891
Random Forest	regr.randomForest	2 235 332
simple linear regression	regr.lm	4 971 280
Neural network	regr.nnet	14 512 632
Partial Least Squares	Regr. Plsr	4 958 886

⁶³ Bernd Bischl, Michel Lang, Lars Kotthoff, Julia Schiffner, Jakob Richter, Erich Studerus, Giuseppe Casalicchio, Zachary M. Jones; 17(170):1–5, 2016. The mlr package provides a generic, object- oriented, and extensible framework for classification, regression, survival analysis and clustering for the R language. It provides a unified interface to more than 160 basic learners and includes meta-algorithms and model selection techniques to improve and extend the functionality of basic learners with, e.g., hyperparameter tuning, feature selection, and ensemble construction. Parallel high-performance computing is natively supported. The package targets practitioners who want to quickly apply machine learning algorithms, as well as researchers who want to implement, benchmark, and compare their new methods in a structured environment.

Table 1 : Example best model Random forest for the intermediate zone

Whether it is north, south, intermediate zone, the best statistical model has always been random forest. We use the function « selectFeatures » to have the most representative variables for each border in relationship with the wheat production (Figure 7). We use the sfs method ⁶⁴ and launch the function analyzeFeatSelResult to have the most representative variables that explain the wheat production.

```

Learner_intermediate_zone=makeLearner("regr.randomForest")
ctrl=makeFeatSelControlSequential(method = "sfs", alpha = 0.02)
# Select features
rdesc = makeResampleDesc("CV", iters = 5)
sfeats = selectFeatures(learner = Learner_intermediate_zone, task = task_train_subset, resampling = rdesc, control = ctrl, show.info = TRUE)
res<- analyzeFeatSelResult(sfeats)
    
```

North (Europe)	Intermediate zone (North west Africa)	South (desert)
Rooting conditions	Cropland rainfed - Tree or shrub cover	Density population
Cropland Rainfed (Herbaceous Cover)	Precipitation of Coldest Quarter	alti_min
Precipitation of Warmest Quarter	Max Temperature of Warmest Month	chicken
Temperature Seasonality	cattle	Precipitation of Driest Quarter
Mean Temperature of Wettest Quarter	Goats	Rooting conditions : Soil textures, bulk density, coarse fragments, vertic soil properties and soil phases affecting root penetration and soil depth and soil volume
Altitude moy	chicken	Precipitation of Wettest Month
Cropland irrigated or post-flooding	Mean Temperature of Coldest Quarter	podzoluvisols (pd): Acid soils with a bleached horizon penetrating into a clay-rich subsurface horizon
Precipitation of Coldest Quarter	Cropland irrigated or post-flooding	Cropland irrigated or post-flooding
Precipitation of Driest Month	Cropland rainfed - Herbaceous cover	goats
Cropland rainfed – Tree or shrub cover	Annual Precipitation	

⁶⁴ Method = "sfs" indicates that we want to conduct a sequential forward search where features are added to the model until the performance cannot be improved anymore. The search is stopped if the improvement is smaller than alpha = 0.02. (https://mlr.mlr-org.com/articles/tutorial/feature_selection.html)

Mean Temperature of Warmest Quarter	Rooting conditions	
slope_5, slope =10%	sheep	
Cambisols	Fluvisols: Young soils in alluvial deposits	
Isothermality	Temperature Annual Range	
Workability	Precipitation of Driest Month	
Temperature of Coldest Quarter	Precipitation Seasonality	
Precipitation Seasonality	Alti moy	
cattle		
Tree cover needle evergreen leaved open		
Oxygen availability to roots		

Figure 7 : Best variables for the wheat production with Random Forest

Results

In the Mediterranean desert, relative to our grid (cf. figure 7), the variable density population shows that is related to wheat production. This leads us to believe that, close to cities, wheat farming is omnipresent. We assume that it is a nourishing agriculture of the city, with markets nearby. Studies of food deserts assign a pivotal role to 'the proximity and density of retail food outlets in specific neighborhood as markers of access to affordable (Shannon 2013, Jane Battersby Jonathan Crush, 2014). In Algeria, wheat, which has always been grown on small areas in the palm groves, has until now been used exclusively for own consumption (Bisson, 2004). This complementary but essential crop is justified from the agronomic point of view, because wheat is one of the crops best adapted to the Saharan climate, and consumes three times less water than palm (Tayeb Otmane et Yaël Kouzmine, 2013). The importance of the water is mentioned like cropland irrigated or post flooding (the best variable), and the precipitation of warmest quarter). Rather, it is subsistence agriculture, or low-yielding agriculture close to the city in medium-sized markets.

In North Africa, There are more variables that emerge from it compared to the southern area (Figure 7). Random forest algorithm in this area, detects several bio-climatic variables like temperature, precipitation and the soil quality. The livestock are important, in general wheat production is more than an average altitude indeed cereal production is more in the mountain ranges of North Africa. For example, the Algerian Highlands are the main cereal areas of Algeria. Bordered to the north by the Atlas Tellien and to the south by the Atlas Saharien, these highlands travel diagonally across Algeria to the North-West of Tunisia at an average altitude of 1000 m. (Beauval, 2017).

The livestock are confirmed by the studies of ICARDA (Pala et Al,2019), « Wheat and barley are the main crops, with sheep and goats as main livestock, although many farms may have some cattle. Farms under private smallholder ownership, fairly productive, diversified, and well managed »

In our European zone, the bio-climatic variables are too very important, the livestock are less important compared in Africa for the wheat production. The altitude and the slope are important, like the cattle where geographical areas in mountain areas appear to be targets. The population density near the city is not a key factor, indeed the production of wheat is grown on large areas away from the city. The common agricultural policy did not favour cereal farming near cities on small areas.

Conclusion

In the end our work can be discussed, criticized whether on the resolution of the pixel between 8 and 10 km, different data sources that have been homogenized in a database, the configuration of the functions in statistics or the cross validation method threshold set at 5. It's the first time that a work presents a database with a large amount of information, on a very large scale and associated with a machine learning method to find the «ideal» statistical model.

In conclusion, at this scale, there is not too much difference on this broad scale between the north of Africa and the European zone, the contrast comes more from the desertic zones or the production of wheat is correlated with the population. It seems that the access is more difficult and therefore it seems that generally it is an agriculture of proximity, of self-consumption close to the cities, with the problem of water.

Even if these three areas have very different climatic, social and political differences (CAP aid for Europe), cultural, agronomic, this work shows us a first trend in our case on wheat production. But these first original works, enriching on a large territory like the Mediterranean, with different zones based on the machine Learning, give us a first general trend, a first understanding to express the production of wheat, which allows us to reflect on the movements of these Mediterranean territories.

However, this work is exploratory but it makes us reflect on the outcome of certain variables which can be studied more deeply in a future work.

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A JUST TRANSITION? JUSTICE PRINCIPLES RELEVANT TO FOOD SYSTEM TRANSITIONS

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Abstract: In response to social and environmental injustices perpetuated by the dominant productionist view of the food system, an increasing number of initiatives are trying to make local food systems more sustainable and more just. These initiatives show which alternative food systems are possible and with the right propelling mechanisms they can help speed up the transition process towards a sustainable and just food system. However, it is important to also reflect on how these initiatives and propelling mechanisms contribute, or not, to a just transition of the food system.

The concept of ‘just transitions’ was developed within the context of energy transitions and climate justice and brings together concerns related to distributive, procedural justice, and social justice for those working in and/or depending on the current dominant system. Within the food systems literature, justice plays an important role, including in the work related to food justice, food sovereignty and food security. However, few studies have adopted a ‘just transitions’ lens and it is unclear which principles of justice are particularly relevant to reflect on the justice of food system transitions.

We reviewed the food systems literature to identify which principles of justice were used to assess justice implications of food system initiatives that had happened or were ongoing. We selected and analysed 138 papers. These papers covered very different types of initiatives in terms of scale - ranging from regional food networks to very local urban agriculture initiatives – and in terms of underlying values - with some initiatives strongly rooted in food justice and others in ecological sustainability.

Across this diversity of initiatives the review identified a number of principles related to distributive, procedural, and social justice relevant to food system transitions. Distributive justice principles included a.o. equality of outcome, equality of opportunity, and sufficiency. Procedural justice included a.o. equal opportunity to participate, legitimacy, transparency, and autonomy. Related to social justice, the papers discussed the principle of redistribution of costs and benefits, and of power, specifically to marginalised communities, to those with certain roles across the food system, to those who (have) suffer(ed) negative consequences of the food system, and to non-humans.

The identified principles encourage a broader debate about the justice implications of food system transitions and can help food system initiatives, and propelling mechanisms, to reflect on the justice of the transition process itself.

LOCAL FOOD SUFFICIENCY IN THE MEDITERRANEAN BASIN - ENABLING AND CONSTRAINING FACTORS**a Esther Sanz Sanz, Carolina Yacamán Ochoa b , c Lamia Arfa , d Rosalia Filippini**

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Abstract: Current land use is causing unprecedented changes in agriculture mainly because of urban sprawl, in particular on coastal or metropolitan areas. These main changes are not independent and act in a feedback chain: disturbance of traditional agriculture surrounding urban areas due to cities expansion that leads to the development of a market-oriented agriculture for the globalized market, while new forms of agriculture linked to the city are created. In other words, the new urban food agenda is addressing global challenges and developing place-based solutions as a means to enhance reliable food supply at a local and regional scale. In this context more research is required to address challenges of global urbanization and metropolitan growth and to develop place-based solutions. The aim of this session is to identify key enabling and constraining factors of local food sufficiency (i.e. proportion of locally grown food which is consumed locally) as a means of food security, especially to hone in on options to deepen and broaden a transformative urban food agenda. Therefore, we invite papers to present and discuss current urban food systems dynamics including both land use and network interactions. Case studies involving stakeholder perception or/and statistical approach of the determinants of local provision of locally grown food products along the three major levels of the supply chain (agricultural production, food chain organization and commercialization) are welcome. This session could benefit from the contribution of some local case studies concerning some specific products, developed in the framework of the Arimnet2 project DIVERCROP (Land system dynamics in the Mediterranean basin across scales as relevant indicator for species diversity and local food systems). With these case studies, we are able to characterize the drivers of the re-localization of urban food systems in term of policy, processing infrastructure and social innovation. However, we would like to enrich the session with other papers focus on non-Mediterranean area.

“I AM SURE THEIR VET IS THEIR MAIN ADVISER”: KNOWLEDGE NETWORKS AND INNOVATIVE POTENTIAL IN SHEEP FARMING

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Abstract

Current health management practices in livestock farming are not sustainable, mostly because they select pathogens resistant to treatments. If integrated pest management is a common and accepted practice in agriculture, its animal counterpart is way behind. In other words, integrated health management in animal production embeds in so few practices that farmers do not recognize and advocate it per se. In this context, research and development is needed 1) to identify and design innovative livestock systems and management tools in line with integrated health management principles and 2) to better understand innovation dynamics in livestock farming.

This article contributes to the latter. The aim of our study was to explore how knowledge and information circulate among farmers, and between farmers and non-farmer stakeholders around the theme of parasitism control. For this purpose, we carried out a questionnaire-based survey among 536 dairy-sheep farmers in the Pyrénées-Atlantiques (France).

We analysed knowledge networks for parasitism control by listing whom farmers talk to when dealing with parasitism control. We identified the kind of individuals likely to be contacted by farmers depending on the farming system and the farmers' representations. Results are discussed in terms of implications for developing integrated health management programs that take into account the diversity of health management actors and farmers identities.

Introduction

Transitions towards agroecological farming systems calls for higher autonomy of farms (Dumont et al. 2016) and decreased the inputs needed for production (Dumont et al. 2013). This advocate for ruminant livestock systems based on grasslands (Soussana et al. 2014). However, several technical barriers come with managing grassland-based livestock systems. Among them are gastrointestinal nematodes, round worms from 4 mm to 3 cm to which any grazing animals are exposed (Charlier et al. 2017). Infestation risk increases with warm and wet conditions; the same as the one needed for grass growth. The life cycle of gastrointestinal nematodes divides in two main phases: one on grasslands and the other in the digestive tract of the host. They damage intestinal tissues and feed with host's resources, leading to weak animal health. They can cause up to 15% of economic losses in grassland-based farming systems as they lead to weight loss, anaemia, diarrhoea and can cause animal death in the most severe cases (Mavrot, Hertzberg, and Torgerson 2015).

The efficacy of anthelmintic⁶⁵ drugs is being threatened by current practices for controlling nematode infestations (Rose et al. 2015). Anthelmintics are mainly used on the entire flock, in a preventive way and without consideration of the health status of the animal. This favours the emergence of resistant nematodes that leads to lower to null efficacy of treatments (Sargison et al. 2007). In other words, it means that farmers and farm animals would have no other option but suffering infestations and hoping

⁶⁵ also known as worm medicines.

animals will be able to survive and recover. In short, there is a tension between the autonomy of the farm through grazing, current anthelmintic use and animal health on the long term.

The perspective of an anthelmintic breakdown would be transformational, if not dramatic, for ruminant production. First, it would mean a transition towards indoors livestock farming systems, with few or very low access to grasslands. Grasslands will change to forests and the multiple ecosystem services associated to grassland-based products would disappear (e.g. cultural heritage, biodiversity conservation and water quality (Dumont et al. 2019); or providing essential fatty acids (Duru et al. 2017)) while reinforcing others (e.g. flood control (Ford et al. 2012)). Second, for the farms maintaining grazing, no efficient anthelmintic would require i) lower stocking rates to decrease infestation risks and ii) lower individual production level as the immune response to infestations requires energy and proteins. In either way, it would increase production costs and might lead to an economic crisis of the industry. Even if the consequences on consumption are uncertain, given that consumers are used to low price food products, it could be assumed that consumers would not be flexible enough to compensate costs by buying at higher price. Overall, it could compromise entire zones where agriculture and territorial vitality depend on grazing (e.g. pastoral areas, (López-Santiago et al. 2014)). In this context where livestock production is trapped in the dead-end of relying exclusively on treatments to ensure animals' health, developing new livestock systems with integrated health management practices is crucial.

In this article, we look at the innovation potential of livestock industries regarding integrated health management through a preliminary network analysis. We explore the diversity of patterns of one-to-one information and knowledge exchange among 535 dairy sheep farmers, and between farmers and non-farmer stakeholders around the theme of parasitism control in the Pyrénées-Atlantiques (France). It enables us to illustrate how farmers' practices embed in sociotechnical systems, and identify the kinds of farmers' social environment involved in lock-in situations or in transitions towards agroecological practices.

Material and methods

Case study

The study covered the area of Pyrénées-Atlantiques, in the South Western France, which ranks first in the country in number of dairy sheep farmers and second in sheep milk volumes (Agreste 2010). It covers 7,645 km² with mountains, hillsides and plains, and a coast to the Atlantic Ocean. Elevation goes from sea level to 2900m, with summer pasture going up to 2700m. The climate is temperate oceanic, without dry season and with warm summers (rainfall between 1000 and 1700 mm/year, average minimal temperature: 8°C). Such climate is highly favorable to continuous grass growth, either in summer or in winter. Similarly, it is highly favorable to gastrointestinal nematodes infestations (nematode larva developing best at 20-30°C, in wet conditions, (O'Connor, Walkden-brown, and Kahn 2006)).

The main dairy sheep farming system in the area is a diversified livestock system with both dairy sheep and meat beef (70%), dairy cows (8%) or meat sheep (1%) (SRISSET 2014). The average flock size is 224 ewes, and half of the farms have between 150 and 300 ewes.

The threat of a generalized resistance to any anthelmintic is a great concern among the local industry (CDEO 2017; GIS id64 2006). Resistances to one class of anthelmintic, benzimidazoles, have already been reported in most of local farms (Geurden et al. 2014) and other resistances are now reported for the other classes (Cazajous et al. 2018). On the top of that, dairy sheep farming is highly exposed to resistance risks because only few products are compatible with lactation: farmers keep using the same molecule from one year to the other, which increase the probability of resistance.

Key local stakeholders: sheep farmers and private veterinarians

Sheep farmers are key players in preventing the emergence of new resistance hotspots since the risk of resistance can be mitigated through both livestock management practices (grazing management, batches composition, diet, animal density) and animal health management practices (prevention, diagnosis and treatment of diseases). In the study area, numbers of sheep farmers are aware of the resistance issue. Still, most do not have any idea of how to adapt their practices for preventing it. This comes from two main points. First, resistance has been recognized as a concern by some local producers and private veterinarians only few years ago, and not every local producer or veterinarian are aware of it. Second, there is no ready for use protocol: managing parasitism is highly complex, solutions should be mixed and adapted to each farm, and some promising practices are still at a research stage (e.g. tannins, grazing management...). On the top of that, parasitism management means dealing with tradeoffs between controlling infestations, avoiding resistance, and limiting the impact of anthelmintic drugs on the environment.

Although veterinarians are not the only suppliers of anthelmintic drugs, they remain the official point of reference on this matter. For example, they are the only ones legally able to diagnose and prescribe veterinary drugs. This explains why several founders and research partners had the following remark when we presented our research to them: "I am sure their vet is their main adviser". In practice, farmers can be out of reach of veterinarian advice as they can pretty easily find anthelmintic drugs somewhere else (internet, pharmacy...). In France, we expect the role of veterinarians to be reinforced with the 2019-2020 campaign of mandatory health inspection visits, which focused on anthelmintic use and resistance risk. A transition to an integrated use of anthelmintics could reshape the relationship between veterinarian and farmers, as well as the economic model of private veterinary operations. For example, lower sales of anthelmintics might be compensated with increased advising prestations.

Survey development

The survey was designed by researchers in collaboration with local extension services : breeders' association staff including extension service agents and a veterinarian (CDEO Coop). It aimed at drawing up the diversity of health management practices and being able to test whether it could be correlated to farming systems, demographic information or farmers' social networks. The questionnaire has about 100 close-ended questions. The questionnaire is organized as follows: socio-demographic characteristics, farm structure and organization, livestock characteristics, dairy sheep management, dairy sheep health management, and farmer's social environment.

The survey was tested through two consecutive trials. Six people (two researchers, three extension agents and the veterinarian) did the first trial: we surveyed 10 farmers in real conditions and changed the survey according to farmers' feedback and our own suggestions. The 36 local technicians did the second trial: they tested themselves the second version of the survey in dedicated workshops. We changed the survey according to technicians' feedback and this was the final version of the survey.

Participants

The sample consisted in 536 dairy sheep farmers in Pyrénées-Atlantiques who use or had used animal insemination. Most of them (97%) already had relationship with the local breeders' association either adhering to their technical performance monitoring and advising service or participating in their genetic animal selection scheme (providing rams or using semen). The association is the only structure providing these services to dairy sheep farmers in Pyrénées-Atlantiques.

It was composed of 83% of men and the average age in the sample was 43 (from 19 to 70). Almost all participants were professional farmers (99%). The majority adheres to the technical performance monitoring and advising service (75%) and the average ratio of artificial inseminations is 40% per farm. In the sample, farms have 43 ha (sd=20) and 346 ewes (sd=157) in average, are mixed-systems (80%)

mostly combining dairy sheep and meat beef productions. Pasture area is 36 ha in average ($sd=15$), and half of the farms use summer pastures.

Survey administration

Data was collected by 36 advisers of the local breeders' association from February to April 2019 from 536 dairy sheep farmers (17% female, 83% male), representing 27% of the industry (Agreste, 2018). Interviews took between 45 minutes and 2 hours.

In addition to pre-testing the questionnaire, all advisers participated to a training workshop prior to going interviewing farmers. The training workshop aimed at i) presenting study rationale, goals and methodological choices, ii) providing face-to-face survey techniques adapted to the context of the study and iii) explaining questions meaning when needed. At any time of the study, advisers could ask assistance from a hotline. Depending on their preferences, advisers either typed data directly into LimeSurvey (version 2.50+) or filled out a paper copy of the questionnaire and then reported data into LimeSurvey interface.

Network analysis

Statistical analyses were carried out using R 3.5.3. Results were considered significant when the p-value was lower than 5%.

Network characterisation

We analysed one-to-one information and knowledge exchange regarding parasitism control. The data was collected with the question "Over the last two years, have you discussed with someone about some of your choices regarding parasitism management? If yes, please give their name".

We transformed answers into connection attributes (who is contacted, how many people are contacted, who contact, etc...). We tested correlations between network data and characteristics of the farms, farming practices and health management practices with chi2 test when the variable was qualitative and linear regression when it was quantitative. These correlation tests were carried out on two types of variables:

raw variables (e.g. size of the farm, number of ewes, number of treatment).

two composite variables, "farming system" and "nematode control cluster".

The farming system variable results from a hierarchical clustering on the following five variables: main production on the farm, number of ewes, stocking rate, label for geographical indication (Yes/No), on-farm cheese production (Y/N). The farming system diversity in our sample gives three typical farming systems: "Higher herd size without summer pastures", "Specialized farm and smaller herd size", "intermediate herd size with summer pastures". Similarly, the variable "nematode control cluster" results from a hierarchical clustering on the following variable: number of treatments (>2 or <2), selective treatment (yes or no), dose selection strategy (recommended or not) and practices against nematode infestations (recommended or not). These four categorical variables have been selected because they refer to nematode control practices that can generate resistance to anthelmintics. The clustering gives 4 clusters of nematode control management style. Clustering analysis were performed using the package FactorMineR (Lê, Josse, and Husson 2008).

Further network analysis was not relevant considering the low number of connections (the median number of connections per farmer is 1 and 25% of the sample were not involved in any discussion about parasitism (136 farmers)).

Results

Parasitism management: a non-subject for a third of the sample

Around a third of farmers interviewed declared not having discussed parasitism with anyone; we call them “autonomous farmers” in the rest of the article. In other words, 68% of farmers declared having discussed parasitism management with someone over the last two years. This was not correlated with nematode control clusters, nor with farming systems.

Farmers discussed with veterinarians, other farmers, advisers and random people (ranked from the most consulted category to the least). Among farmers who cited someone, 80% discussed with a veterinarian (resp 48, 36 and 12% with “other farmers”, “advisers” and “random people”). The number of persons cited goes from 0 to 10, with a mean at 1,6 and a median at 1 person. This number did not correlate with nematode control clusters or farming systems.

Farmers’ referents and trusted persons on the topic of nematode control

An underwhelming presence of veterinarians

Veterinarians are the first category to be cited as **contact person** on parasitism control (cited by 288 farmers). Veterinarians (either private or state) were also the first most “trusted” person regarding parasitism control, and were cited by 86% of the sample. This was not correlated with nematode control clusters, nor with farming systems.

However, around half of farmers (46%) did not discuss parasitism with any veterinarian, even if 97% of farmers surveyed bought anthelmintic to veterinarians. Most of them (175) fall into the category “autonomous farmer” presented above (in section 1 of results). Still, the others (73 farmers) discussed with someone but not with a veterinarian (more details in Figure 29). In other words, when farmers had talked to someone about parasitism, 20% of them did not exchange with any veterinarian.

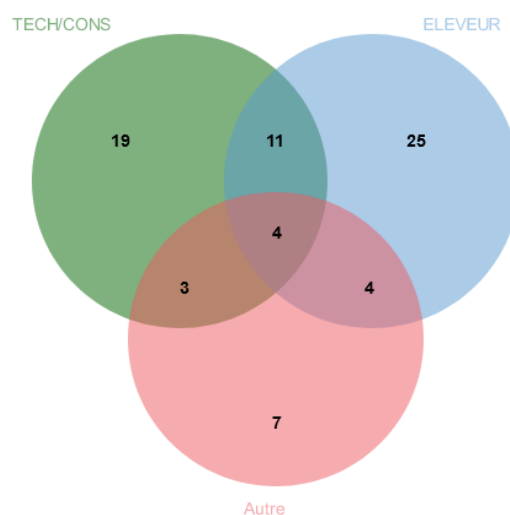


Figure 29 : Venn diagram of the persons cited (farmers, advisers or random person) by the farmers who did not discuss with veterinarians (n=73).

As this situation can be rooted within both farmers’ and veterinarians’ attitudes, we wondered if some veterinarians were more prone to discuss parasitism control with farmers than others. Some variability exists within veterinarians, with some talking about parasitism control to all of their clients and other talking with none of them (see **Erro! A origem da referência não foi encontrada.**). In average, it seems that each veterinarian discussed parasitism with half of the farmers they advise (47%, sd= 33). Such information should be interpreted with caution as our results are based on farmers’ declarations only, and we have not surveyed veterinarians. A farmer might not consider as an “advice” or “discussion” when a veterinarian providing and selling an anthelmintic. On the other hand, a veterinarian might see

it as an advice and discussion since it would imply advising a molecule, and a dose adapted to the farm and animals considered.

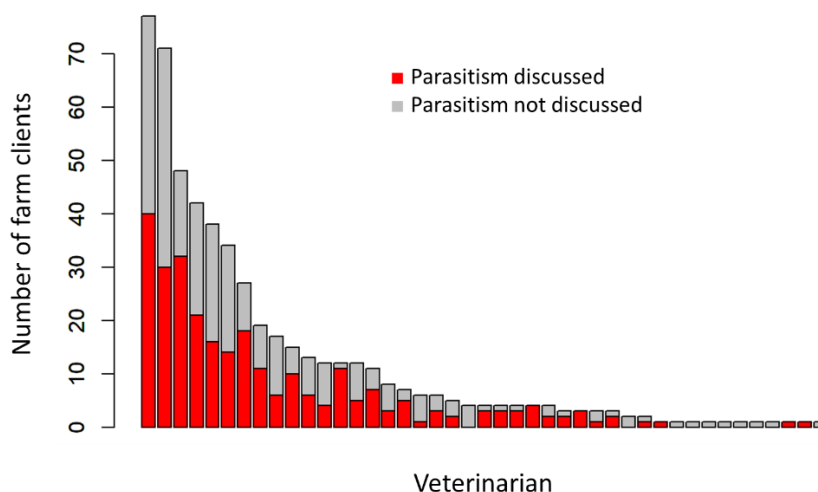


Figure 30: Number of farmers who discussed (red) and did not discussed (grey) parasitism control with their veterinarian, for each veterinarian cited.

Those who discussed with at least a veterinarian, i.e. the other half of the sample, mostly cited one veterinarian (in 88% of cases), or two (8% of cases). The number of veterinarian cited did not correlate to the variable “nematode control cluster”. However, in three of the five clusters of nematode control, a veterinarian was over-cited in each specific cluster.

Farmers: the second referent in parasitism control

Farmers were the third most “trusted” person regarding parasitism control, and were cited by 27% of the sample.

Farmers are the second most cited category after veterinarians as **contact person** on parasitism control (cited by 173 farmers). They were mostly cited with one or more veterinarians (129 farmers, more details in Figure 31), which scored higher than the “veterinarian only” response (96 farmers). In total, 146 farmers were cited namely, and farmer names were not specified in 51 answers. Farmers were cited from 0 to 6 times, and 1.6 times in average when they are cited. Twenty farmers names were cited more than twice. They were not over-represented in any nematode control cluster, or any farming system.

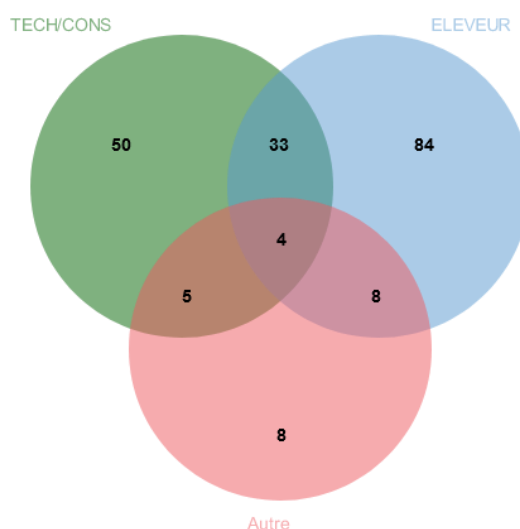


Figure 31: Venn diagram of the persons cited (farmers, advisers or random person) by the farmers who discussed with one or more veterinarians (n=288, including 96 farmers who cited only one or more veterinarians – bot represented).

We focus now on the farmers who declared having discussed with someone about parasitism.

They discussed with 0 to 8 other farmers, with an average of 0.9 farmers cited by answer (zero excluded). The 48% discussed with one or more farmers.

Advisers: from a potential support for veterinarians to substitutes

Advisers ranked second as **trusted person** regarding parasitism control, and were cited by 52% of the sample.

They were the third most cited category as **contact person** on parasitism control (cited by 129 farmers). They were mostly cited with one or more veterinarians (92 farmers). Advisers were cited from 0 to 5 times, and 1.2 times in average when they are cited. Ten adviser were cited more than twice, with an outstanding adviser cited by 17 farmers. Advisers were mostly cited “alone” (with no other adviser cited). Citing or not an adviser correlated with the farming system: the specialized farms with small herds tended to not cite advisers.

Some farmers (37, i.e. 10% of the farmers who cited someone) discussed with an advisers and no veterinarian.

Discussion and conclusion

In our study, a large proportion of the farmers surveyed had not discussed parasitism with anyone. This will be a major barrier to transitions towards a decreased use of anthelmintic. It would hinder the first stage of a change towards an alternative practice (“awareness of the problem or opportunity” (Pannell et al. 2006)) to happen: if farmers do not talk about nematode control practices they reduce their opportunities to hear about alternative practices. This is even truer in our sample where human referents (veterinarians, advisers and farmers) were more trusted than specialized periodicals to inform on nematode control. In an extension perspective, we should explore the reasons for this result to design a program that would be adapted to this specific population. Among others, parasitism control could not an issue for them, or they perceive they are not able to change practice (for example because “it is the veterinarian’ role”). They might have other priorities, or be not aware of resistance risk and their expected impacts. Finally, it could be related to farmers’ ideals of autonomy (Stock and Forney 2014) and in particular the way farmers perceive the role of veterinarians in health management. These “autonomous” french sheep farmers might consider, as UK sheep farmers in 2013, that they are the only ones able to manage their flock and no other people would be able to provide them with any relevant advice (Kaler and Green 2013).

In the same vein, it was surprising to see that not every farmer we surveyed cited veterinarians. It reveals a limited reach of veterinarian advice on the matter of parasitism control. Further research is needed to better understand this situation. Our thoughts is that parasitism control might has become a routine for both veterinarian and farmers so no advise is repeated from one year to the other, even if molecule and dose should be adapted each time a drug is sold.

The study showed that trusted persons were not exactly the same one as referent persons. In other words, farmers who discussed about parasitism were not necessarily seeking an advice. Surveyed farmers sought both information and advice on parasitism control. This shows that supporting farmers in their changes in nematode control practices should involve wider actors than veterinarians and involve other postures than prescribing solutions. It calls for a transformation of knowledge circulation in the agricultural sector where knowledge is not only hold by experts (veterinarians, advisers...) but

where knowledge circulate among any person belonging to a community of practices and interest, including farmers.

Most often, farmers consulted more than one referent. Each additional referent represents a new opportunity to talk about practices; however the associated risk is to generate confusion and inaction if discourses diverge from one referent to the other. Coordination between actors it thus key in reducing anthelmintic use. Participatory processes can be a tool to facilitate such coordination between stakeholders and even trigger stakeholders' interest in, and motivation to reducing resistance risk on the territory.

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TRANSITION TOWARDS SUSTAINABLE FOOD SYSTEMS: A FOCUS ON WORKPLACES, WORKERS AND FOOD PRACTICES AT WORK

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Abstract

To reach sustainability, it is now well recognized that food systems need significant innovation and transformation of the existing corporate food regime. Many scholars analyze top-down innovations (innovations thought and promoted by some actors, e.g. engineers, for the benefit of other actors, e.g. farmers) and bottom-up initiatives (innovations developed by some actors for their own benefit). They investigate the complex dynamics of coupled innovations in technologies (e.g., recycling technologies,

agronomic practices) and in non-technological areas (e.g., cooperation between food system actors, different organizational arrangements, consumption practices). However, few studies have precisely explored how work, workers and workplaces are impacted by these transitions; and how work, workers and workplaces may be the catalysis of such transformations. The present paper proposes a methodological approach to explore how both bottom-up and top-down initiatives transform work activities, as well as how these changes are included in new sociotechnical arrangements. We use the conceptual framework of the design of sociotechnical systems in ergonomics. The research focus on workplaces (e.g., companies) transition towards sustainable food practices and aims to explore work and workers at different scales: employees-consumers, producers, cooks, decision-makers, etc. The methodological model combines: (i) the evaluation of work activities, from the production, to the transformation, distribution and consumption of food; and (ii) the anticipation of new sociotechnical arrangements which take into account social (skills, knowledge), organizational (rules, procedures), practical (economic, technical such as physical spaces) and ideological (values) issues. Iterations between the two phases aim to contribute to both the development of work activities and the durability of the local food system.

1. Introduction

To reach sustainability, it is now well recognized that food systems need significant innovation and transformation of the existing corporate food regime (Meynard et al., 2017; Elzen et al., 2017). Sustainable food system is defined as a set of practices, from the production to the consumption of food products, economically viable, socially sustainable and ecologically responsible (Gaitán-Cremaschi et al., 2019). This is not only about organic food. It relates to the quality of the food, the number of intermediaries and the geographic proximity as well (Renting et al., 2003; Ostrom et al., 2017).

Over the last two decades, the field of *Sustainability Transitions Studies* has explored processes of innovation in agrifood systems (Elzen et al., 2017). Many scholars analyze top-down innovations (innovations thought and promoted by some actors, e.g. engineers, for the benefit of other actors, e.g. farmers) and bottom-up initiatives (innovations developed by some actors for their own benefit). They investigate the complex dynamics of coupled innovations in technologies (e.g. recycling technologies, agronomic practices) and in non-technological areas (e.g. cooperation between food system actors, different organizational arrangements, consumption practices) in activities of growing, processing, distributing, consuming and disposing of foods (Marsden et al., 2018). They identify local food systems as social innovations which encourage fair prices, solidarity, democracy and participatory processes between different actors, especially farmers and consumers (Chiffolleau and Loconto, 2018). Here, Social Innovation refers to a set of “innovative activities and services that are motivated by the goal of meeting a social need” (Mulgan et al., 2007, p.8). This generates new forms of coordination and collaboration between people and promotes community values such as equity and mutual aid (Harrisson and Vézina, 2006). Finally, there is a stream of research within Innovation Studies that focuses on the governance of systems transitions and transformations (Borrás and Edler, 2014; Turnheim and Nykvist, 2019).

Sectors concerned by sustainability transitions can be conceptualized as *sociotechnical systems* (Markard et al., 2012; Geels, 2004; Weber, 2003). In the field of Transition Studies, such systems consist of “(networks of) actors (individuals, firms, and other organizations, collective actors) and institutions (societal and technical norms, regulations, standards of good practice), as well as material artifacts and knowledge” (Markard et al., 2012, p.956). The systemic approach highlights the fact that the various elements are interrelated and dependent on each other (Hughes, 1987). A sociotechnical transition concerns both the elements of the system and the dynamics between these elements. This involves changes along different dimensions such as material, organizational, political, economic and cultural; and leads to the emergence of new products, services, business models and organizations (Geels and Schot, 2010). Furthermore, sociotechnical transitions differ from technological transitions because they

interest changes in users' practices and institutional structures. Sociotechnical transitions impact domains such as trade, housing, working and policymaking (Markard et al., 2012).

Current studies on transition in food systems focus on what innovation in food systems is, how it emerges, how to support it and how to assess it. They analyze economical, technological, political, institutional and social issues of transition towards sustainability in food systems. However, few studies have precisely exploring how work, workers and workplaces are impacted by these transitions; and how work, workers and workplaces may be the catalysis of such transformations. Firstly, few studies have investigated "what is eating sustainable food at work", including how eating at work is constrained by work dimensions, the work environment and the logics that are all vital to the development of the company such as finances, marketing, human resources, quality and sustainability. Indeed, studies on sustainable out-of-home eating mainly focus on territorial collectivities and public catering (e.g. school canteens, seniors' residences and hospitals). Secondly, few studies have explored how both bottom-up and top-down initiatives transform work activities, neither how these changes are included in new sociotechnical arrangements.

2. Research objectives

This paper focuses on workplaces (public and private sectors) transition towards sustainable food practices and aims to explore work and workers at different scales: employees-consumers, workers involved in the development of the local food system, cooks, managers, decision-makers and staff representatives. The main objective is to propose a research methodology which helps bottom-up and top-down initiatives to meet each other, and which considers the work of the diverse actors. We use the conceptual framework of the design of sociotechnical systems in ergonomics. We assume that transition in workplaces is a "design" process, i.e. a continuous process, collaborative and situated which involves solving an ill-structured "problem" (Simon, 1973). This means it is not possible to predict the final state of the system (i.e. the "new" functioning of the workplace "after" the transition, the "new" arrangements between actors). A lot of states may be reached or considered, due to desirable futures more or less defined by the actors; and due to a vision of the "future" system more or less shared between them.

Such design process results in open discussions and negotiation between the various stakeholders, considering the indeterminate intertwining of the technical (technologies, artefacts), social (work organization) and ideological (beliefs, values) aspects of transition towards more sustainable food practices. Our methodology seeks to respond to the following questions: (i) What are the initiatives of both employees and workplaces towards sustainable food practices at work? How these two types of initiatives interact? (ii) How these initiatives transform the organization of the work in the local food system? Do these transformations lead to the development of workers (i.e. the development of skills and knowledge on their work situation and on the whole food system)?

At first, we explore the literature on sustainable food practices in workplaces and in everyday life, and we highlight a lack of consideration of the relationships between these practices and work activities. Then, we propose both a theoretical framework and a methodological model to focus on work and workers during sustainable transition. We finally discuss the contribution of our methodological proposal to enhance workplaces transition towards sustainable food practices and to support the development of local food systems.

3. Sustainable food practices in workplaces

Food practices in workplaces may be considered with two aspects: (i) providing sustainable food for employees, generally through canteens and cafeterias within companies (workplace catering); (ii) the daily lunch strategies of employees (e.g. canteen, ready-meal, food cooked at home, grocery shopping,

food-truck, sandwich bar, go home, etc.). Both aspects do not just concern food products. They are influenced by the environment as well (Dagevos, 2005). Food consumption involves structural, social, cultural and economic contexts such as organization of the daily life, physical infrastructures of consumption, routines, norms and politics, groups and individuals' values (Sargant, 2014; Di Giulio et al., 2014; Spaargaren et al., 2013). Food choice is also influenced by personal factors such as taste, money and time (Jabs and Devine, 2006; Blanck et al., 2009).

3.1. Sustainable food practices in workplace canteens

Research on sustainable food practices in the sector of workplace catering mainly focuses on how such practices boosts the sustainable food economy; how it improves consumer's access to healthy and sustainable food; how functions the sustainable canteen food provisioning; and how practices of end-users are taken into account and satisfied or not.

For example, the study of Mikkelsen et al. (2005) compares the nutritional quality of the menu offered to customers in "green" and "non-green" workplace canteens. Results show that green canteens have more healthy options in their menus than non-green ones, due to the use of seasonal vegetables more extensively. This implies that caterers change their practices and procedures to match the current supply of organic products.

The study of Goggins (2016; 2018) focuses on the role of large organizations (e.g. hospitals, schools, prisons, workplaces which employ over 250 people) in the emergence of sustainable food systems. The study of Sargant (2014) analyses which factors influence the success of sustainable food provisioning, including the working relationship between caterer and contract-lender, the organization and infrastructures of kitchens, and the canteen food culture (habits, norms and expectations). These two studies highlight that the development of relationships between canteens and rural communities (local producers) requires a significant change of food provisioning practices. It implies the skills of diverse food professionals and it changes the work of actors involved. Catering managers, which do not have knowledge on sustainable procurement (e.g. food seasonality), undertake regular tender training to cope with the "new" food procurement. Local producers are not competent to deal with tender documents. Cooks do not have culinary skills and adequate materials to cook the 'new' food products (i.e. generally less transformed). Furthermore, these two studies highlight the role play by NGOs (Non-governmental organizations) to educate people about food and to promote healthy sustainable eating. Companies forge strategic relationships with these actors to increase their sustainability performance (Goggins, 2016).

Finally, the study of Spaargaren et al. (2013) highlights that employees-consumers of workplace canteens have "robust" practices in terms of time and price allowed for lunch, place preferred to sit, expected food to eat, opinions on food labelling, etc. These particular practices shape the system of provision of food which tries to respect these practices and the dynamics between them. Transition must consider the existing activities and their dynamics.

3.2. Daily lunch strategies of employees and sustainable food consumption in everyday life

Sustainable food practices at work concerns how employees attempt to eat "green" during working time as well. Research on daily lunch strategies of employees mainly focus on how and why employees choose the canteen or other food service provision (commercial catering). Several factors determine food choices of employees (Blanck et al., 2009; Mathé and Francou, 2014; Lhuissier et al., 2018). The most cited in previous studies are: ratio price-quality (i.e. cost and taste/healthfulness); proximity and convenience (related to the time allowed for lunch); social factors such as eating with friends, colleagues or family (e.g. going back home to eat with the children); and the diversity of the food offer in the area of the work (the presence of a canteen within the company, diverse food services).

Research on sustainable food consumption does not focus on consumption during work, but rather concerns how consumers purchase sustainable products in their daily life. Sustainable food

consumption can be defined as the way of consuming food to minimize the effect on the environment and to contribute to the local economy by making socially responsible choices (Sargant, 2014; Azzura et al., 2019). Again, previous studies indicate that several factors underly sustainable purchasing behavior (Squires et al., 2001; Pino et al., 2012; Verain et al., 2012; Hemmerling et al., 2015; Azzura et al., 2019): consumer involvement in sustainable products; sustainability knowledge and concerns (e.g. animal welfare, support to fair prices for farmers); personal values; socio-demographics factors (age, gender); distrust on conventional food products (perceived as less healthy and safe); and lifestyle variables. However, these studies generally consider that sustainable food consumption is only the result of people rationality, motivation, needs and preferences (Sargant, 2014).

Other studies based on practice theory – which analyses the social and physical (i.e. environment, spaces, infrastructures) dependencies of consumption – acknowledge the contextual and collective nature of food consumption (Shove and Pantzar, 2005; Jackson et al. 2007; Spaargaren and Oosterveer, 2010). The context of consumption is seen as both constraining and enabling, i.e. as influencing negatively or positively our food habits. This depends on the sociotechnical system in which the consumption occurs and that precondition certain modes of provisioning, access and use (Spaargaren and Oosterveer, 2010). For example, the study of Sargant (2014) shows that consumers choose alternative products which do not involve substantial changes in cooking, eating and shopping practices. That means they choose products which do not change their everyday food practices, notably in terms of skills, time and money. Sargant (2014) highlights the importance “to investigate food consumption in relation to practices of food consumption and their contexts” (p. 87). Again, the study highlights that NGOs constitutes important sources of information for consumers.

4. What about work and workers?

The literature on sustainable food consumption, both in workplace canteens and everyday life, shows that transition towards sustainable practices concerns activities of all actors involved in the sociotechnical system. More precisely, such transition involves technical (equipment, physical spaces), social (skills, knowledge), organizational (rules, procedures) and ideological (norms, values) issues.

However, work is an activity which is impacted by sustainable food transition and not really investigated. On the one hand, previous studies acknowledge changes in the work of workers involved in the food system (cooks, catering-managers, producers, deliverers). But these studies do not investigate precisely the transformations of work activities, neither how to support these transformations. How workers acquire skills? Are changes in food practices safe for workers? Do these changes correspond to the needs, abilities, expectations and values of people? Do these changes optimize human well-being at work? Shortly said, do work transformations respect the social dimensions of sustainable development? On the other hand, previous studies on sustainable food consumption in everyday life do not pay attention to consumption in working contexts. How consumers, in a working context, buy and eat sustainable food? What are their expectations? What are their food practices? Is the work environment appropriate for sustainable food consumption?

Figure 1 illustrates our vision of the system of work activities related to sustainable food provision and consumption at workplace. The notion of *workplace* is used as *set of places where people are during working time*. This is the spatial environment where the work occurs. It includes companies and institutions (public and private sectors). But we consider *places of work* as larger than organizations and companies, to include other places where people do their work (e.g. meetings outside the company, in another company or in a restaurant, teleworking, etc.). With such a perspective, it is possible to consider a lot of ways of consuming sustainable food. And it is possible to investigate the frontier between food places and workplace (i.e. working and eating at the same time, such as during a business lunch).

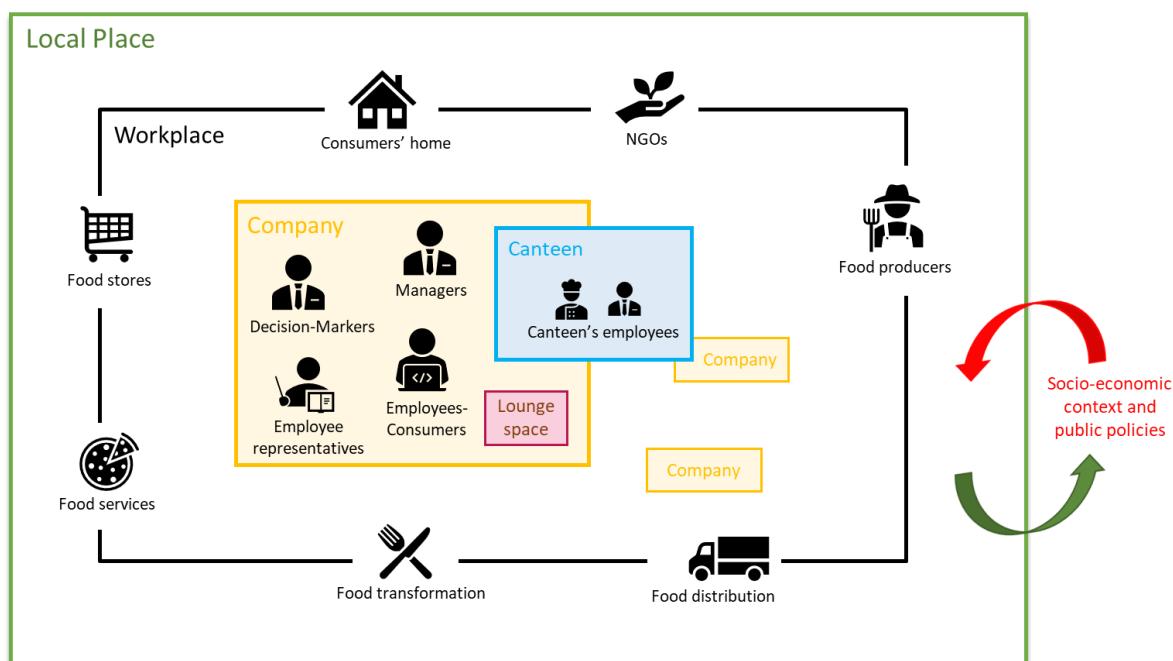


Figure 1. The system of work activities related to sustainable food consumption in workplace.

We see workplace as part of a local food system which involves a number of companies (or institutions). Local place comprises food producers, NGOs, food transformation and food distribution. In addition, local place includes places where employees-consumers eat during working time (their home or friends/family's home, food stores, food services such as food-truck, fast-food, etc.). Workplace comprises diverse companies which provide or not a canteen for their employees. Canteens are shared or not between various companies. Within workplace, employees have different opportunities to eat sustainable food such as the canteen, other food services, staff lounge spaces (i.e. bringing food at the office) and food stores. These opportunities depend on the characteristics of the workplace (e.g. urbanized area, industrial zone, commercial zone) and the specificities of the work (e.g. work schedule). Decision-makers, managers and employee representatives (e.g. syndicates, occupational medicine, professional associations) play a role concerning the organization of the work and the implementation of a canteen or a cafeteria within the company; and they are food consumers too. Within canteens, there are work activities such as food transformation and food preparation; and there are employees such as cooks and catering managers. Every cited actor (and their work activities) interact with each other. Furthermore, local food system influences – and, in turn is influenced by – public policies and socio-economic context.

In the next section, we propose a methodological approach to investigate work and workers, considering the different scales of work activities within the local food system.

5. Methodological proposal: sustainable transition as design process

Our methodology combines: (i) a data collection among employees and companies who take initiatives to develop food practices at work which claim to be more in line with sustainability issues; (ii) an involvement in some associations (NGOs) which purpose is to support companies in developing sustainable food practices; (iii) the design of projective scenarios of new sociotechnical arrangements within the local food system. Our methodological proposal is based on the conceptual framework of design of sustainable sociotechnical systems in ergonomics.

5.1. Conceptual framework: design of sustainable sociotechnical systems in ergonomics

Ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize both human wellbeing and overall system performance (Definition from the International Ergonomics Association). Ergonomic design concerns products, services and work organizations. Design projects are organized in two major phases: 1) identifying the determinants of human activity to specify design solutions; 2) anticipating activity changes that are inherent to the implementation of these new solutions. The first phase involves quantitative and qualitative methods of data collection such as survey, interviews and field observations. The second phase involves projective methods (e.g. simulation, prototypes such as drawings, mock-ups and storyboards) to adjust and enrich design proposals (Béguin and Cerf, 2004). Ergonomics concerns work as well as other application domains (e.g. transport, energy, etc.).

At its early beginnings, ergonomics has set its goal as fitting jobs and workstations (work positions) to the human. Then, the scope of ergonomics has expanded to the optimization of work systems in companies including their organizational structures, policies and processes (e.g. team management, design of working times, cooperative work, prescription of rules). Work situations involve both technical (e.g. work tools, objects, technologies, physical spaces) and social (e.g. individuals' motivations, relations between workers) determinants within work organization (rules and procedures). In that respect, the notion of *sociotechnical system* in ergonomics refers to the dynamics between the technical system and the social system within work organizations.

These recent years, organizational (sociotechnical) design is situated in the field of constructive ergonomics (Falzon, 2014). It aims at supporting the development of individuals, collectives and organizations. The notion of development refers to the construction of know-how, knowledge and skills regarding the "future" work organization along with health and performance issues. The methodological approach of such design projects is based on the integration of multiple actors with different visions. This refers to a participatory design approach where workers negotiate with other stakeholders (mainly managers, prescribers of the work) organizational solutions (Damodoran 1996). Participatory design suggests moments of meetings, discussions and deliberations (i.e. democratic decision-making). Organizational design is viewed as a collaborative design process of rule-making, which requires collaboration and management of points of view (Barcellini et al., 2014). Constructive ergonomics aims at designing enabling organization for the development of both individuals and collectives. "Enabling" or "empowering" is used in reference to Sen's work and the capabilities approach (Sen, 2009). Capabilities are alternative combinations of functioning that are feasible for a person to achieve (e.g., for mobility, for participating to the politic life, for feeding, etc.). Enabling systems increase capabilities if the organization provides resources to transform social and technical potentials into effective possibilities. However, this field of ergonomics has two limits to understand and to support both sustainability transition and social innovation (Le Bail, 2018). Firstly, it does not take into account ideology (system of values) within the design process of work situations. Secondly, projects are intra-organizational and initiated by a request of a company which encounter difficulties such as absenteeism, dissatisfaction, lower productivity, workers with health problems, etc. Constructive ergonomics is mostly limited to small-scale sociotechnical systems (i.e., limited to a few work/use situations, and limited to one organization). It does not interest projects at regional level.

Design of innovations is situated in the field of prospective ergonomics (Robert and Brangier, 2012). Innovation is used as "undefined future" and prospective ergonomics means searching for novelties and alternatives in design. Within projects of innovation, ergonomics focuses on artefacts to create as well as needs and activities to define. This is based on prospective, which consists in looking forward in time through the analysis of several factors such as economic, social, technological, political or environmental (Godet and Roubelat, 1996). The scope is much larger than the scope of transformation (i.e. scope generally used to apprehended organizational design). Prospective ergonomics attempts to responds to the importance for companies to innovate and remain competitive in the global economy. The approach encourages working sessions with end-users and experts of the domain, supported by creative methods

to generate and assess the maximum of design solutions. For example, these methods and tools are Brainstorming (Osborn, 1953) and Personas as archetypical representations of end-users (Pruitt and Grudin, 2003). Prospective use projective methods and tools as well. They help the diverse stakeholders to imagine what the future system is. For example, these methods are scenario-based design (Carroll, 1995) and storyboards (Hart, 2008). Again, this field of ergonomics has limits to understand and to support both sustainability transition and social innovation (Le Bail, 2018). Prospective ergonomics mainly concerns products and technologies but do not interest new forms of organization in society.

Recent studies in ergonomics have investigated innovation and transition in local systems (Le Bail, 2018; Détienne et al., 2019). Based on the two previous fields, these studies consider this is a collaborative design process of new dynamics between social system, technical system and ideology (system of values) within local organization (coordination between actors, design of rules in local scale influenced by larger scales). In a sustainability context, transformations of work activities are socially and ideologically embedded, as far as stakeholders consider necessary to take into account the insertion and future position of the system in its societal and cultural environment. Values of sustainable development underlie the design of organizational solutions (i.e. coordination of work activities within the system) and practical solutions (e.g. technological, economical, etc.). This involves design methods which support discussion on both sociotechnical and ideological issues.

5.2. Methodology for sustainable transition in food systems which focuses on work, workers and workplaces

We propose a method with two phases, iterative and integrative (Figure 2). The iteration between the two phases is constructive, i.e. favourable to the development of work activities (construction of skills, know-how and knowledge); and to the development of the local food system in which the workplace evolves (continuation, durability, longevity). The two phases correspond to the two main phases in design projects: evaluating (analysing, understanding, identifying) and anticipating (transforming, innovating, designing). They help to study how transition affect work, workers and workplaces, and how in turn, work, workers and workplaces affect transition.

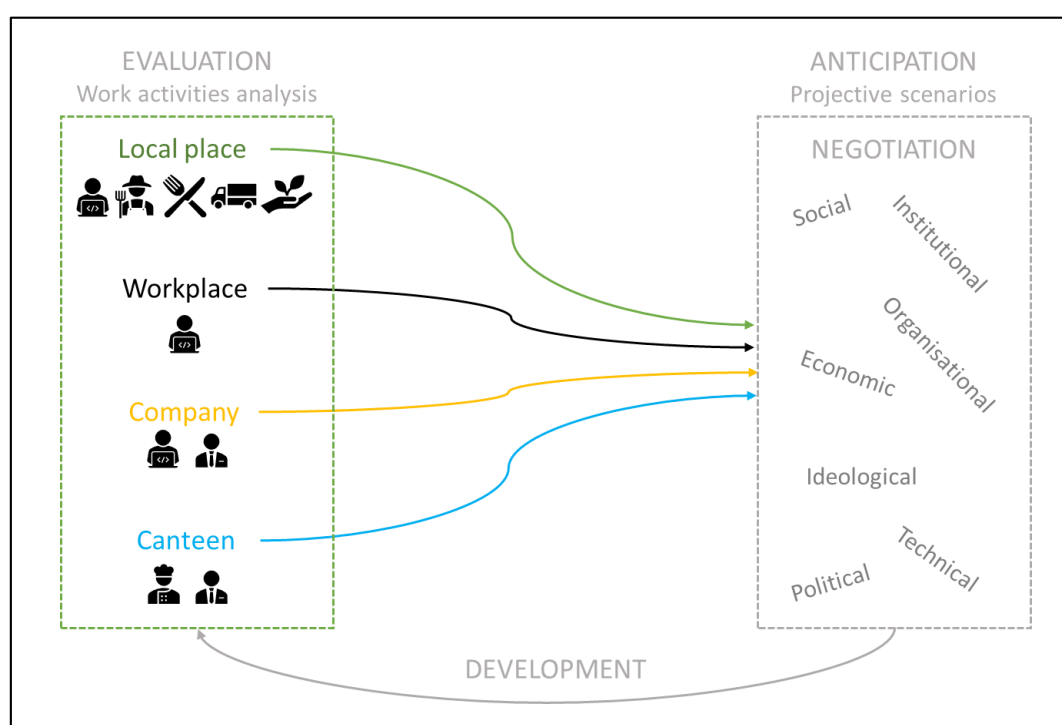


Figure 2. Illustration of the iterative process between phase 1 (evaluation) and phase 2 (anticipation).

5.2.1. Phase 1: Evaluation of the various work activities within the local food system

The first phase (Table 1) seeks to analyse the work of the diverse stakeholders of the local food system. This concerns activities of production, transformation and distribution of food, activities of NGOs supporting the development of the system, activities of employees as actors of the local place, the workplace and the company, and activities of canteens’ employees (Figure 2).

The empirical material is both quantitative and qualitative (discourses, practices). The data collection comprised: (i) online surveys; (ii) interviews of employees concerning their food habits during work time (sustainable or not); (iii) interviews and observations of workers whose activities take place in more sustainable food production, transformation and provision; (iv) interviews of companies which have evolved or plan to change to sustainable food practices at work (via managers and decision-makers); and (v) interviews and observations of associations/NGOs, which help companies’ transition towards sustainable food practices.

<i>Table 1. Phase 1 (Evaluation).</i>
Identifying internal factors (knowledge, motivation, values) and external resources (technical, organisational, environmental) related to sustainable food practices.
Identifying what are the determinants (e.g. social, organisational, economic) of work for the implementation of sustainable food practices.
Identifying effective possibilities for the implementation of sustainable food practices; and identifying which criteria facilitate or interfere with these possibilities.
Investigating innovative practices concerning sustainable food in workplaces, as well as innovative local food systems and innovative collective practices.

Such analyse is meant to identify the various activity systems according to their respective object and motive (e.g. which sustainable food practices do they claim) and to their respective coordination rules and the way this influence work transformation. It is not possible to analyse all the organization of the local food system. We seek to identify various modes of organization between the diverse stakeholders and analyse how these modes of organization are related to sustainability values. Then, we seek to identify how the various modes of organization may be articulated (which constraints and opportunities) in order to develop work and workers.

5.2.2. Phase 2: Anticipation of the new arrangements within the local food system

The second phase (Table 2) seeks to support the design of innovative solutions, based on constructive negotiation between diverse issues which are related to sustainable transition (e.g. social, ideological, political, institutional, technical, etc. See Figure 2). This concerns all stakeholders involved in the local food system. The negotiation between diverse constraints is made possible through the design of projective scenarios which imagine probable, desirable and acceptable futures.

The empirical data is qualitative (mental representations, opinions, practices). The data collection comprise: (i) focus groups and creative design workshops with all the diversity of stakeholders and with experts of the domain (e.g., associations/NGOs which support companies’ transition); (ii) language-based simulations (role-playing game, system mapping, storyboard...) with all stakeholders and with experts of the domain; (iii) feedbacks of stakeholders (interviews and observations).

<i>Table 2. Phase 2 (Anticipation).</i>
Creating conducive conditions for the expression of multiple point of views, needs, constraints and expectations concerning the implementation of sustainable food practices.

Creating conducive conditions for the development of knowledge about the future situation (i.e. negotiation, “debate spaces”).
Designing scenarios of actions collaboratively.
Simulating the solutions.
Assessing the solutions collaboratively
Giving the opportunity to generate a lot of ideas, to create innovative solutions and to evaluate these solutions collaboratively.

6. Concluding discussion

Transition towards sustainable food systems cannot ignore the work transformations of actors involved at different scales, from production to transformation, distribution and consumption. In that respect, our paper presents a methodological approach to explore how work, workers and workplaces are impacted by the development of local food systems; and in turn, how they contribute to the development of the local food system. Our approach proposes iterations between work activities analysis (evaluation of the system) and projective scenarios (anticipation of new arrangements within the system).

Future research concerns the application of our methodological approach. We plan to explore the Saclay territory (Saclay plateau) located in the south of Paris. This is a peri-urban project territory which involves both urbanization and rurality issues, and which is favourable to the emergence of local food systems. Saclay is an open space close to a dense urban area and where prosperous agricultural activities remain, despite huge construction sites for the installation of both private companies and public infrastructure (like universities). Local stakeholders try to preserve agricultural and natural spaces to develop the well-being of people. Local initiatives (i.e. short food-supply chains) have emerged to help the connection between local consumption and local production (Tedesco et al., 2017). Through our data collection, we wish to identify individual and collective actions of employees-consumers as well as actions envisaged and/or implemented by companies, to understand how the work of all stakeholders involved in the local food system is impacted by the sustainable transition. Through our involvement in NGOs which advised companies on sustainable food practices we try to equip them to open discussions with the various stakeholders in order to take into account the technical, social and ideological aspects of work organizations in transition towards more sustainable food practices.

We expect to highlight that transition towards sustainable food systems is integrated in a working context which includes work, workers and workplaces. We expect to identify how work activities reshape the sociotechnical system, and in turn how work is influenced by new sociotechnical arrangements. Concerning our methodological model, we expect to offer for practitioners (including NGOs) who manage a process of change, tools and methods to identify and to anticipate the key components of the work involved in the transition. Another important contribution lies in the interest in systems of ideas and values (i.e., ideologies) on the levels of organisations, communities and society, which is not that much considered within design projects related to sustainability issues.

To finish, we hope to extend the scope of debate on Sustainability Transitions Studies and bring an ergonomics' point of view of how both technical and social processes are interrelated in society. Indeed, both sociotechnical system and sociotechnical transition do not have the same signification within the two fields of research. But they are conceptualized identically, i.e. as the articulations between technical and social determinants within (societal or work) organization. The analysis, at different scales, of sociotechnical dynamics related to transition towards sustainable food systems may enrich the understanding of such transition.

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THE CONSTRUCTION OF NETWORKS IN ITALIAN SOCIAL FARMING

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Introduction

Multifunctionality in agriculture becomes a strategy to diversify business activities in response to the new demand for goods and services to the primary sector expressed by consumers since the end of the last century (Fabiani 2014; Aguglia et.al, 2009). The agricultural world - in a new "post-productivist" perspective, of multifunctional agriculture and of sustainable development of rural areas - discovers the new capacity of the farm to promote a wide range of services that complement the traditional function of producing food (Senni, 2010; Giarè et al. 2018).

Social farming (SF) is part of this framework, offering innovative services, enhancing and mobilizing local resources, strengthening networks of relationships and ensuring a new reputation and visibility for local actors (Senni, 2013). Social farming practices, widespread in Italy, are carried out by farms, agricultural cooperatives, social cooperatives, public companies, public and private health and social structures and find in Law 141/2015 "*Disposizioni in materia di agricoltura sociale*" the regulatory framework of reference.

One of the goals of Europe 2020 Strategy that aimed at promoting “a smart, sustainable and inclusive growth and at achieving high levels of employment, productivity and social cohesion” is the importance of social inclusion and the fight against poverty. The programming cycle of the European Structural and Investment Funds 2014-2020 gives an important opportunity for social farming development (Ascani and De Vivo, 2016).

Social farming represents an innovative solution for the cohesion of territories. It intervenes both on the need to meet new social requirements for protection and services to people in rural and peri-urban areas and on the possibility of encouraging the development of rural networks able to promote social entrepreneurship. SF promotes solidarity and professional integration in social enterprises and the social economy in general in order to facilitate employment for disadvantaged people.

Local and national networks have been set up in the areas concerned with the development of SF. They originate from the traditional rural self-help networks that were well established in rural areas before the modernisation of agriculture and the rise of the public welfare system. Some local networks have given rise to initial ways of formal recognition of social farming practices by those responsible for social and health policies. Recently, from an organisational point of view, interesting links have been established between the world of agriculture and social enterprise, which mediate skills and entrepreneurial networks with those of social cooperation, mobilising available resources in a new way to create economic and social value. It is a question of enhancing, alongside the formal networks of services, informal networks aimed at the formulation and provision of services by the farm. Social farming develops in this sense as a practice that integrates agricultural activities with other ones- social, welfare, educational, etc. - based on cooperation between different actors, sectors and areas (Foti et al., 2014; Lanfranchi et al., 2015; Scuderi et al., 2014; Steigen et al., 2016). In this light, SF includes public-private partnerships, community services and innovative forms of welfare undergoing experimentation and development in various European contexts (De Vivo et al., 2018).

This paper aims to describe the importance of networks between different actors of the agricultural system and how these could favour the process of rural transition, i.e. how SF stimulates innovation in the welfare system. The work takes its cue from the first results of a study conducted on the role that a public body, the Italian National Rural Network (NRN), can play in fostering the creation of networks within a group of heterogeneous subjects (agricultural entrepreneurs, farmers’ unions, public officials, young students, health and social workers) who met thanks to the events (study visits and summer schools) organized by the NRN (Borsotto et al., 2019).

The purpose of this study is to investigate networks and their efficiency within a group of actors that are involved in social farming in Italy.

Materials and methods

The research carries out a qualitative analysis in two steps to describe Italian SF operators and the networks among them.

The study involved a group of Italian SF operators who participated, between 2016 and 2017, in a questionnaire with the CAWI (Computer Assisted Web Interviewing) methodology carried out by the Italian National Rural Network in collaboration with the National Institute for Public Policy Analysis (INAPP) (CREA-PB, 2017). The decision to use the CAWI survey strategy is linked to considerations about the nature of the target population, composed of subjects who are familiar with the use of the Internet (Bosnjak et al., 2008), but also about the advantages offered by the CAWI methodology compared to other methods of administering questionnaires (e.g., lower costs, timeliness in collecting information, low risks of conditioning, insertion of data collected directly into the matrices, possibility for respondents to resume the questionnaire when filling in).

About 1,200 subjects distributed throughout the Italian territory were invited to participate in the questionnaire through an e-mail; these subjects were identified as "potential" SF operators. The list was

drawn on information contained in official websites and publications. The *Forum Nazionale Agricoltura Sociale (FNAS)* and *Rete Fattorie Sociali* also provided a list of their members.

The 1,200 actors involved in the CAWI survey were different in terms of legal form, agricultural production, social activity and therefore they were divided into four main categories:

agricultural farm/enterprises (individual enterprises, agricultural companies, agricultural cooperatives);

social cooperatives (A-type, B-type and A+B type⁶⁶);

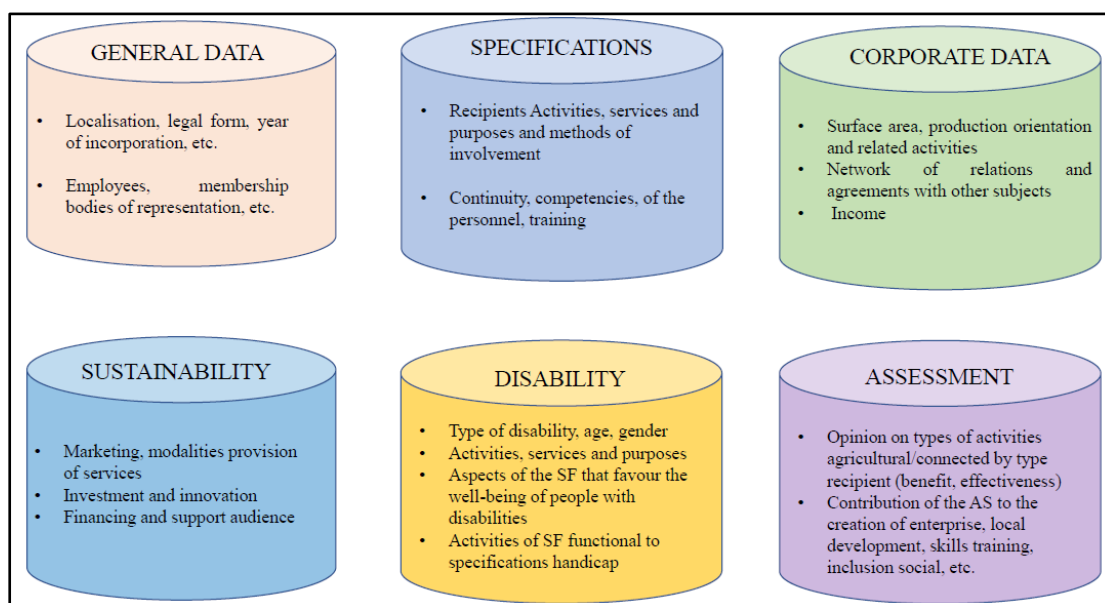
public bodies (local health authorities, hospitals, prisons, schools, universities);

other subjects (Unions' Farmers, associations, Local Action Groups (LAG), consortia, rehabilitation centres, communities and religious institutions).

In order to define the objectives of the survey to be carried out through the questionnaire, a discussion with a group of experts in social farming at national level was organized. Experts from public research (*Istituto Superiore di Sanità*, University of Pisa, University of Tuscia, University of Perugia) defined the main areas of investigation and the structure of the questionnaire.

The questionnaire mainly contained closed-ended questions. It was divided into six different sections aimed at collecting general information, the farm structure, the agricultural and social activities, but also specific aspects such as the economic sustainability of the SF experiences, the specificity of the activities aimed at people with disabilities, the opinions on the effects of SF and the critical points that operators encounter in the implementation of activities (figure 1).

Figure 1 - Structure of the questionnaire CAWI



⁶⁶ Social cooperatives (SC), defined by the Italian Law no. 381 of 8th November 1991, aim at “pursuing the general interest of the community in the human promotion and social integration of citizens”. SC are classified according to the way in which they pursue the non-profit purpose and are divided into SC of type A), i.e. dedicated to the “management of social, health and educational services”, and SC of type B), which provide for the “performance of different activities - agricultural, industrial, commercial or service - aimed at the employment of disadvantaged people”. SC can also be of the mixed type, i.e. A and B. Unlike other types of cooperatives, SC may have voluntary members (at least half of the workers) and, if type B, they must have at least 30% of disadvantaged workers.

Source: Our elaboration on CREA-NRN data

Of the 1,200 "potential" SF operators, 411 answered the questionnaire, but the response rate is 31%, as 367 questionnaires were filled in and completed (Weimiao and Zheng, 2010). Some questionnaires presented problems that did not allowed their use (such as incomplete questionnaires or respondents not carrying out SF activities). Even if they do not represent a statistically significant source, we have used these data to give an articulated and differentiated picture of social farming in Italy.

Social relations, networks and values influence the functioning and development of societies and social capital. Several authors have scientifically defined (Acciani et al., 2009; Cristini et al., 2012) and measured social relations between subjects, groups, organizations or other entities involved in processes of exchange of goods, information and knowledge (Wasserman and Faust, 1994).

We have mapped and measured the links (formal and informal) that some of these 367 realities have created by using the Social Network Analysis (SNA). SNA is the mapping and measurement of relationships and flows between people, groups, organizations and other information/knowledge entities (Krebs, Holley, 2002). It plays a role of organizational investigator by uncovering the real networks, which operate below the formal organizational structure and indicating ways of improvement. The SNA also allows to describe the complexity of the relationships, as well as to highlight the distinctive elements of the network, the strengths and weaknesses and the most important nodes (Trobia and Milia, 2011).

The relational data, necessary to determine and make visible the cognitive map of relationships, were obtained through the analysis of 112 questionnaires received. The reports were then classified by categories of homogeneous actors (social workers, farmers, public officials, etc.). The data collected were then organized through the creation of a square symmetrical matrix, called the adjacency matrix (one mode), in which the links were represented by dichotomous values. The matrix represents the playing field in which all the actors are identified. For the following mathematical elaborations of the data, the UCINET software (Borgatti et al., 2002a) version 6.685 was used, while for the transposition of the matrix into graphs, the NETDRAW software (Borgatti, 2002b) version 2.168 was used. The latter allows, even if at an intuitive, non-formalized level, the observation of the relational structure represented by the graph called sociogram.

The results of the analysis help to highlight the elements that make networks efficient and those that hinder their good functionality; in particular, the SNA allows to:

understand the lack of connections between groups/subjects;

highlight the areas of possible improvement regarding the flows of knowledge and information;

recognize the categories of subjects/individuals that play a central role in the networks or that can have a catalytic function towards other categories of subjects;

intercept the categories of subjects/individuals who show the greatest difficulty in participating in the networks;

identify the nodes that make the circulation of information difficult;

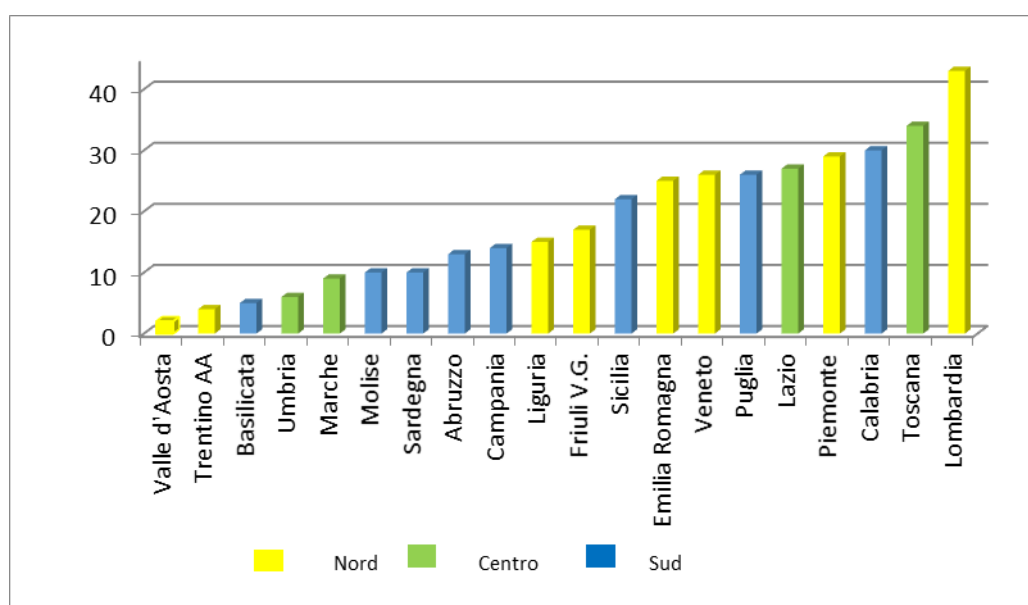
raise awareness of the importance and effects of informal networks.

The analysis provides useful indications not only for further research and analysis activities, but also to better finalize the activities of support carried out by NRN aimed at networking the subjects who work in SF and therefore to improve the exchange of knowledge (Albanese et al., 2012).

Sample description

The largest number of questionnaires were completed in Lombardia, Toscana and Calabria while the least representative regions are Valle d'Aosta and Trentino Alto Adige (Figure 2).

Figure 2 Number of filled questionnaires at regional level



Source: Our elaboration on CREA-NRN data

The realities surveyed are mostly newly established: social farming activities have been activated in almost 80% of cases since 2005 and only 18% are the firms that started social farming before 2000.

The sample is characterized by a high farm size of about 25 hectares, a value significantly higher than the average farm data from the 6th General Census of Agriculture of ISTAT in 2010 (7.9 ha) and a preponderance for the classes of UAA with more than 50 ha (76%), whose area is managed by 7% of farms. In contrast, 58% of farms have only 5% of the total UAA. About half of the UAA is rented, more than double the percentage of the property, which is also related to the legal form of the realities of SF, among which social cooperation is predominant (representing 46% of the total sample, with a prevalence of B-type cooperatives). There are forms of free loan of both public and private land, as well as management of confiscated land from the mafias, predominantly in Southern Italy. Free loan is a method of management that allows the use of abandoned land, with the aim, among others, to protect degraded areas in order to stem the loss of productive land, but also the neglect of the territory, one of the main causes of hydrogeological instability. Urban and peri-urban gardens respond to this aim and to an increasingly present need to self-produce food with a view to eco-sustainability and quality.

The analysis of the questionnaires clearly shows a correlation between the practice of social farming and the adoption of natural farming methods (organic or biodynamic), adopted by 68% of farms. The protection and enhancement of resources, with respect for the environment, animal welfare and consumers concerns are in fact the prerequisites for sustainable development as a model and lifestyle, able to become a reference point not only for those who work in this field, but also for citizens and users.

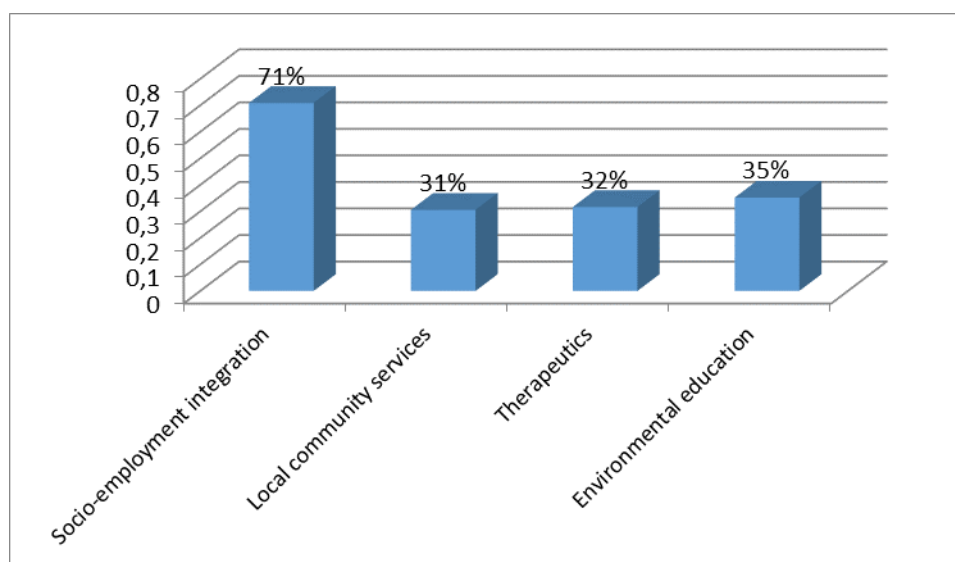
The distribution channels of agricultural products from SF are differentiated: more than 60% sell directly on the farm, more than 35% to Solidarity Purchasing Groups (SPGs), more than 32% in the farmers markets and 22.3% in the catering sector, 8.5% in organized distribution and 7.0% in wholesalers.

The agriculture-related activities of the farm represent an important element in the organization of the realities of SF and, in many ways, represent the heart of it. As highlighted in other studies (Lanfranchi et al., 2015), multifunctionality includes all the functions attributable to agriculture: from socio-cultural to environmental, from transport to educational and cultural services. Some of them are explicitly identified by the Law (educational farms, environmental education, etc.), others are useful channels for the employment and social inclusion of vulnerable sections of society. On average, each of the analysed

realities carries out more than 2 connected activities, with a prevalence of farm shops and educational farms. These activities are more present in social cooperatives, as the maintenance of green areas, due to the high percentage of work inclusion activities.

The analysis of the activities carried out, classified according to art. 2 of Law 141/2015, shows that social and employment integration of disabled and disadvantaged workers is the main one, present in 71% of the sample, while the other three types are represented in a similar percentage of the sample (figure 3).

Figure 3 Different services offered (%)



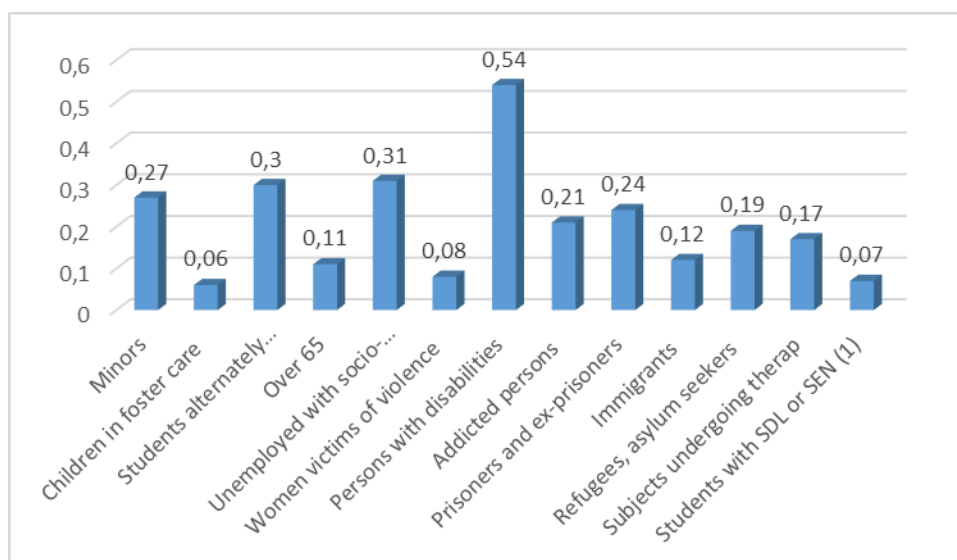
As well: multiple choice question

Source: Our elaboration on CREA-NRN data

The activities are mainly carried out directly by the structure (79% of cases). The external subjects involved are primarily social cooperatives (28%), which have different professional backgrounds within them, followed by voluntary associations, which play an important role in social aggregation and listening to needs.

As is well known, SF addresses the weaker sections of the population, from minors to the elderly, from refugees to prisoners, with a variety that often derives from the specific needs of the contexts in which it operates. The activities are aimed at more than one type of person and 54% of the sample carries out activities aimed at people with disabilities, a percentage that is much higher than that of the other categories (figure 4)

Figure 4 Recipients of SF activities



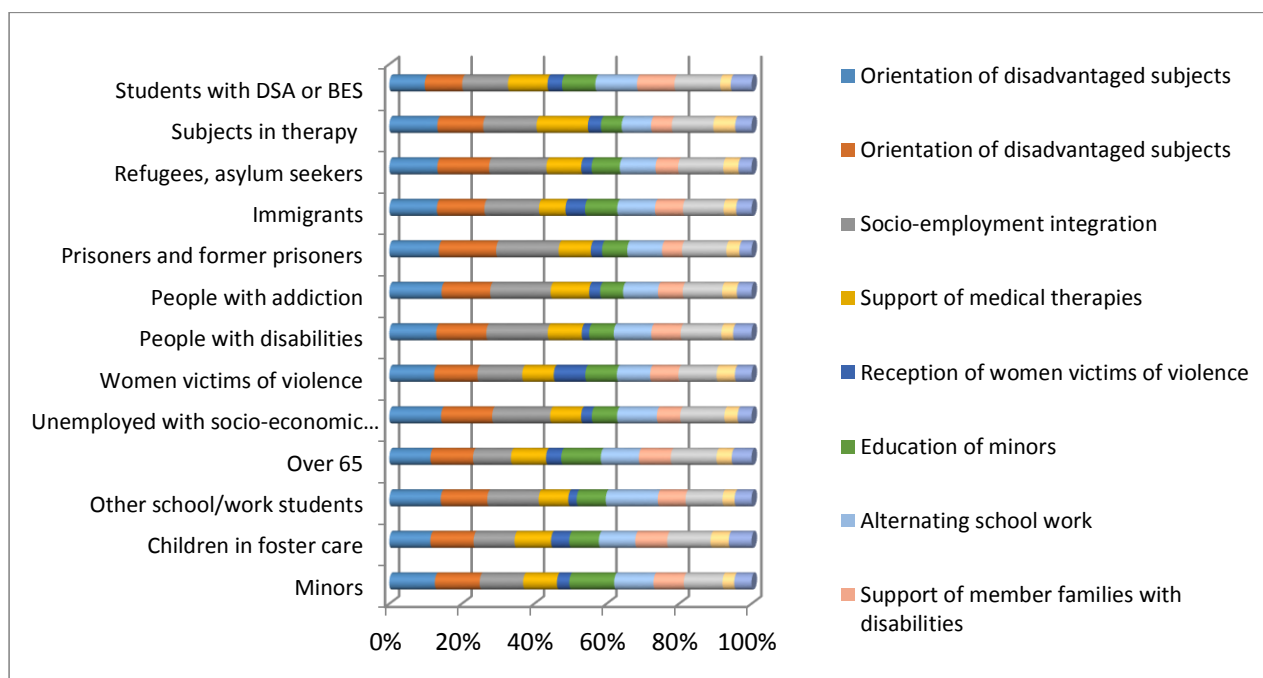
As well: multiple choice question

SDL Specific learning disabilities; SEN Special educational needs

Source: Our elaboration on CREA-NRN data

The services offered are many and respond to different needs, some more specifically oriented to training and employment, others aimed at supporting socially excluded people and families with members with disabilities. Figure 5 shows, for each type of recipient, the percentage of services used.

Figure 5 Services offered by type of recipients of SF activities (%)



Source: Our elaboration on CREA-NRN data

The services present in all categories of recipients are counselling and training, both important for disadvantaged people, as they allow to acquire skills and information guiding life and work paths. Social and work integration also play a significant role.

Another element investigated in the survey is the way in which the recipients of SF activities are involved in them.

Networks in social farming

Social farming is a very complex activity that requires the contribution of different skills and expertise. More than 85% of social farms have adequate staff to carry out the activities but the remaining 15% needs external subjects. Usually those who turn to external subjects identify one or two interlocutors (75%), however there are also cases where the number of relationships increases considerably, up to 7 experts.

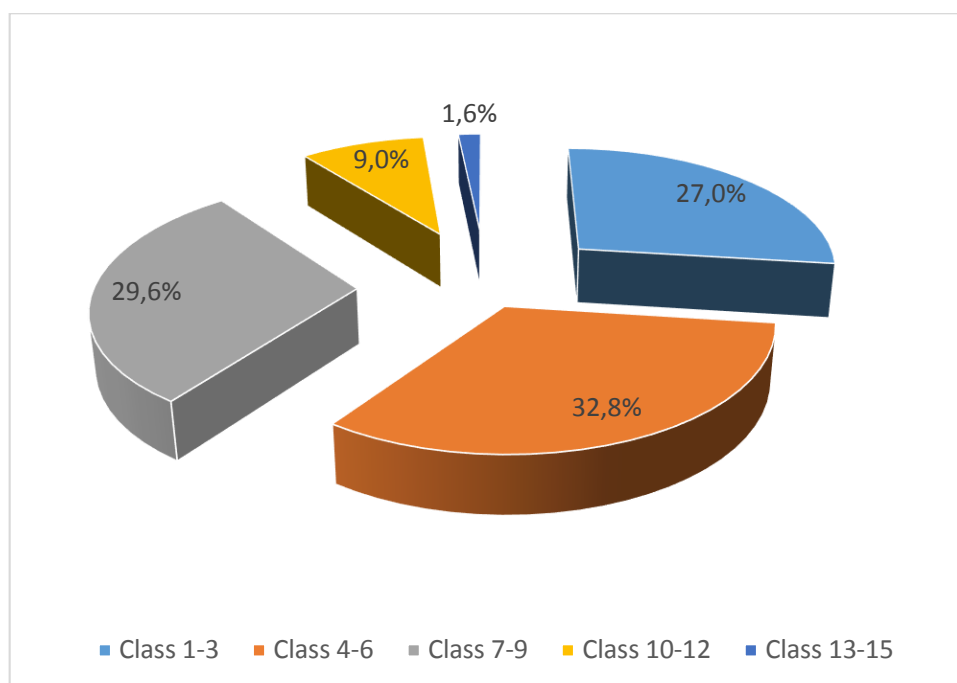
The legal form of social farms influences the use of external services. However, cooperatives, which are the most widespread form, make less use of external services, while farms, partnerships, corporations and other associations turn more to the outside. This is because cooperatives have more complex structures and more social skills.

The most involved external subjects are cooperatives (31%), in particular social cooperatives (27%). Other important entities are the associations (21%), individual companies (11%), local authorities (8%), health authorities (7%) and penitentiary institutions (7%). People that work in social farming have a good organizational structure and developed skills and in this sense the world of cooperation is the most representative.

In addition to relations with external subjects for the implementation of SF activities, the relationships not strictly connected to the practices of the SF are fundamental; they are established with actors through different types of agreements. The networks are complex due to the type of agreements and the number of subjects involved. Social farms enter into agreements at the same time with different

categories of actors. The agreements mainly range from a minimum number of 2 to a maximum number of 9 with 87% of the sample falling within this range. The most representative class, with 33% of the sample, is the one that provides for relations with a few subjects ranging from 4 to 6, followed by class 7-9 (30%) and class 1-3. Finally, even if numerically less consistent, 11% of the sample is at the centre of a network with more than 10 relationships (figure 6). The relationship is, therefore, a characteristic element of SF and the opening to the outside of social farms emerges in a significant way. On the one hand, these farms need a continuous exchange of professionalism, services, experiences, ideas and, on the other hand, they focus on themselves the attention of the surrounding territory as they represent a place where other local actors and the population actively participate in processes of social growth.

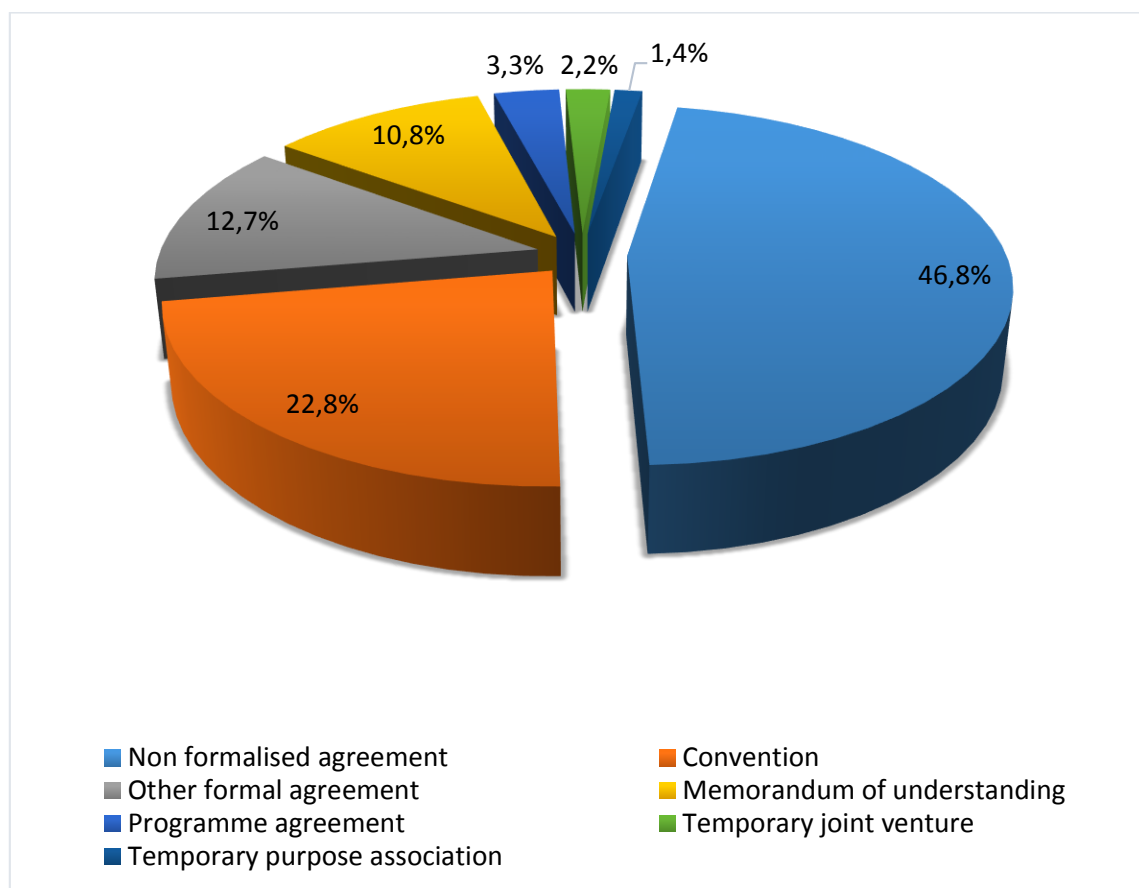
Figure 6 Network agreements in classes



Source: Our elaboration on CREA-NRN data

The most common form of agreement is the non-formalised one (47%) followed by the convention (23%), "other formal agreement" (13%) and the memorandum of understanding (11%) (figure 7). Programme agreements, temporary joint ventures and temporary purpose associations, which represent more articulated types of agreement, are marginal forms, totalling only 7% together. The form of agreement differs from the subject with whom it is stipulated: for the more "institutional" external subjects a formal type of contract prevails and in particular the convention (health agencies, social services, penitentiary offices, schools, territorial support centres), while for the other subjects the non-formalised agreement prevails.

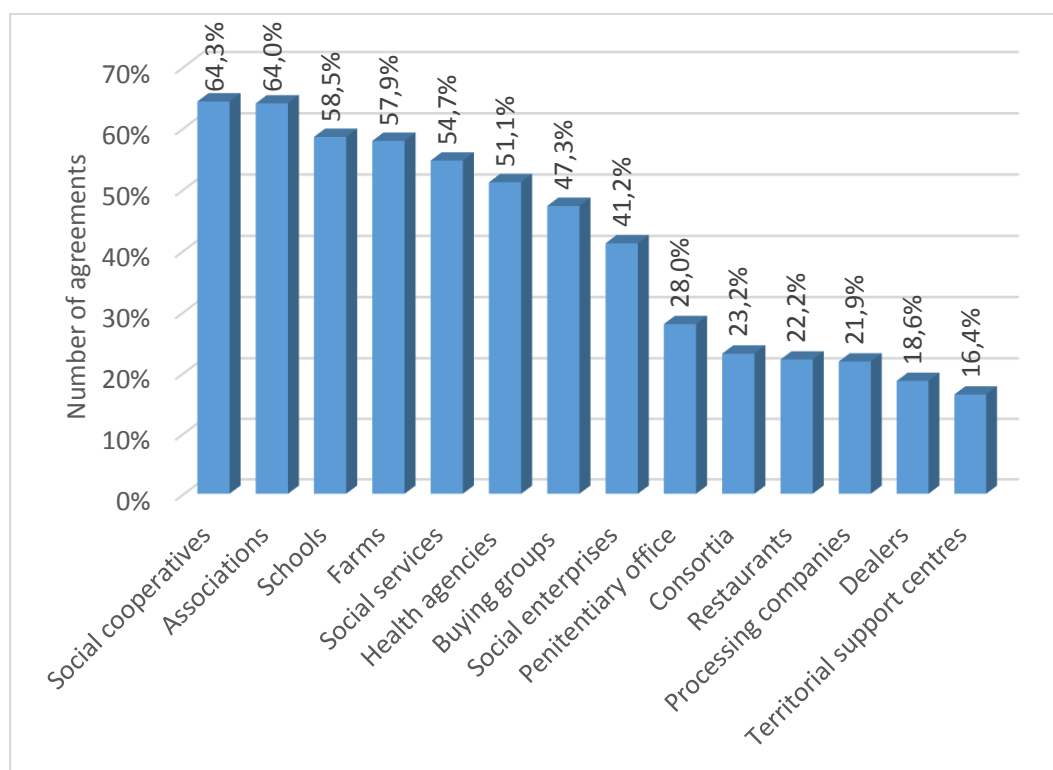
Figure 7 Types of network agreements



Source: Our elaboration on CREA-NRN data

Social farms have the greatest number of relationships with social cooperatives and associations (65%). Furthermore, almost 60% of them have relationships with schools and farms, social services and local health agencies exceed 50%. A significant number of subjects have agreements with buying groups (47%) and social enterprises (41%). The other actors involved in the network agreements represent less than 30% of the sample as shown in figure 8. Cooperation, in particular social cooperatives, and associations represent a frequent operative mode in the world of SF and main relationships take place with subjects who share the same inspiring principles and who are often involved in similar activities.

Figure 8 Network agreements by subject type



Source: Our elaboration on CREA-NRN data

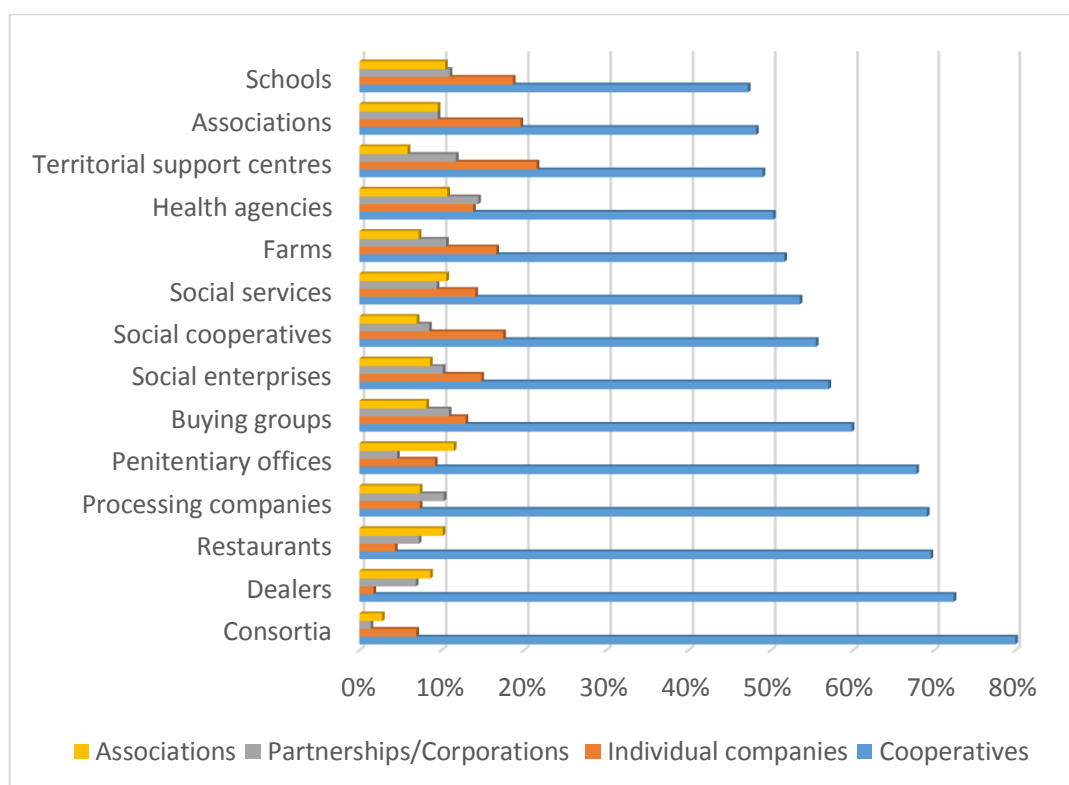
Non formalised agreements are the most common way for social farms and are used mainly with those who connect the world of SF with the consumption. Buying groups and restaurants establish almost 80% of the time direct relationships with social farms using this form of agreement. This particularity of the social farms-consumers connection is highlighted by the incidence of this mode of agreement also for dealers and processors.

The formal agreement is the second mode chosen for the agreements and represents almost a quarter of the overall agreements. Most of the actors who work on the territory and who have a public structure operate with formal agreements and in particular through the instrument of the convention.

The other modes of agreement are little used and are significant only for some types of subjects.

The analysis of the legal nature of social farms shows the relevance of some categories in terms of aggregation capacity. A predominant role is played by social cooperatives which, together with other forms of cooperatives, are at the centre of a network that represents the 56% of relations. An important role is played by individual companies (14%), partnerships/corporations (10%) and associations (9%) These four main SF realities are therefore able to build close relationships with the other SF actors, creating very articulated networks (figure 9).

Figure 9 The importance of the four main legal types of social farms in the networks



Source: Our elaboration on CREA-NRN data

SF takes on different forms and dimensions, depending on the needs and resources of the territory and with the aim of building development paths in order to provide services and improve the conditions of the local community. These features are present in an almost independent from the legal form and the role held.

Results

In this paper we wanted to investigate the role of the networks that "social farms" have with farmers' unions specialised in social farming.

From the 367 questionnaires collected, only 112 social farming operators (agricultural enterprises, social cooperatives, etc.) with at least two active ties with other representative actors (14, big and little, farmers' unions) were identified.

In Italy, the bureaucracy in agricultural sector revolves around farmers' unions. Some of them are large in terms of numbers of hectares of the farms associated, but also with reference to workforce size of the farms (*Coldiretti*, *Confagricoltura* and *Confederazione Italiana degli Agricoltori*) and others are less large (*Copagri*).

There are also some representative structures not specialised in the agricultural sector but mainly in the cooperative and associative world.

In social farming there are currently three large representative associations: *Forum Nazionale Agricoltura Sociale (FNAS)*, *Rete Fattorie Sociali*, and *BioAgricoltura Sociale*, the latter was set up in 2018

and is therefore not part of the organisations surveyed in this work. *Coldiretti* put together the farms that operate in Social Farming activities under the *Campagna Amica* brand.

The survey's descriptive modalities and results were presented in the previous chapter. Concerning the "global" properties of the network, the degree of cohesion of the network was verified through the density index. This index is given by the ratio between the number of ties existing in the network and those that can be activated. The density has a range of variation between a minimum value of "0", which indicates zero density (network completely disconnected) and a maximum value of "1", which indicates the extreme density where all potential ties have been activated. The analysis showed a very low value of density (0.034); in fact, representing 530 activated ties out of a total of 4,206 potential relationships between the 126 actors surveyed. The value of the density is inversely proportional to the size of the network. In fact, the ties of an actor do not grow as the number of nodes in the network increases and therefore the measure must be related to the size of the network.

In order to deepen the analysis and increase the understanding of the network structure, some of the main relational indicators available for the mathematical analysis of the actors have been used, which allow to identify the position and characteristics of each node in the network. This network centrality measurement has been carried out by using an index, called centrality index, which is aimed at measuring the structural position of one node in relation to the others. The centrality represents one of the main objectives in the empirical analysis of social networks, as it allows to define and identify the positioning of a specific subject in its network in purely relational terms (Cordaz, 2005).

From the sociogram (fig.10) emerges, moreover, the presence of some larger nodes that present a high degree value (*Forum Nazionale Agricoltura Sociale (FNAS)*, *Rete Fattorie Sociali*, *Coldiretti*, *Confagricoltura*, *Copagri* and *CIA*). The degree of a node, called $d(ni)$, is given by the number of lines adjacent to it. The degree of an actor means the number of relationships it has. According to this indicator, the greater is the number of relationships that an actor has, the more central is its position in the network (Wasserman and Faust, 1994).

Centrality degree is an analytical index that varies from "0" to "1" (minimum and maximum centrality) and measures how much a node is connected. According to this mode, the greater centrality of a node is determined by the number of relationships that each node has with the others, calculated on the basis of the relationships that can potentially be activated.

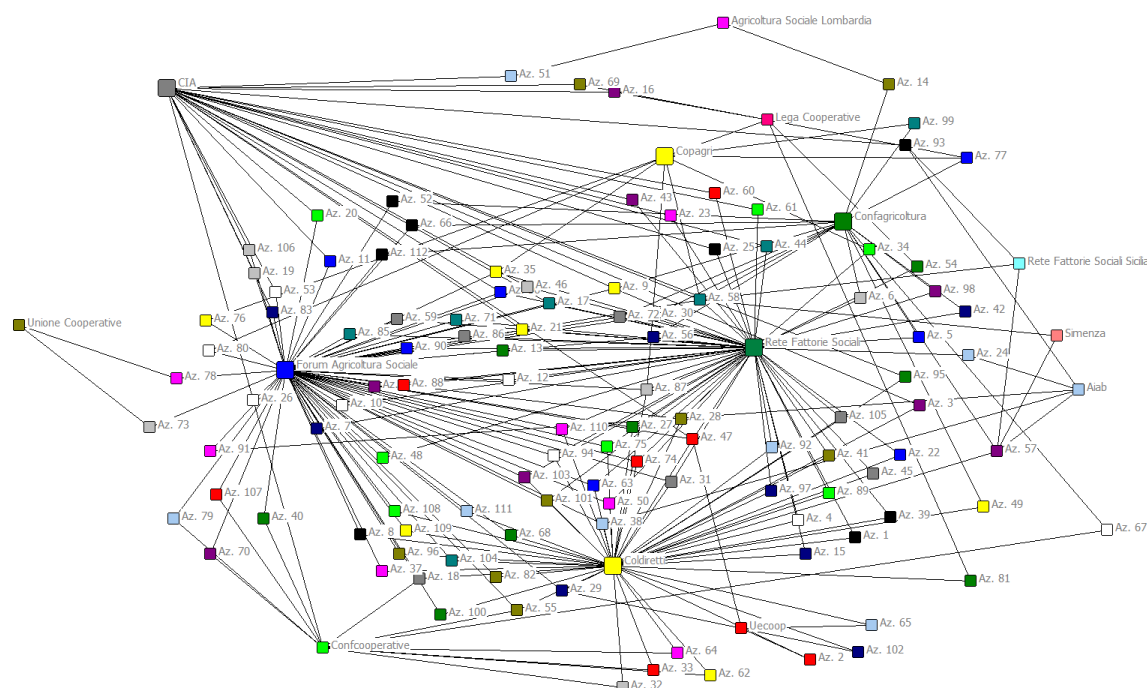
The formula is:

$$CD(ni) = \frac{d(ni)}{n-1}$$

where CD stands for centrality index calculated on degree; $d(ni)$ indicates the degree of the node; n represents the number of nodes making up the grid. In a simple graph the degree varies from 0 (isolation) to $n-1$ (linked to all the other nodes). It is evident that a greater degree corresponds to a greater integration of the node in the network (Marcolin, 2007). The mode centrality degree shows that the most involved actor in connections with SF enterprises is the *Forum Nazionale Agricoltura Sociale (FNAS)* with a level of 0.540, followed by the *Rete Fattorie Sociali* with 0.468, *Coldiretti* with 0.397 and *Confagricoltura* with 0.143. This index shows the potential communication activity of a node: greater is the possibility of communicating directly with the other nodes, greater is the centrality.

The analysed network has not proved to be very cohesive, due to the lack of ties between many of the actors. This value is influenced by the presence of social actors who interact little with the others, or who do not interact at all. Moreover, it is an active and inclusive network characterized by a certain amount of redundant links that can be poorly efficient and an obstacle to its further expansion. With respect to this network, some trade unions play an important role in representing farms operating in the social farming sector.

Figure 10 - Sociogram



Source: Our elaboration with UCINET software version 6.685 and with NETDRAW software version 2.168 on CREA-NRN data

Moreover, through the SNA, within the Italian Social Farming Network (ISFN), all the subgroups of at least 3 actors in which each node is directly connected to the others have been identified. In the ISFN sociogram (figure 10) each actor is represented by a square (node), while the relations between subjects are represented by bi-directional lines, being the collaboration relationship a reciprocal one. The figure shows the relationships within the structure. *Forum Nazionale Agricoltura Sociale* and *Rete Fattorie Sociali* represent the central nodes that have activated all ties through their institutional activities.

Concluding remarks

Literature highlights how strategic is the creation of networks in the performance of Social Farming activities. These are implemented through cooperation between actors with different professional skills and abilities and require networking between participants. Interactions between the components of Social Farming activities are fundamental for the internal decision-making processes of the network.

The survey conducted on a group of subjects who develop SF has shown how often the search for professionalism takes place outside the organization through both formal and more often informal agreements. Networks are formed not only between subjects with different skills (agricultural and social) but also between organizations that carry out similar and complementary activities and find in bodies such as *Forum Nazionale Agricoltura Sociale* and *Rete Fattorie Sociali* important nodes to improve their activities and to implement new networks.

The SNA has allowed the identification of the subjects who, by centrality and interposition, are potentially very much representative of Italian social farming movements. The network analysed is not very cohesive due to the lack of ties between many actors; however, it is active and inclusive, even though it is characterized by redundant ties that may be inefficient and may hinder its further expansion.

In the future, it would be interesting to strengthen and support the creation of a specialised network aggregating stakeholders in order to activate initiatives concerning education, information, projecting, finance, etc. Such a network would play a crucial role in facilitating the matching between demand and supply of Social Farming services and contribute to the local development of territories.

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THE PARADOX OF FARMER EMPOWERMENT AND ON-FARM DIVERSIFICATION IN FRANCE

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Abstract

This paper aims at understanding to what extent on-farm diversification contributes to empowering farmers in the food chain. In this respect, a qualitative enquiry was conducted in the North of France in 2019 among forty five farmers transforming and directly selling their own products (poultry, cereal, market gardening, wine and bovine meat sectors). The paper aims at analyzing how these farmers were more empowered. After having clarified the concept of empowerment in economics and stressed what has been developed in the literature on farmer empowerment, the results of the qualitative analysis are developed. We find that farmers now have the ability and freedom to fix the prices according to the costs of production and are no more dependent on other actors of the food system (mass retailing, food industries, trading companies) and world market prices. They usually observe that their income has risen since the development of on-farm processing and selling (market empowerment). They also enjoy and feel proud to sell their own products and exchange with consumers (non-market empowerment). That being said, one can also observe some shortcomings. One of the most important ones is the time farmers spend processing and selling their products. After having analyzed these empirical findings, we shall question the very concept of farmer empowerment: to what extent do farmers actually gain control over their lives?

Introduction

Empowerment is a crucial concept and is particularly relevant in a farming systems approach that considers the farmer as the central actor (Darnhofer, Gibbon and Dedieu, 2012). This concept has gradually gained pride of place in the social sciences since the 1960s. Over the decades, it has been used with reference to oppressed groups (see for instance, Solomon, 1976). Empowerment was then seen as the result of a pragmatic endeavor to change the world by fighting social and economic injustices, especially when analyzing empowerment of women farmers, and farmers in developing countries. However, there seems to be a gap in the literature regarding farmer empowerment in developed countries. With growing liberalization of agricultural markets, and rising influence of mass retail and food processing sectors worldwide, farmer empowerment seems central in understanding agricultural systems in developed countries.

Our paper’s objective is to analyze to what extent on-farm diversification (processing and direct selling) contributes to French farmers’ empowerment. The paper first clarifies the concept of empowerment in standard economics and in a capabilities approach. The results of the qualitative survey based on 45 qualitative semi-structured interviews to farmers processing and/or directly selling products in the North of France are then explored, in order to understand which market and non-market capabilities were enhanced. We shall tackle one major paradox of farmer empowerment: the additional workload generated by on-farm diversification, that could be at the core of the limits to farmer empowerment.

1. A clarification of the concept of empowerment

An indication of the growing success of the concept of empowerment is the fact that it has become a public good, used in various fields from social work, gender studies, minority studies, to development

studies. Empowerment literally refers to the process through which a person or group gains power⁶⁷. After having briefly examined how mainstream economics views empowerment, the capabilities approach shall be addressed. The latter approach is chosen as the framework to grasp farmer empowerment.

1.1. Market empowerment: the mainstream economics view

Getting empowered is understood by mainstream economics through a quantitative, tangible lens. Actually, mainstream economics⁶⁸ does not mention people's empowerment *per se*. From this viewpoint, gaining power over people's own affairs can be achieved through an increase of their utility or their income. This strand of thought considers each individual as a rational *homo economicus* who is constantly trying to improve his/her position and therefore mechanically responds to incentives (notably price incentives), in a rational and hedonistic manner. When prices are too low or costs are too high, entrepreneurs have no incentive to grow their business and withdraw from the market. As for demand, it will in turn increase. This situation will cause prices to rise allowing the market to return to equilibrium. When prices are higher, the reverse occurs. These are basic supply and demand rules. Free markets are therefore the best way of organizing economic life. They allow to maximize economic welfare, usually measured in terms of utility or income.

Another way of tackling empowerment within this framework is to consider market power, that is to say the power over pricing, either from the demand or the supply-side. Under perfect competition, neither the buyer nor the seller has such a power. They are all price-takers and cannot raise or lower the market price.

There is evidence of empowerment through the market, either by the participation in it or by benefiting from a power over it (El Karouni, 2012). In the case at issue, obviously, farmers who have sufficient market power to be able to fix prices in a manner which is independent of the behavior of their competitors, increase their revenue and therefore have more power over their lives. It is then in their best interests to acquire or reinforce their market power.

1.2. The capabilities approach

The concept of capabilities was first devised by Amartya Sen in his 1979 Tanner Lecture (Sen, 1980). Sen criticized standard economics' sole focus on utility and income as tools for assessing well-being. He advocates a vision beyond utility, taking into account the individuals' capacity to act. Capabilities are a set of 'beings' and 'doings' that are available to a person. So, from this viewpoint, getting empowered means having access to a greater range of opportunities either in terms of 'beings' or 'doings' (the ability/opportunity to be or to do).

From the 1990s, people's empowerment in terms of capabilities explicitly appear in the specific objectives of some international organizations. The World Bank defines empowerment as such: "Empowerment means enhancing the capacity of poor people to influence the state institutions that affect their lives, by strengthening their participation in political processes and local decision-making" (World Bank, 2000: 39). World Bank (2002) gives a more precise definition of empowerment: "Empowerment is the expansion of freedom of choice and action. It (...) is the expansion of assets and capabilities of poor people to participate in, negotiate with, influence, control, and hold accountable institutions that affect their lives" (Deepa, 2002: 14). Of course, this report mainly focuses on the elimination of poverty, especially in poor countries. It however allows a broad understanding of this concept, that we shall use to tackle farmers' empowerment.

⁶⁷ We adopt Weber's definition of power as the capacity to impose one's preferences to others albeit their resistance (Weber, 1954).

⁶⁸ We refer to mainstream economics as neoclassical theory.

2. Farmer empowerment and on-farm diversification

2.1. Farmer empowerment and on-farm diversification

Farmer empowerment literature is essentially based on developing countries (Wouterse, 2019) from the perspective of fair trade (Kruger and Du Toit, 2007; Dubuisson-Quellier and Lamine, 2008; Valkila, Haaparanta and Niemi, 2010; Guijt and van Walsum, 2016) and women farmers (Porter and Zovighian, 2014; Annes and Wright, 2015; Wright and Annes, 2016). The latter authors' research allows a better understanding of farm women's empowerment through on-farm diversification in the United States (Michigan) and in France. Wright and Annes (2016) analyze farmer empowerment women farmers' empowerment in Michigan in a sociological perspective. They define empowerment as a "multi-dimensional process constituting the 'power to' realize one's goals, the opportunity to exercise 'power with' others, and the ability to find and nurture 'power within' the self" (2016, p. 545). Based on 32 qualitative semi-structured interviews in 2013, the authors find that these women have gained autonomy in the decision-making process and control over their farm, but may still often be dependent upon male incomes and may conform to culturally expected gender roles.

As for research on farmer (men and women) empowerment in developed countries, Milone and Ventura (2018) illustrate case studies in England, the Netherlands and Italy in which farmers take back control over resources and products leading to greater autonomy. Needless to say, more research is needed to understand farmer empowerment in developed countries.

2.2. Research methods

The research was based on 45 qualitative semi-structured interviews to farmers processing and/or selling products themselves in five different food sectors (poultry, cereal, market gardening, wine and bovine meat sectors) in the North of France⁶⁹. The goal was to understand what on-farm diversification changed in economic (income, workload) and social/psychological terms (satisfaction, self-esteem). Farmers were essentially identified through internet sites⁷⁰ and snowball sampling. The selection of farmers interviewed was based on a typology capable of encompassing the variety of transformation and direct sales alternatives (on- and various direct sales such as off-farm processing, farm gate sales, resellers, farm stores...). Table 1 in annex 1 illustrates this variety with the typology of cereal growers selected.

The interviews conducted between January and April 2019 contained approximately twenty questions based on topics such as farm history, organization (employees, workload...), motivations to diversify, and how farmers defined the economic and social success or difficulties of on-farm diversification. The interviews generally lasted from one to two hours and were tape-recorded and transcribed. An inductive

⁶⁹ Interviews were conducted by 4th-year student engineers from UniLaSalle Beauvais (France), under the general supervision of Gilles Moreau. Respectively twelve farmers were interviewed in the cereal sector, nine in the bovine meat sector, eight in the poultry sector, eight in market gardening activity, and eight in the vine sector. All names have been changed in order to respect the anonymity of farmers interviewed. Verbatim were translated from French to English by Sylvie Lupton. As map 1 in annex 1 indicates, interviews with independent winegrowers were conducted 20 km around Chablis, situated in the North-east of France. This region was chosen as there is no wine production in the Northern part of France (Brittany, Normandy, Picardy and the Nord-Pas-de-Calais regions).

⁷⁰ Internet sites such as Bienvenue à la Ferme (<https://www.bienvenue-a-la-ferme.com/>), a site grouping farm gate sales that have the same logo "Bienvenue à la ferme") and Acheter à la source (Buying directly <https://www.acheteralasource.com/>) allowed a broader selection of different ways farmers use to transform products and sell directly (farm gate sales, AMAP that are consumer associations supporting small farming, farmers stores...).

method was used, and each transcript was carefully scrutinized. This enabled to highlight different textual themes related to farmer empowerment in terms of capabilities.

2.3. Results of the survey

We distinguish two different kinds of capabilities that were developed by farmers with on-farm diversification, leading to market or non-market empowerment.

2.3.1. Market empowerment

One capability that is predominantly mentioned is the ability to fix prices, and not depend on world market of bulk price fluctuations, or intermediate actors. In other words, farmers that process and/or sell directly to consumers are empowered in decision-making: they choose the price, marketing channels (internet, consumer associations, on-farm shop, producers' shops, ...) and to whom they want to sell. As farmers create a niche market, they process and sell their products with no intermediary, corresponding to a situation of monopolistic competition (Chamberlin, 1933). Each product has its inherent qualities (location, product processed by the farmer, authenticity, taste...), allowing farmers to fix the price. As Denis mentions (cereal farmer) regarding the eggs he sells on his farm, "it's pure craftsmanship. I calculate packaging costs, the time I spend, and I fix the price". Clyde, an independent winegrower (processing and selling bottled wine himself), remarks for Chablis wine: "In bottles, you don't depend on the Chablis bulk market. (...) The bottle, it's the mastery of our sales. We have a real negotiation power".

Communication skills are another interesting capability developed because of the direct interaction with the consumer. The farmer therefore adapts to consumers' desires regarding the variety and quality of products sold (horizontal and vertical differentiation). Moreover, on-farm processing develops knowledge and skills on the whole value chain. Ted (cereal producer who processes his wheat into flour) acquired skills on the quality of different wheat varieties: "I surprise myself talking about wheat like a winegrower talks about his grape variety, because from one variety to the other, you don't get the same results". Hence, quality is at the center of on-farm processing and direct selling. Farmers often mention consumers asking them if their products are organic, which has led some to start organic production. As Octave (organic beef producer and direct seller) mentions: "The advantage of organic food is that it opens doors regarding direct selling (...) Systematically when you sell directly to consumers, they ask if you have organic products". A greater variety of goods is often offered by farmers, following consumers' suggestions. Many farmers selling directly on their farms have stressed the fact that consumers ask them for new recipes, new products which induces them to adapt to their suggestions and to innovate. The closeness farmers have with consumers also encourages them to produce quality products. As Nick, a market gardener (selling his vegetables on his farm) finds: "When we don't do (the job) well, it forces us to do better". Farmers want to build trust with their clients, which seems to reduce potential asymmetric information on product quality. They want to be transparent. Martin, who sells poultry (produced and processed on his farm) observes: "There's a thing: it's trust. I have people who are allergic, in terms of traceability, I need to be clean with people". Finally, producing quality products necessarily creates a sense of satisfaction, as Alfred (wagyu beef producer and on-farm seller) notes: "Producing a product with such quality is gratifying, yes. (...) People know us thanks to that".

The ability to be economically independent is very important for all farmers interviewed. They all earn a living and a positive revenue from processing and/or direct selling (except for one), and this was often the reason why they started on-farm diversification. As Adrian (selling poultry on producers' shops) notes: "the objective when I took over the farm was not to be a slave of my work and to earn a living". Economic independence creates a sense of satisfaction, as Diane (selling her flour on the farm and to dealers) finds: "today, I'm happy, as I'm not going to hide it (...). We get more than 800 euros/ton for wheat processing". Three farmers also emphasize their will to be autonomous from CAP.

Finally, we come to the ability to create employment, thanks to increased revenue. This is a source of pride for farmers. Here market and non-market capabilities are embedded. Three farmers have employed on their farm thanks to on-farm diversification, and they express a certain pride in this. Ronald who sells organic vegetables on his farm and through a vending machine expresses his satisfaction: “we’re happy about the fact that our way of working creates jobs, that’s essential for us”.

Yet, probing transcripts in terms of capabilities allowed us to understand that they are intertwined. It is therefore difficult, if not impossible, to separate market and non-market capabilities as though they were independent from one another (see figure 1⁷¹). The fact of being able to fix prices, to be independent from intermediary actors (mass retailing, cooperatives...) and sell quality products due to enhanced communication with consumers nurtures a sense of satisfaction and pride.

2.3.2. *Non-market empowerment*

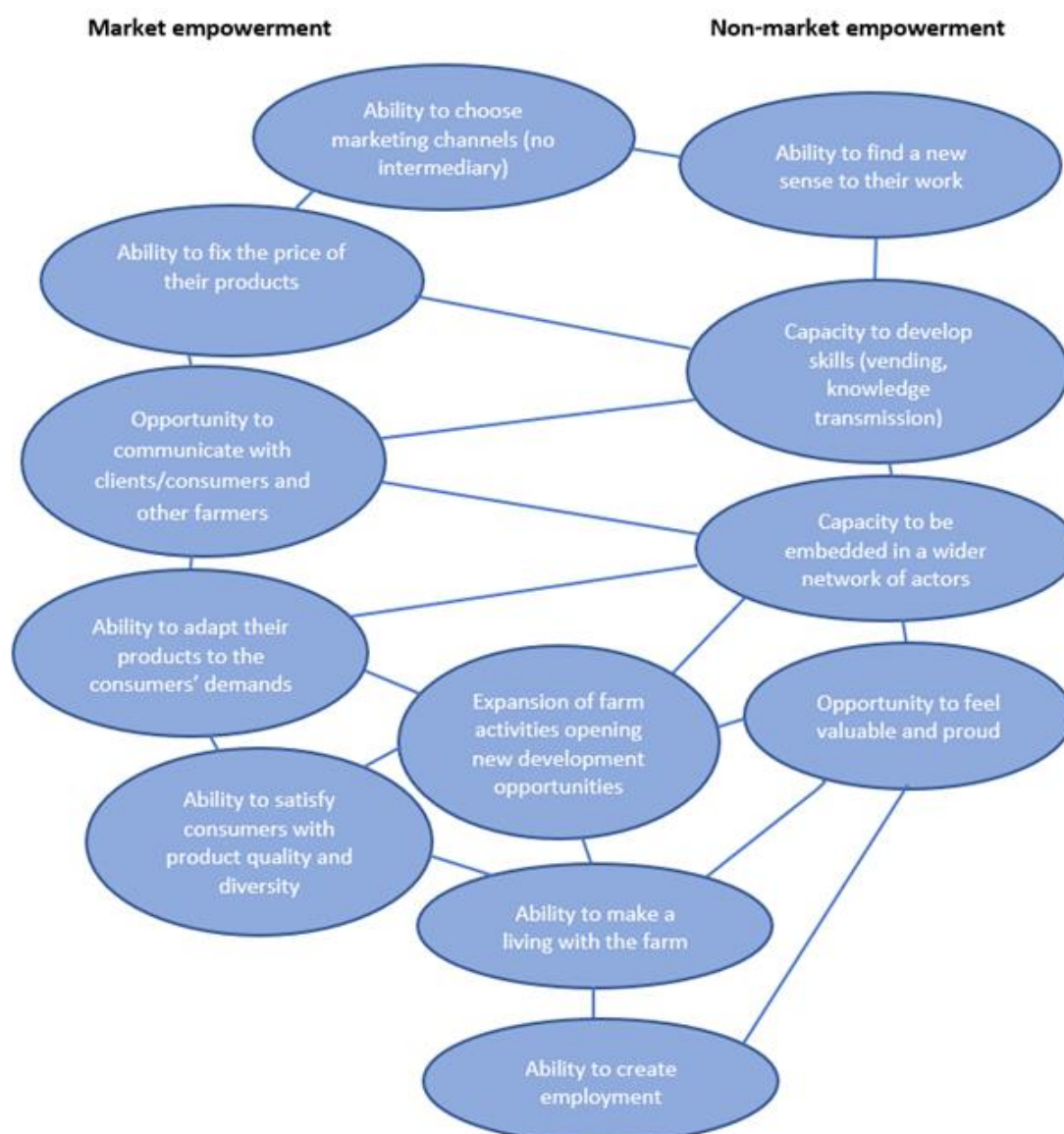
When reading and examining the transcripts of the farmers, one notices that on-farm diversification gives a new sense to their jobs. This is common to all farmers’ experience. The fact that they process and/or sell directly is very pleasurable and rewarding. This boosts their self-esteem and a sense of accomplishment. In what follows, we identified three main non-market capabilities that they develop, enabling them to develop this empowerment from within.

Interacting with and listening to consumers’ requests, creating bonds with them (leading sometimes to long-lasting friendships) allow farmers to adapt to demand and offer a wider variety of fine-tuned quality products. This in turn generates compliments and higher appreciation from consumers that boosts farmers’ moral and self-esteem. As Clement, a poultry producer who slaughters and sells his chickens on the farm, witnesses : “what’s important for me is what organic food quality brings to people, I’m proud to propose that type of product to my clients, and if they come back, it’s because it has a good taste”. When Ernest explains his activity processing flour from wheat, rye and einkorn and preparing organic bread, he mentions the new sense of his activities, “that, that has sense to me, yes, and it’s sourdough bread, it’s a choice on quality”.

Farmers also evoke the fact that selling on their farms allowed them to increase their network and be in contact with farmers that they had never met before, even though they lived next doors. This was mentioned by 10 farmers who explained how direct selling widened their network. As Diane (processing wheat and directly selling flour) notes, “There are farmers a dozen kilometers away that I didn’t even know, and now that I make flour, I got to know them”.

Finally, the work they do is more stimulating and meaningful. Thirty-two farmers mention the fact that the mastery of the product from the raw material to the final product or the fact that they have a wider variety of tasks to do gives them satisfaction. As Herbert, a market gardener who has a fruit and vegetable pick-your-own, underlines: “It’s exciting because it’s a really complete profession, you must be good in production, in human management, in communication”. As for Robert who processes wheat and sells flour and pasta, mastering the whole value chain has lots of sense: “Make no mistake, it really gives sense to our profession. When we started the stone mill three years ago, the first flour we made, I had shivers down the back! (...) All of a sudden, I saw that my profession was different”.

⁷¹ Figure 1 will be more precisely explained during the conference. We shall point out the interactions of different capabilities according to farmers interviewed to demonstrate the embeddedness of market and non-market capabilities.

Figure 1. Intertwined capabilities

Source: figure elaborated by the authors

2.3.3. A paradox: the workload

When delving into on-farm diversification, several authors have mentioned the extra workload due to various activities the farmer has to manage (Aubry, Bressoud and Petit, 2011; Darduin et al., 2013).

In terms of farmer empowerment, this workload can be depicted as a 'paradox of unintended consequences' (Weber, 1922): farmers' empowerment leads them to work more. Put differently, by getting empowered, they also become self-alienated. By self-alienation, we mean the paradox of a situation of subjugation resulting from the empowerment process. Farmers clearly take great satisfaction from their activities, particularly regarding the autonomy, increased revenue, and control they have acquired over their lives they enjoy more. But their on-farm activities (processing, selling, promoting...) also represent more working hours. Some farmers do not have the possibility to create extra employment as this would mean a significant decrease of their own income.

Thirty-three farmers mention the fact that processing and/or direct selling of their products increases their workload. What is more, most farmers don't complain about this workload. This is undoubtedly the paradox of farmers' empowerment. As Herbert mentions "oh, I must be at around 80 hours a week". This market gardener also points out how much he loves his job: "it takes a lot of work and it's really interesting". Apparently, farmers do not stint on their time. This is common to most farmers as only five farmers out of 33 would like to change pace. Ted who processes wheat with his stone mill is particularly dissatisfied as he has an insufficient income with these activities and is tired of the extra workload. Although he and his wife like what they do, they are considering if they should stop farming altogether. Brad who produces beer from his barley would like to work less and create a firm that would require less personal work: "as we have grown older, we are looking for something more comfortable".

It seems that despite increasing workload, most farmers have passion in what they do. Even Hugo, processing and cutting beef on his farm, who nearly suffered burnout, and admits that sometimes he gets tired, also adds he likes working a lot: "you know working 35 hours a week doesn't interest me, I must do the double, actually I don't know how much I work...um...it doesn't bother me". Paula, an independent winegrower does the job from A to Z from production to marketing and assumes this workload: "I do three jobs in one but (...) it's because I want to".

How can one explain this acceptance to work much more, and to not even count working hours for some?⁷² In strictly utilitarian and rational terms, one could quickly conclude in terms of disutility to work as much, and even farmers' irrationality. However, if one goes beyond this framework, and observes farmers' behavior and preferences, these are not only guided by reason but also by feelings and passion (Franck, 1988). Rationality combines both emotions and reason. Veblen's thought can also be enlightening in this matter. For him, people are not only hedonistic and rational calculators. Their behavior is also influenced by habits of mind which are themselves driven by 'instincts'. One of these instincts is the 'instinct of workmanship', in other words, the love for work well done (Veblen, 1898), and this is particularly visible in the transcripts.

Conclusory remarks

This paper has scrutinized the empowerment of northern French farmers who process and/or directly sell their products. These farmers have gained power through enhanced market and non-market capabilities. As far as market capabilities are concerned, their activities allow them to fix the prices of the products they produce, transform and sell, and their income is not jeopardized by the fluctuation in world market prices. They are autonomous and no more dependent on other actors of the food system. In the majority of cases, their income has risen since the development of on farm processing (market capabilities). As for non-market capabilities, farming has a new meaning for most farmers. They are proud of selling quality products directly to consumers, and consumers' positive reaction boost their self-esteem. That being said, one can also observe some shortcomings, in particular regarding the excessive workload that most farmers seem to be willing to accept. This seems however understandable if their passion for their work is taken into account. But, this also raises the question of the limits to their empowerment.

This research opens a Pandora's box of questions regarding farmer empowerment. With growing agricultural market liberalization and less financial support on farming activities, farmers have been encouraged to develop value-added activities. They actually gain more from these activities than from their production, but the workload is considerable. What are the long-term consequences of this growing trend in agriculture? Are there growing risks in terms of farmers' exhaustion? Was the Common

⁷² When asked about what is important in his value-added activities, Sebastian, who produces and sells beer responds: "Not counting one's hours. If we counted the hours, it would get scary". Alfred, a wagyu beef producer and seller adds this as being common to agriculture in general: "in agriculture you never count your time".

agricultural policy intended for this ? To what extent is this model desirable for farmers? Can one imagine that the new CAP will respond to this issue as it intends to remunerate farmers in terms of working units?

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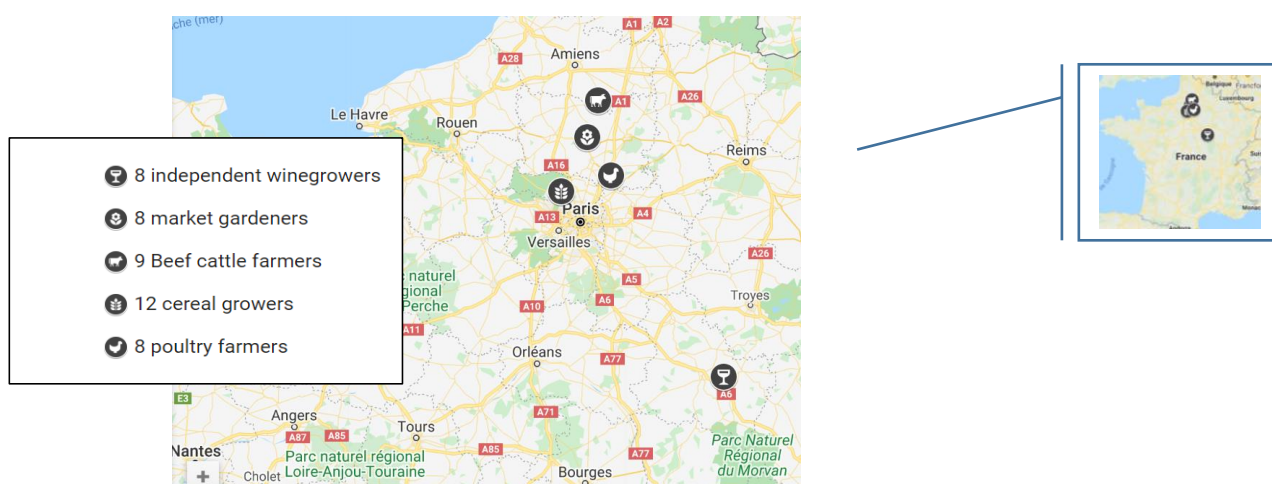
Annex 1. Details on the farmers selected for the qualitative analysis

Table 1. Typology of cereal growers interviewed

Type of farmers	Name	Location (department number) and farm size (ha)	Off and on-farm transformation	Direct selling
Cereal growers	Denis	Val d'Oise (95) 330 ha	Barley and wheat transformed into flour with a stone mill developed in the farm since 2013.	Direct selling and vending machine of flour-barley (stone mill in farm since 2013). Also sells in an AMAP 4 times a year.
	Karl	Val d'Oise (95) 280 ha out of which 15 ha are used for the transformation of wheat and rape-seed and sunflower for the oil.	Oil-mill was set up in 2005 (rape-seed and sunflower). Processing of wheat into flour in their stone mill since 2008. 10% of the production of wheat is transformed on the farm, the rest is sold to a cooperative. 20 tons of wheat is grinded on the farm per year.	Direct selling on the farm for 30% of the flour (the rest is sold to dealers) and for all the oil.
	Diane	Somme (80) 150 ha out of which 60 ha of wheat (sustainable agriculture qualification)	Soft wheat is grinded on the farm since 2016. 3 ha of wheat are grinded (representing 10 tons of flour) every year.	The farm sells biscuit mixes (madeleines, cookies and crackers). Online sales are starting to develop (farmer delivers due to high postal costs)
	Ted	Loiret (45) 135 ha	30 tons of durum and soft wheat (representing 10% of the wheat production) is transformed into flour in the stone mill since 2016	Resellers, markets
	Robert	Loir-et-Cher (41) 164 ha	25% of wheat produced is transformed into flour (stone mill) and fresh pasta (40 tons/year)	Out-of-home catering, resellers (on other farms and farm stores). A certain percentage is sold to supermarkets
	Josephine	Indre-et-Loire (37) 110 ha	Out of 300 tons of wheat produced, 12 tons of wheat are transformed into flour (stone mill).	Flour and sweet and savoury cake mixes are sold on farm stores and on other farms (40 different outlets)
	Celia and Patrick	Pas-de-Calais (62) 68 ha	6 ha of soft wheat are used for heating (representing 4.5 tons/year of wheat grains) cushions since 2008. A seamstress sows the fabric bags.	Resellers (shops, consignment sales). They count 60 outlets in the North of France.
	Brad	Nord (59) 30 ha	15 tons of barley is used to produce 30 000 litres of beer a year on the farm brewery (representing 10% of barley production). Beer production started in 2007. 8 tons of durum are	Resellers (farm stores)

			transformed on the farm into wheat and then transformed into pasta since 2019.	
	Sebastien	Oise (60) 300 ha	Out of 40 ha of barley, 3 tons is used to produce beer on the farm brewery (8000 l/year). The first beer was sold in 2018. The farm also has a malting plant. The farmer sells 50 to 100 kg/month.	Sells on the farm, in bars and on a gardening market. Online sales concern especially malt (50 to 100 kg/month).
	Xavier	Yvelines (78) 160 ha	40% of the wheat is transformed into flour (out of a total of 88 ha) and baked into bread since 2010.	Bread is sold in supermarkets, local outlets and three shops owned by the farmer's two sons.
	Ernest	Oise (60) 16 ha	4.5 ha of wheat are transformed on the farm into flour. The flour (12 tons) is then transformed into sough dough bread (12 tons/year). The farmer needs to transform wheat coming from other farms.	Sells on the farm, in AMAP, and to a dealer (farm sales)
	Louis	Oise (60) 220 ha	No transformation or processing on the farm. Out of 96 ha of wheat, 30 ha are transformed in a local flour mill.	Sells wheat directly to the local flour mill.

Map 1. Location of farmers interviewed



Source: Map elaborated by S. Lupton based on students' data, and using ®GoogleMyMaps

DEFINING PATHWAYS OF TRANSITION TOWARDS A DIVERSIFIED MILK VALORIZATION: WHAT THE HISTORICAL EVOLUTION OF WALLOON DAIRY COOPERATIVES TELLS US**Véronique De Herde^a, Yves Segers^b, Kevin Marechal^c, Philippe V. Baret^d**^a Université catholique de Louvain, Earth and Life Institute, Belgium^b Katholieke Universiteit Leuven, Belgium^c Université de Liège – Gembloux Agro-Bio tech, Unité d'Économie et Développement Rural, Belgium^d Université catholique de Louvain, Earth and Life Institute, Belgium

Abstract: Dairy cooperatives in the Walloon region do not valorize milk on a diversified pattern of added-value products despite of the agro-geographic characteristics of the region holding potential for it. As the valorization of milk is dependent on the immobility of investments and strategical choices made in the past, we decided to explore the historical background of the present situation. By clarifying the past context and the actions taken by dairy cooperatives in this context, our objective is to: 1) enrich the understanding of the present situation by clarifying which contextual, structural and agent-related roots led to the present situation 2) reveal patterns of agency specific to the Walloon dairy sector that might hold significance in terms of future transitions.

We conducted a historical analysis based on the exploration of archival material, oral sources, and published sources. We contextualized the evolution of dairy cooperatives as from the end of the Second World War up to the first decennia of 2000. That timespan saw the evolutions of milk transformation technology, market configuration, and public policies determine the development of dairies until today.

Our results reveal that the Walloon dairy cooperatives followed an orientation mainly focused on the industrial production of milk powder and butter in response to the guaranteed market outcomes allowed by the Common Agricultural Policy as from the middle of the sixties. The technological investments put the cooperatives in a logic of international competitiveness based on the ability to rationalize the costs and to use the industrial tools to their maximal capacity. The structural characteristics of milk production (density, seasonality, farm-use of the milk) hindered the economic sustainability of this model in the Walloon region. The lack of coordination between dairies in a non-homogeneous political landscape and the inability to define merging strategies exempt of particular interests prevented the development of a concerted strategy to invest successfully in other pathways of milk valorization. In a continuous context of growing International competition on the markets, the price paid to the farmers acted moreover against the capitalization necessary to sustain pathways of higher added-value dairy productions. We point out the tension between the function of farmer as both a *milk deliverer* and a *cooperator* as a source of difficulties to implement pathways of transition from an industrial model of milk valorization.

INTERACTIONS BETWEEN AGRICULTURAL VALUE CHAINS AT LOCAL LEVEL: A METABOLIC APPROACH

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Abstract: Main resource for human and animal nutrition, agricultural biomass has also high potential uses as substitute for non-renewable resources in other sectors (construction, chemistry, energy, etc.). It plays an important role towards the energetic transition. In that regard, public institutions, particularly at local level, highly support new biomass uses for food and non-food uses, for products (e.g. grains, livestock) and co-products (e.g. straw, manure), leading to value chain reorganizations and/or creations. To prevent from de-structuring the other existing value chains, or from escaping local energetic, environmental or socio-economic issues, it seems important to understand the interactions between value chains in place. For that aim, the framework of metabolism seems particularly relevant. It allows an analysis of the flows of materials and energy occurring between nature and society, between different societies, and within societies. Interactions between value chains can be characterized by material flows and an analysis of actors which produce or use agricultural products and co-products. However, due to value chain specialties, the complexity of actor networks and highly diverse localities, these evaluations are difficult to undertake at local scales.

Our goal here is to present and discuss an approach to account for interaction within and between agricultural value chains, based on a representation of material metabolism coupled with an analysis of actors' networks. First, we build a theoretical metabolism, based on public databases to: i) inform on potential agricultural products and coproducts, ii) gather general information on local actors. Second, we lead a survey to consolidate this metabolism from the actual flows and develop a reading grid of actors' networks based on the forms of: i) circulation of material flows between actors; ii) organization and coordination of this circulation of material flows between actors; iii) synergies, dependencies and competitions between actors around these material flows. The main challenge is to structure these interactions in a global representation of the local agricultural metabolism.

We show an application of the method on two French localities that are contrasted in terms of agriculture in: i) the North of the Aube department, an area specialized in large field crops; ii) the Vallée de la Drôme, farm fields are four times smaller and the agriculture is more diversified with different types of crops and livestock systems.

This method can be used with local partners as a reflexive tool on agriculture and value chains and as a starting point for foresight studies.

A PARTICIPATORY PROSPECTIVE APPROACH FAILS TO IGNITE DEBATE ON THE FUTURE OF THE LIVESTOCK SECTOR IN BELGIUM

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Abstract

Livestock systems are challenged because of their environmental impacts and in terms of animal welfare. A now classic vision of the transition of the agricultural sector is the substitution of conventional industrial systems by ecological or organic production systems. However, the benefits, difficulties and risks of such a massive substitution are not always evaluated and rationally discussed among actors.

We developed scenarios towards 2050 for the livestock sector in Belgium. The objective was to provide actors with a shared framework for discussing transition horizons and conditions and challenges for entering transition pathways. The study provided an analysis of the current diversity of production systems in each livestock sector. Three scenarios were then described: a. a business-as-usual scenario; b. a scenario based on extensive systems and relying on national cereals production for livestock feeding; and c. a scenario exclusively based on organic systems and feed from byproducts. This research was funded by an environmental NGO. While the most alternative scenario (c) was chosen in compliance with the NGO's guidelines, the study also offered a reference scenario (a) and an intermediary scenario (b). The consequences of each scenario were assessed in terms of environmental aspects, production, export capacities and required changes in food habits. The study was rolled out with a participatory process: actors contributed to the data collection and then had the opportunity to collectively discuss the scenarios and their consequences. A peer-review was implemented in order to strengthen the reliability of the results. Finally, a public presentation of the study was organized and gathered about sixty participants.

The responses of farmers' unions to the release of this study can be analyzed and provide insights on the understanding of such prospective approaches by actors. Several aspects were identified as critical for ensuring acceptance of the study as a relevant framework: 1. proactively offering transparency on the data and the process; 2. maintaining a clear separation between the NGO's position and the research work; 3. participatory and iterative data collection ensuring a fine-tuned consistency with local context, and 4. having several scenarios presented (not a normative approach based on a single proposition). In spite of those aspects, farmers' unions reactions to the scenarios publication were mostly defensive and focused on supporting the current situation. This questions the possibility of building-up long-term environmental objectives and related policies and operational strategies. In addition, feedbacks were different in the two regions of Belgium, corresponding to two visions of the livestock sector challenging the development of a shared vision at the national level.

Introduction

At the worldwide scale, the livestock sector has been massively growing over the last fifty years. From 1970 to 2017, milk production almost doubled, from 359 million tons to 675 million tons. Cattle meat went from 38 million tons to 66 million tons, while eggs production grew from 19 million tons to 80 million tons, chicken meat from 13 million tons to 109 million tons and pig meat from 36 million tons to 120 million tons (FAO statistics). Meanwhile, the center of gravity of livestock production was moving South, with a few developing countries in Asia, Africa and South America emerging as powerful new players on the global scene. While a large part of the worldwide animal-based production was located in Europe in 1970 (43% of the egg production, 37% of cattle meat production, 37% of chicken meat production and 50% of pig meat production), in 2017, Europe accounted for only 14% of worldwide

eggs production, 16% of cattle meat production, 17% of chicken meat production and 24% of pig meat production.

This growth is not inconsequential and the livestock sector has been strongly challenged regarding its environmental impacts. International reports such as FAO's *Livestock's Long Shadow* (Steinfeld et al. 2006), which titled « Livestock as a major player in global environmental issues », have highlighted the significant importance of livestock activities in greenhouse gas (GHG) emissions, water depletion and pollution, loss of biodiversity and unsustainable land use. In particular, the report evaluated that livestock are responsible for 18% of greenhouse gas emissions⁷³. In a context in which IPCC reports call for limiting emissions⁷⁴ and FAO states that « this sector growth needs to be accommodated in a context of finite natural resources, contribute to livelihoods and long-term food security, and respond to climate change » (FAO, n.d.), it is of concern that livestock production – and GHG emissions – continues its rapid growth. In EU27, the contribution of livestock to GHG emissions accounts for between 12% and 17 % of the region's GHG emissions (Bellarby et al. 2012).

What are the options to ensure that the livestock sector is, at the worldwide scale, sustainable? There are two parallel approaches to tackle this challenge, which may not have yet been stated clearly enough in international and scientific arenas. The first one is the quantitative question: *how much* livestock production can be maintained under planet's environmental boundaries? The second one is the qualitative approach: *how* to produce sustainably, with which types of livestock systems that are respectful of the environment? Finally, a third question should be asked: is it possible to implement those quantitative and qualitative strategies, that is: can scientific recommendations regarding *how much* and *how* to produce sustainably be endorsed by public policies institutions at the international, regional and national levels and implemented by private actors of the food chain?

This international context reflects in different ways across countries. In Belgium, meat topics have been quite on the agenda in the medias. However, a complete debate taking into account all the challenges related to this question, which could lead to the establishment of a consensus and concerted political decisions, has not yet been conducted. In this context, and with funding from an environmental NGO, we developed a prospective study with three scenarios towards 2050 for the livestock sector. The central objective of this study is to provide actors with a shared framework for discussing transition horizons and conditions for entering transition pathways.

In this article, we present the participatory approach that was mobilized along the elaboration of the scenarios, and analyze the responses of farmers' union to the scenarios publication.

Context: the livestock sector in Belgium, its environmental aspects and farmer's unions

Livestock productions

Belgium is a small player in the worldwide livestock sector: it provides less than 1% of the eggs, cattle meat, chicken meat and pig meat (FAO stats 2017). However, at the national level, the presence of the livestock sector is noteworthy as the country's production largely overpasses consumption levels, a large share of the production being exported. Self-sufficiency ratios are 109% in the eggs production (i.e. the national production level reaches 109% of the apparent consumption), 135% in the milk production, 158% in the bovine and poultry meat, and 261% in the pork production sector. Belgium has two main agricultural regions: Flanders and Wallonia. Poultry and pigs' livestock activities are mainly located in Flanders: respectively 94%, 84% and 85% of pigs' population, broilers and laying hens are located in that region. Dairy and bovine cattle raising are more spread across the two regions of Belgium: Wallonia hosts 61% of suckler cows and 40% of dairy cows while Flanders hosts 39% of suckler cows and 60% of

⁷³ A more recent study revised the estimate of anthropogenic greenhouse gas emissions due to livestock to 14.5% (Gerber et al. 2013).

⁷⁴ « With clear benefits to people and natural ecosystems, limiting global warming to 1.5°C compared to 2°C could go hand in hand with ensuring a more sustainable and equitable society » (IPCC 2018).

dairy cows. Livestock systems tend to be more intensive in Flanders comparatively to Wallonia⁷⁵ (Riera, Antier, and Baret 2018) (Table 1)..

Table 1: Livestock populations, production and self-sufficiency ratio of meat products in 2015 in Belgium.

	Livestock population	Share in Flanders	Share in Wallonia	Main product	Production	Net consumption ^b	Self-sufficiency ratio ^c
	in number of animals	%	%		Tons of product ^a	Tons of product ^a	%
Pigs	6,364,164	94%	6%	Pork	1,140,326	437,632	261%
Broilers	23,838,182	84%	16%	Poultry meat	369,590	233,832	158%
Laying hens	8,109,466	85%	15%	Eggs	165,269	151,116	109%
Suckler cows	393,595	39%	61%	Bovine meat	261,639	166,083	158%
Dairy cows	507,390	60%	40%	Milk	1,275,496	943,162	135%

Notes:

^a For bovine, pork and poultry meat, values are expressed in tons of carcass weight. For eggs, data is from 2013 (last available data) and values are in tons of eggs and are estimated from number of eggs, assuming that one egg weights 60g. Finally, for milk, data is from 2012 (last available data) and values are in tons of fresh liquid dairy products.

^b Net = Production + Imports – Exports and can be associated with apparent consumption.

^c self-sufficiency ratio = Prod/Net, which gives an indication on how much the national production contributes to the national consumption.

Source: (Riera, Antier, and Baret 2018).

Environmental aspects: GHG emissions

The degree of environmental impact of livestock systems was assessed through four indicators: emission of greenhouse gases, nitrogen emissions, biodiversity score⁷⁶, pesticides uses for feed crops

⁷⁵ For example, in the eggs production sector, 91% of laying hens are in more intensive in-cage and indoor systems and only 9% of laying hens are in more extensive free-range and organic systems, while in Wallonia, 68% of laying hens are in more intensive in-cage and indoor systems and only 32% of laying hens are in more extensive free-range and organic systems.

⁷⁶ In order to characterize the biodiversity impacts of each system, the methodology developed by De Schryver et al. (2010) was used. The method is based on the impact of feed ingredients on biodiversity: a characterization factor (CF) which expresses the ecosystem damages of certain land-uses and agricultural areas, is attributed to each feed ingredient. The CF depends on land uses (arable land and grassland) and intensiveness of agricultural practices (organic vs. intensive). The indicator also varies with the duration of the crop and the occupied area (see step 1 below). The impact of each feed ingredient is then aggregated to determine the overall Damage Score (DS)

and pastures. Those indicators cover three of the twelve midpoint impact categories⁷⁷ identified in Life Cycle Assessments (LCA) applied to livestock products (McLelland et al. 2018)⁷⁸. In addition, a qualitative assessment of livestock systems in terms of animal welfare was provided. In this article, we focus on greenhouse gases emissions, and biodiversity score.

Overall, annual GHG emissions due to the Belgian livestock sector were estimated being 13,850 kilotons of CO₂e in 2015⁷⁹ (Riera, Antier, and Baret 2018). Those emissions come from feed (54%), enteric fermentation (32%) and manure management (15%). The bovine sector is responsible for 57% of total livestock sector's GHG emissions (with 34% from the dairy sector and 23% from the bovine meat sector), while the porcine sector accounts for 34% of livestock sector's GHG emissions, and broiler and laying hens sectors only 10% together. In Belgium's GHG national inventory, emissions attributed to the livestock sector are only enteric fermentation and manure management, that is 7,540 kilotons CO₂e, 7% of national emissions.

The Flemish Climate Policy Plan plans to the livestock sector a further reduction of 26% by 2030 compared to 2005 emissions (Vlaamse overheid 2018), while in Wallonia (the other region of Belgium), no specific objective was so far announced in the draft regional climate policy plan (Agence wallonne de l'Air et du Climat 2018).

The study showed that in each livestock sector, GHG emissions varies from one production system to another. As an example, in the pork production sector, four production systems were identified (Table 2), and it was estimated that the emissions are 3.16 kg of CO₂e per kg of live weight obtained in conventional systems, while it was 3.21 kg of CO₂e in differentiated systems⁸⁰ and 3.76 kg of CO₂e in organic systems.

Table 2. Characterization of production systems in the pork sector in Belgium.

	Conventional	Certified (Certus)	Differentiated	Organic
Final live weight (kg)	110	110	120	120
Feed consumption (kg feed/kg live weight)	2,7	2,7	3,3	3,3

associated to a certain production system (step 2). The higher the Damage Score, the higher the impact on biodiversity.

⁷⁷ In LCA, a midpoint category describes a proximate impact along the environmental chain that can be measured before the end- point impact is realized (e.g., GHG emissions are a midpoint indicator for average global temperature changes) (Jolliet et al., 2003).

⁷⁸ McLelland et al. completed a systematic review of the livestock LCA literature to better understand the impact categories included and the progress made towards more comprehensive LCAs. The authors' search of publications between 2000 and 2016 identified 173 relevant peer-reviewed papers and then categorized midpoint environmental impacts into 12 categories based on Jolliet et al. (2004). The twelve categories are: acidification; biodiversity; climate change (or global warming potential); ecotoxicity; eutrophication; human toxicity; ionizing radiation; land use or land occupation; ozone depletion; particulate matter; photochemical ozone formation or photo-oxidant formation; and resource depletion (including biotic and abiotic resources; e.g., fossil fuel, electricity, water, etc.)

⁷⁹ This figure is obtained without taking into account possible carbon sequestration in pastures due to high data uncertainty.

⁸⁰ Differentiated systems differs from conventional systems as they guarantee specific raising conditions (non-GMO feed, specific breed, animal welfare considerations, etc.)

Use of phytopharmaceutical products	Yes	Yes	Yes	No
GHG emissions (kg CO ₂ e/kg live weight)	3,16	3,16	3,21	3,76
Share (% of slaughters)	73%	23%	4%	<1%
Total GHG emissions (kt CO ₂ e/year)	4,498		201	6

Source: (Riera, Antier, and Baret 2018).

Farmers' unions in Belgium

There are three main farmers' unions in Belgium. Boerenbond and FWA (Fédération wallonne de l'agriculture) are the main farmers' union, respectively in Flanders and in Wallonia. Boerenbond and FWA generally defend positions that can be classified under the conventional agriculture paradigm and are members of COPA-COGECA⁸¹. FUGEA is a smaller farmers' union located in Wallonia, which defines itself as *a peasant movement that develops and supports agricultural policies in favor of a multifunctional sustainable agriculture [taking into account the aspects of] rural employment, respect of the environment, quality of the products and the satisfaction of the consumers.*

Methodology: scenarios as an intermediary tool in a participatory approach

Participatory approach

The study was rolled out with a participatory approach involving the diversity of livestock sector's actors: farmers' unions, representative of upstream (feed suppliers) and downstream industries (slaughterhouses, commercial intermediaries). Actors were involved similarly to the method presented in (Antier, Petel, and Baret 2018) (Figure 32). First, actors contributed to the data collection through individual semi-directed interviews for the characterization of the current situation. Here, the method relies on a specific participatory process: the 'informed participatory research' (IPR) approach developed by (Van Damme, Dumont, and Baret 2016). The IPR approach combines the classic elements of participatory research and a specific, comprehensive and multi-dimensional assessment of the diversity of farming systems that is discussed with actors in an iterative process. Second, actors had the opportunity to collectively discuss the scenarios and their consequences. Third, a peer-review was implemented in order to strengthen the reliability of the results. Finally, a public presentation of the study was organized and gathered about sixty participants. The final presentation of the study was followed by a significant number of press articles.

⁸¹ COPA is the Committee of Professional Agricultural Organisations, and COGECA is the General Committee for Agricultural Cooperation in the European Union.

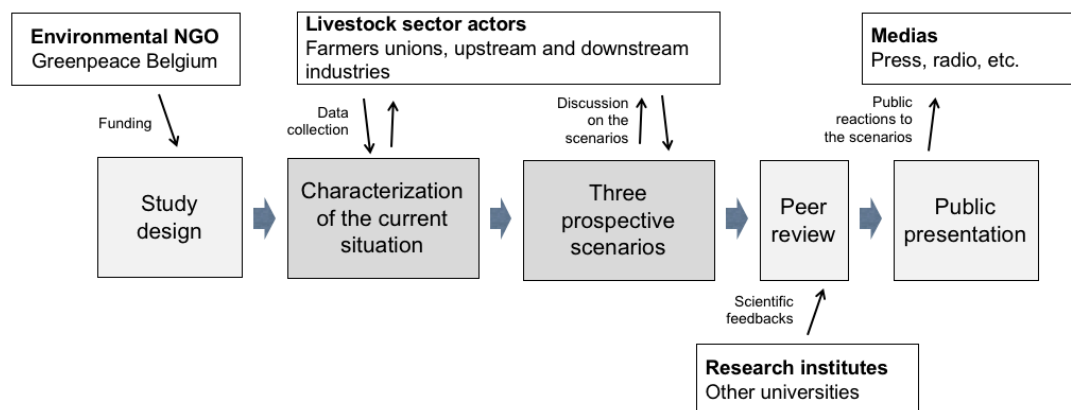


Figure 32. Steps of the study and interaction with actors along the participatory process were different depending on actors.

Three scenarios: a tool for fostering discussion on the sector's productive orientation

« Given the unsustainability of the food system, and the uncertainty of how it may evolve, scenario analysis can be a useful tool for imagining plausible futures as an aid to unlocking business-as-usual thinking » (Benton 2019). Prospective approaches can help to build visions of desirable futures, to develop collective strategies and highlight relevant actions and, consequently, to improve the quality of the decisions to be made (Destatte and Durance 2009).

The authors of *Prospective et Société. Problèmes de Méthodes, Thèmes de Recherche* distinguishes three stages of the prospective approach: a. the **analytical** phase, based on the data and facts collection and the analysis of a current situation; b. the time for identifying "possible futures" (**exploratory** phase); and c. the confrontation of possible futures with the desirable choices, according to an explicit system of values, that then allow to return to the present in order to redefine it according to the desired future (**normative** phase) (Datar 1972).

In our case, an **analytical** phase was implemented through a series of key facts about the livestock sector in Belgium and the inventory of existing livestock systems. The study provides an analysis of the current diversity of production systems, highlighted through a typology of production systems within each of the five main livestock sectors (poultry meat, eggs, pork, dairy and bovine meat production).

Three scenarios at the national level were then described (**exploratory** phase): a. a business-as-usual scenario; b. a scenario based on extensive systems and relying on national cereals production; and c. a scenario based exclusively on organic systems and feed from byproducts. Each scenario implies choices in terms of: a. the respective importance of each sector (in number of animals and in production volume); b. the livestock systems themselves (from the current diversity of systems to a focus on extensive and organic systems); and c. practices (type of feed, etc.) (Table 3).

Finally, the consequences of each scenario were assessed in terms of environmental impacts (through related indicators), production volumes, export capacities and required changes in food habits (Table 4). The business as usual scenario shows no radical change in the livestock population, and the volume of animal based products remain similar. Self-sufficiency ratio is 228%, exports remain a major strategy for the livestock sector. Organic production grows but remain very minor. GHG emissions could decrease of -13%, mainly due to technical optimization. The conditions of transition 1 scenario (T1) listed above implies a significant decrease in livestock populations. As a consequence, meat production would significantly decrease (296 kt vs 740 kt in 2015), leaving no export capacity. The national production would cover national consumption if food diets evolve towards less meat, slightly more than accordingly to current trends. GHG emissions would be halved due to decrease in livestock population and technical optimization. In scenario T2, the conditions set implies an even stronger decrease in

livestock populations. Meat production would also strongly decrease (125 kt vs 740 kt in 2015), leaving no export capacity and covering national demand only if food diets radically change (27 g of meat vs 87 g meat/cap/day in 2015). GHG emissions would be more than halved (-58%) due to decrease in livestock population and technical optimization.

The comparison of scenarios shows that:

the reduction of GHGs that can be obtained through technical optimization is limited to -13% (BAU scenario). More ambitious targets of GHG emissions reduction would imply a reduction of the herds (T1 and T2 scenarios);

the livestock systems that are the most efficient on one parameter (GHG per unit produced) are the least efficient on other parameters (biodiversity, pesticides, animal welfare) (the results are provided as an example in the pork sector in Table 2).

It is possible to feed the Belgian population by significantly reducing the number of herds. Scenario T2 requires a real shift in consumption patterns while scenario T1 is very close to food diets trends.

Table 3: Description of the scenarios.

	Business-as-usual scenario	Transition 1: the intermediary scenario	Transition 2: a radical shift
Production systems in the scenarios	The scenario continues the trends from the past 10 years	organic and extensive systems	Only organic systems
Feed		Cereals feed: using only national (BE) resources	No cereal feed. Only regional (EU) coproducts for animal feed
Pastures area	427.551 ha (-23% vs 2015)	556.845 ha (no change vs 2015)	556.845 ha (no change vs 2015)
Bovine systems	Dairy Meat	Mixed dairy systems	Mixed dairy systems

Table 4: Consequences of the scenarios.

	Business-as-usual scenario	Transition 1: the intermediary scenario	Transition 2: a radical shift
Livestock population (in million livestock units)	no major change: - bovine cattle: 0.23 (-26%) - dairy cattle: 0.49 (-4%) - laying hens: 1.38 (+20%) - broilers: 0.11 (+0%) - porcine: 3.61 (+1% vs 2015)	significant decrease: - mixed cattle: 0.61 (-26%) - laying hens: 0.36 (-69%) - broilers: 0.05 (-55%) - porcine: 1.37 (-62%)	very strong decrease: - mixed cattle: 0.69 (-16%) - laying hens: 0.09 (-92%) - broilers: 0.01 (-91%) - porcine: 0.34 (-90%)
Respective importance of each sector	- bovine cattle: 4% - dairy cattle: 8% - laying hens: 24% - broilers: 2%	- mixed cattle: 26% - laying hens: 15% - broilers: 2% - porcine: 30%	- mixed cattle: 61% - laying hens: 8% - broilers: 1% - porcine: 30%

(in % of livestock units)	- porcine: 62%		
Organic production	<6%in each sector	+30%in each sector	+100% in each sector
GHG emissions	-13% vs 2015 mainly due to technical optimization	-48% due to decrease in livestock population + technical optimization	-58% due to decrease in livestock population + technical optimization
Meat production	743 kt similar to 2015	296 kt versus 740 kt in 2015	125kt versus 740 kt in 2015
Meat consumption	70g meat/cap/day versus 87g meat/cap/day in 2015 (trend)	64g meat/cap/day versus 87g meat/cap/day in 2015	27g meat/cap/day versus 87g meat/cap/day in 2015
Self-sufficiency of meat	228% versus 209% in 2015	100% (no export capacity)	Based on a shift in diets no export capacity

Methodology for analyzing actors' reactions

The responses of actors at the regional and national level to the release of this study can be analyzed and provide insights on the understanding and conditions for the appropriation of such prospective approaches by actors. As shown by (Bengtsson and Tillmann 2004), it is useful to analyze how actors define, and relate to, problems and interpret the risks and benefits of different options in order to understand the nature of a controversy and what need to be address for allowing progress in this controversy.

In this perspective, the press release from each of the three farmers' unions was collected⁸². Arguments were listed in each publication and classified into three categories: arguments challenging the relevance of the study (R), arguments focusing on the current situation and its technical and economic constraints (C) and arguments about possible futures (F) discussing scenarios with their advantages and risks.

Farmers' unions responses to the scenarios

There were 24 arguments across farmers' union press releases, mainly arguments challenging the relevance of the study (9 arguments) and discussing the current situation (13 arguments) while only two arguments were about the future (

Table 5).

Table 5: Some press releases and types of arguments

Code	Types of arguments	Number of arguments in farmers' unions press releases
R	Challenging the relevance of the study	43% (9 arguments)

⁸² Rapport Greenpeace- la Fédération Wallonne de l'Agriculture réagit ! www.fwa.be/elevage/rapport-greenpeace-la-federation-wallonne-de-lagriculture-reagit-2

Le rapport de Greenpeace, opportunité ou massacre ? fugea.be/05-02-2019-le-rapport-de-greenpeace-opportunite-ou-massacre/

C	Technical and economic aspects about the current situation	48% (13 arguments)
F	Scenarios and possibilities for the future	10% (2 arguments)

Overall, farmers' unions (in both regions) interpreted the study's purpose as willing to denigrate farmers' activities (a purpose stated as « agribashing » by Fwa) and challenged the relevance of reducing meat production. Meanwhile, their press releases included very few comments on the comparison of the three scenarios. Similarly, typologies of production systems, which were the keystone for describing the current situation of livestock sectors and for the elaboration of the scenarios, were not mentioned in their press releases. Arguments are detailed below.

Arguments aimed at challenging the relevance of the study

The first argument (present in each of the farmers' unions press release) was that livestock only accounts for a small share of national GHG emissions, and that efforts should therefore rather be implemented in other sectors. Boerenbond underlines that « *livestock farming accounts for only a limited share [of climate impacts]. Today, livestock farming is responsible for barely 7% of greenhouse gas emissions in Belgium. This puts it in fifth place, after mobility, energy, households and industry* ». FWA reminds that the livestock in Wallonia accounts for « *only 4% of Belgium GHG emissions* ». Boerenbond then concludes that « *a reduction in livestock will only lead to a minimal reduction in total emissions. The reduction of our livestock is therefore not the solution for the climate problem!* ».

The second argument provided for challenging the prospective study relevance was the significant efforts already accomplished by the agriculture and livestock sector regarding environmental externalities. Boerenbond estimates that « *in the past 30 years, the sector has already achieved a 20% reduction [in GHG emissions]* »⁸³. FWA also stated that « *our agriculture sector, aware of the importance of increasing its sustainability, has taken into account the needed changes in its farming practices* ». FUGEA considers that « *solutions already exist and are being implemented in our farming systems* ».

Finally, there were arguments against the study as farmers' unions perceived it as an attack towards farmers. Boerenbond considered that the study was seeking « *stigmatizing our Flemish livestock farmers* » while FUGEA considers that « *it is damaging to Walloon breeders to be included in a national inventory* » given that « *agricultural realities [between the two regions] are not comparable* ».

Arguments based on economic or technical aspects in the current situation

First, there were four arguments about the current livestock' sector economic context. Firstly, farmers' union argued that the integration of their sector into international trade rules and competition limit the relevance of prospective approaches at a national level. Boerenbond reminded that « *meat imports [...] cannot be prevented* » while FUGEA regretted that the study « *presents Belgium as an island, whose only mission is to feed its population* ». Second, the unions highlighted the economic challenges already faced by the farmers. Boerenbond proposes that a priority should be given to « *stop the outflow from the sector* »⁸⁴ while FWA asked « *to support the farming sector and to increase farmers' revenues* ». Third, it was underlined that consumers' food diets evolution may not go along with the transition scenarios. Boerenbond challenged: « *The study assumes - also somewhat naively - that Belgian*

⁸³ This decline is, in fact, largely related to the evolution of livestock populations. At the Belgium level, between 1990 and 2018, the cattle herd decreased by 26% (Etat de l'Environnement wallon 2019). Emissions have fallen due to a decrease in emissions from enteric fermentation and decrease in the amount of nitrogen excreted on grazing land (Commission Nationale Climat, n.d.).

consumers will not consume more than 23 grams of meat per day, spontaneously consume only Belgian meat from the (more expensive) organic chain and ignore other (foreign) meat ». Finally, the orientation of subsidies towards sustainable practices was underlined as FWA reminded « the current CAP already includes 30% of the aid budget for greening approaches », suggesting that no further economic support could be obtained for undertaking a more significant or rapid transition pathway.

There were also two arguments on current livestock systems themselves. Farmers' union tended to underline the performance and the positive aspects of current systems. FWA talked about « *family farms* » which are « *far from the industrial farms described by Greenpeace* ». Boerenbond reminded that « *conventional farming systems score better in terms of climate than extensive farming systems* ».

However, none of the actors explicitly talked about the typologies of production systems. Specifically, discussions on environmental aspects were focused on GHG emissions while the other aspects (nitrogen emissions, biodiversity score, use of pesticides) were not mentioned, and the relative impacts of intensive and extensive/organic systems in terms of GHG emissions and biodiversity impact were little discussed.

Arguments related to scenarios and possibilities for the future

Across the press releases, there were two arguments – provided by Boerenbond only – related to the scenarios themselves. The first argument is that a business-as-usual scenario with stronger reduction in GHG emissions can be achieved: « *The Flemish Climate Policy Plan imposes a further reduction of 26% by 2030. Ambitious, but the sector is willing to commit to this. However, this reduction does not necessarily - contrary to what Greenpeace proposes - lead to a reduction in livestock, but can also be achieved through technology and innovation (adapted feed ration, management, etc.)* ». However, no strategies and technical innovation were explicitly presented as solutions for reaching this ambitious objective. The second argument is that socio-economic aspects should be in first line of scenarios' design, instead of engaging into a reduction of the livestock populations. Boerenbond regretted that « *the socio-economic impact [of the possible scenarios] is completely disregarded* » while « *declining the stock of livestock [is seen] as a miracle solution* ».

Discussion: factors that limited the emergence of a debate on the scenarios

One of the objective of such a prospective approach and participatory process is to facilitate the emergence of a debate based on relevant arguments.

Several aspects were identified as critical for ensuring acceptance of the study as a relevant framework: 1. proactively offering transparency on the data and the process⁸⁵; 2. maintaining a clear separation between the funding body (an environmental NGO) political position and the research work; 3. participatory and iterative data collection ensuring a fine-tuned consistency with local context, and 4. having several scenarios presented (not a normative approach based on a single proposition).

In spite of those aspects, when analyzing farmers' unions responses to the scenarios' publication, it appears that their arguments were mostly defensive of the current situation, as the analysis of their press releases show: 9 arguments challenging the relevance of the study, 13 arguments discussing the current situation and only two arguments were about the future (see above). This questions the possibility of building-up and implementing shared long-term environmental objectives at the national

⁸⁵ The transparency measures included online communication, individual meetings on demand and actors group discussion in which information was provided regarding funding sources, study objectives and process, methodology and limits.

level. We discuss below some factors that contributed to limit the emergence of a debate on the scenarios themselves.

A specific context: an object with a high symbolic value already under crisis

This prospective study was applied to an object (meat and animal-based products in general) that is already under crisis. Different topics are included in this crisis such as the environmental consequences, health issues related to food diets, economic viability of farms, and ethical issues of meat consumption. The question of meat consumption levels and associated ethical and environmental dimensions has been especially high in the media over the last years, with the opposition of vegan principles to farmers' and traditional food culture. In our context, this focus was at the expense of the debate about livestock systems themselves and their respective impacts that the study could have brought up. Indeed, the debate partly moved out of the political arena in which it would have supported the elaboration of policy decisions based on consensus, and shifted to the individual sphere of consumer responsibility. Meat consumption has, in general, a high degree of cultural elaboration (Fischler 1991; Fiddes 1991). The symbolic value of meat in the sector and in the Belgian society in general may have strengthened the difficulty of entering a strategic discussion about the sector and its production levels.

Actors attitude: extreme positions rather than compromise.

The choice of providing typologies of production systems (beyond a simple opposition of conventional vs organic systems, see Table 2) and presenting three scenarios (not only one, or two) was made in order to facilitate the emergence of an educated and open discussion.

However, in spite of the presentation of several scenarios, actors were generally publicly denouncing the study or defending the feasibility of the business-as-usual scenario. While the most alternative scenario was chosen in compliance with the NGO's guidelines, none of the actor talked about the intermediary scenario which could have been seen as a consensus. We link this to the logic of advocacy in which actors are involved, which makes it difficult to incorporate facts and to be involved in a debate based on its real terms.

Difficulty to encompass multi-dimensional scenarios

Most of the arguments in the debate (both from farmers' union and other actors) were focusing on a specific dimension (farms' viability, employment, food accessibility, etc.). They did take into account other dimensions such as environmental aspects only separately from production levels arguments. In addition, entire aspects of the debate, such as the relevance of an increased share of organic production, were entirely missed. This shows a difficulty of the actors to encompass multi-dimensional scenarios, while they focus on defending their interests in the current situation. This may be linked to the fact that, in Belgium, due to education programs design and content, farmers tend to develop a shared vision about farming mainly based on intensification, growth and high investments in equipment (De Herde, Maréchal, and Baret 2019). Consequently, and as "pedagogy underlies all food system change, especially for forming cultural legitimacy of emergent spaces" (Hsu 2019), pedagogy is likely to be a crucial aspects for successfully bringing such prospective, multi-dimensional approach into the public arena.

Although a complete debate on the desirable futures and relevant transition pathways of the livestock sector in Belgium was not directly generated by the study, the extent of the reactions in the media tends to suggest that an agenda effect has still occurred. This is supported by the fact that the scenarios have been regularly mentioned in later debates.

Synthesis: two opposed ideologies

Underlying the above discussion is the question of ideologies. We provide in Table 6 a synthesis of the differences of views identified between the farmers' unions and the funding NGO. This could be further

linked to different *agrarian ideologies* (as studied by (Beus and Dunlap 1994)) or different *cognitive framings* (as defined per (Surel 2000)) of the livestock's future controversy across the Belgian society.

Table 6: Compared views of farmers' unions and the environmental NGO who funded the study.

Topic	Farmers' union views	NGO views
The Belgium livestock sector should change, in accordance with worldwide livestock' sustainability challenges	A small country like Belgium has little influence on the worldwide trajectories.	A shrink-and-share approach ⁸⁶ is needed, for achieving a balanced amount of animal protein among the poorer peoples in the world will inevitably require drastic cuts in the richer sections of societies.
Agriculture functionality	Economic viability first	Multi-dimensional
The livestock sector is responsible for 7% of national GHG emissions.	The livestock sector contribution to national GHG emissions is small.	The livestock sector contribution to national GHG emissions is significant.
Objective for livestock sector GHG emissions reduction	The definition of a GHG reduction objective is not necessary for the livestock sector in Wallonia. There already are objectives defined in Flanders (-26% in 2030).	An ambitious GHG reduction objective should be defined for the livestock sector in Belgium (about -70% in 2050).
Production systems	Current production systems are acceptable	Current production systems are not acceptable in terms of biodiversity impact, pesticides use, animal welfare. Only organic, extensive systems should be maintained on the long term.

Conclusion

The publication of those scenarios on the future of livestock in Belgium offer an interesting experience on the potential of prospective studies as a tool for facilitating the emergence of an educated debate, but also on the importance of differences in cognitive frames that affect an effective debate. In spite of the presentation of several scenarios, farmers' unions were generally publicly denouncing the study or defending the feasibility of the business-as-usual scenario. Although a complete debate on the desirable horizons and relevant transition pathways of the livestock sector in Belgium was not directly generated by the study, the publication of this study led to a cycle of encounters of farmers' unions and the national environmental NGOs. This permits to confront arguments from both sides and to highlight central differences in their worldviews and priorities. In addition, the study allowed to raise key topics for transition pathways (such as the potential of alternative, vegetal proteins in the country; the relevance of choosing which production systems to develop; etc.). Although this article focuses specifically on the responses of farmers' unions, the study was more broadly addressed to actors, including education and

⁸⁶ The reduction in the global consumption of meat should be achieved with regional considerations on equity, i.e. a common global objective but differentiated responsibilities (Tirado 2019). In Greenpeace's vision, the global consumption of meat should be reduced to 24 kg of meat per capita per year in 2030 (16 kg in 2050) and this should be achieved through a massive reduction in the consumption in the more developed countries and a limited increase in the consumption in the less developed countries (Africa, India).

policy actors. The understanding and appropriation of the scenarios by those actors could be further investigated.

The limits of the scenarios, widely recalled by the farmers' unions, call for a deepening of this kind of prospective study by including the economic consequences (such as the creation of value and the employment) of the scenarios.

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THE ROLE OF RELATIONAL MARKETS AND FARMER AGENCY IN THE PURSUIT OF AGROECOLOGICAL PRINCIPLES AT FLEMISH BEEF FARMS

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Abstract

In our exploration of what sustains and limits agroecological practices at beef farms in Flanders, the relevance of alternative food networks as an assisting or even necessary factor in putting agroecological principles into practice became increasingly clear. The question remained, however, whether alternative, market-based arrangements could in any way be scaled up. This led us to analyze how alternative and not so alternative market exchanges were different and connected. In this paper, we navigate through the rich debates within economic sociology on the social structural basis of market exchanges. We identified two challenges: (i) synthesizing the emphasis of Marxian political economy on objective material relations, and the emphasis of actor-centered approaches on cultural rules in one theory of agency; and (ii) creating a single framework of market exchanges that accommodates the varying influences personal relations among actors have on actual market exchanges. We argue that the work of critical realists such as Douglas Porpora on agency, and the heterodox economist William Jackson on relational markets can be instrumental in meeting these two challenges, respectively. In the second part of this paper, we highlight some observations from our interviews with Flemish beef farmers that triggered these critical reflections on existing approaches to market exchanges in agro-food studies. Developed in 2018, this practice-theoretical framework has since then been applied extensively in the context of beef farming in Flanders (cfr. Ph. D. dissertation, 2021), confirming its versatility and explanatory power for studying alternative and not so alternative market based food networks.

Introduction

Alternative food networks (AFN) figure often as exemplary instances of agroecology, as they appear to address agroecology in all its dimensions, including the socio-economic, -cultural, -political (Dumont, Vanloqueren, Stassart, & Baret, 2016). Moreover, the establishment of economic arrangements of more reciprocal nature between local partners have proven to be central to the socioeconomic viability of systems managed along more agroecological lines in numerous case studies (FAO & INRA, 2018). The mere existence of AFN calls into question deterministic analyses of agricultural development, which conclude on political economic or on discursive grounds that the modernization of farming is inevitable (Renting, Marsden, & Banks, 2003). Yet, in doing away with a determinism of “only one thing is possible”, we must be wary of overcompensating, and opening the door to an excessive voluntarism of “anything is possible” (Hart, 1998). While the model of Homo oeconomicus is rightfully dispelled by rural sociologists as a reductionist model of human agency, it’s difficult to explain the overwhelming lack of involvement of most farmers and consumers in AFN, without some reference to an economic structure motivating certain behaviors. Due regard to the structural basis of market exchanges therefore still needs to be given to understand farmer behavior.

The agency of farmers remains the subject of ongoing conceptual and analytical debate in critical agro-food studies. These debates are dominated by political economy and actor-centered approaches (Higgins, 2006). Political economy approaches foreground the fact that most farmers are commodity producers and therefore part of a wider social division of labor in a capitalist society. It therefore starts

out by analyzing how and to what degree these social relations of production affect farmers' thinking and actions (Bernstein, 2010). Actor-centered approaches foreground the interpretive moment in all human behavior, i. e. that farmers are not passive recipients of transformative forces, but that they are "active participants who process information and strategize in their dealings with various local actors as well as with outside institutions and personnel" (Higgins, 2006). Both political economic and actor-centered approaches are recognized by rural sociologists, but typically their supposed salience depends on the scale and time-frame under analysis (Lamine, Darnhofer, & Marsden, 2019). The political economic approaches are able to explain the existence of large-scale and enduring trends of global food systems, whereas the actor-centered approaches are much more in tune with the diversity and intricacies of meanings and practices observed in anthropological fieldwork. Connecting the dots between these separate explanations of individual practices, and larger economic or institutional determinants remains, however, a key conceptual challenge within the field of rural sociology (Lamine et al., 2019). In our estimation, closer analysis of market exchange as a practice may serve as a potential linchpin in addressing this challenge, given the interconnecting and pervasive nature of this practice at higher and lower levels of contemporary agri-food systems.

In actor-centered approaches, market exchanges figure as a part of the many instituted practices found within social networks of actors, and they are explained as a more or less path-dependent product of rule-following behavior and negotiation of conventions and expectations among actors. This approach is justified based on the observation that most actual exchanges don't take place under ideal competitive market conditions, i. e. impersonal, voluntary, and uncoordinated trade, but that are in fact embedded within social networks of interpersonal relationships (Granovetter, 1985). This fact renders indispensable an analysis of these networks, in order to explain the characteristics particular of trades. This strategy to re-appropriate market exchange as a subject of sociological inquiry amounts to a whittling away at the market construct, revealing that an ever-greater share of transactions are enacted through interpersonal relationships (Krippner et al., 2004). However, in the relative absence of such personal relations (for example traders using algorithmically automated systems to trade stocks) this approach is unable to explain these trades in purely social terms and therefore to make neoclassical models entirely obsolete.

While actor-centered approaches correctly stress that most market exchanges are embedded in personal relationships, it misses that all market exchanges, no matter how instantaneous, are social in the broader sense of the term in two interconnected ways. First, the mere possibility of exchanging commodities depends on such institutions as property and contract law, and it predisposes actors with certain understandings of themselves and the world so that they accept to exchange under a certain set of social rules and not another. These are conditions perhaps even unthinkable in most of human history, yet they are contained into every market exchange, and do not variably exert their influence on some kinds of markets more than others (Krippner et al., 2004; Tordjman, 2004). Second, and this a crucial insight of Marxian political economy, market exchange cannot be separated from the sphere of material production in a capitalist society, as it is the particular form social relations of production have taken and have to take in a society that is made up mostly out of formally independently acting producers. In the absence of direct social regulation of production (e. g. planning in the factory, the household, within the tribe, or by the state), the working activity of members of a market society is regulated through and only through the exchange of things. It is the circulation of goods on the market, the rise and the fall of their prices that lead to changes in the allocation of the working activity of separate commodity producers, and thus to their entry into certain branches of production or their exit from them. While direct social regulation of production plays its part in contemporary society, influential economic thinkers, as disparate as Marx, Polanyi, Hayek, Schumpeter and Keynes (Richards, 2018) have contended that market dynamics form an autonomous mechanism that dominates social production in capitalist societies. It is easy to dismiss visions of "the Invisible Hand of the Market" or "Laws of Supply and Demand" as illusory reifications of actors parroting neoliberal ideologies and mistaken economic beliefs (e. g. Long, 1997). It is much harder to come to terms with the reality that miraculously enough,

a society constituted out of mostly autonomously acting buyers and sellers of products is more or less able to materially and socially reproduce itself without any direct co-ordination (Rubin, 1928).

We can therefore not theorize market exchanges merely in terms of interpersonal relationships among actor-networks identified in a case study, but it must include a theory on how the actions of all buyers and sellers in society structure farmers' behavior, both culturally and materially. In search for such a theory, we came across two publications that were instrumental to overcome two hurdles we identified in our own grappling with the subject. The first challenge is to accommodate the emphasis of Marxian political economy on objective material conditions motivating human behavior, and the emphasis of actor-centered approaches on cultural rules in one theory of agency. We believe that Douglas Porpora's (1993) theorization of agency is very useful to bring the insights of these schools of thought together. The second challenge is to create a single framework of market exchanges that accommodates the influence personal relations among actors may varyingly have on actual occurring exchanges. We believe that the work of heterodox social economist William A. Jackson (2007) is a substantial contribution herein, as he theorized market exchanges of more and less relational nature in social structural terms. Jackson proposes a layered structure of social positions occupied by buyers and sellers determined by personal and impersonal social relations among these positions (figure 1). This is, we would argue, a powerful entry point to explain exchanges that actually take place in agro-food systems.

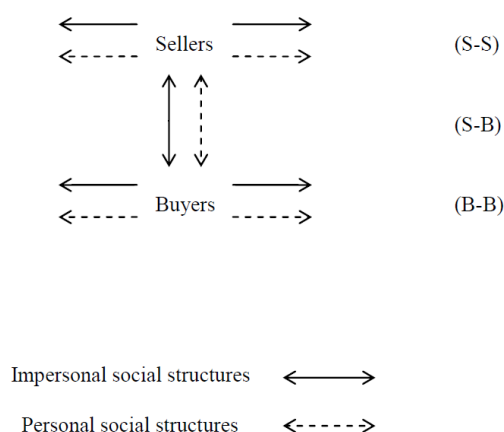


Figure 33. General social structure underlying market exchanges (Jackson, 2007).

Analytical Framework

Synthesizing Social Relations, Cultural Rules and Agency

In an article published in 1993, Porpora observed that there are at least two important traditions within sociology, the first following Marx (or at least a particular strain in Marx's thought), and the second, following Winch and Giddens, that agree that social behavior has to be explained in terms of its context. They disagree, however, on the nature of that context. Whereas Winch and Giddens stressed the cultural context created by constitutive rules, the relevant Marxian tradition emphasizes the material context created by objective social structural relations. Porpora goes on to argue that a more complete context for explaining behavior involves both constitutive rules and material relations, and that this context analytically precedes actor's further self-understanding and behavior. His framework includes three different analytical moments that dialectically influence each other: cultural constitutive rules that establish objective social relations, the social relations themselves, and the situated behavior and self-understanding of actors (figure 2). In this vision, objective social relations arise from the constitutive rules that constitute a group's way of life. For instance, it is the historically specific, shared understandings within a slave society that define who is a slave and who is a slave master, and the

expected behaviors that go along with this position. However, although such relations depend on the conscious rule-following behavior of actors, they have an objective existence independent of actors' specific awareness. To go further with the example, whether a specific person understands him- or herself to be a slave, makes no difference at all to that person being in that particular social position. In fact, these relations may remain opaque to their understanding, just as generative mechanisms and processes of the natural world, like gravity or photosynthesis, may remain so. Yet, since this objective social position is necessarily part of the life-world of any subject in this position, it provides the subject reasons to act. According to Porpora, these social positions themselves contain built-in objective interests and provide distinct motives for action insofar as actors are aware of them. A slave may, for instance, realize he or she would do well not to speak ill over his or her master in public, but may also be well advised to seek to overthrow the system of slavery altogether. However, there is no guarantee that a person will become aware of these interests nor act accordingly. In this conception then social relations can motivate and enable certain behaviors, they are therefore socially consequential, and thus are part of a causal explanation of social behavior. Moreover, the social relations generated by the constitutive rules may differentially benefit and empower certain actors, for instance slave-masters vis-à-vis slaves, who are thereby enabled to maintain or change the rules. Objective social relations are therefore a piece of the puzzle in explaining why the rules are what they are.

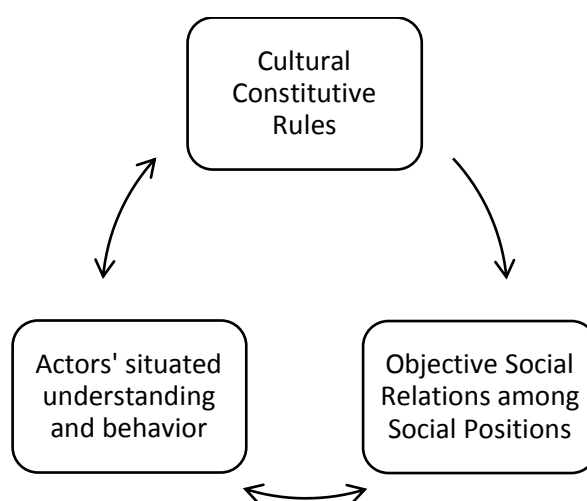


Figure 34 The three analytical moments outlined by Porpora (1993).

Impersonal social relations

In line with Porpora (1993), then, and based on Isaac Rubin's account of Marx's theory of value (Rubin, 1928), but also following Howard Richards' (2018) lead, the underlying structure of competitive market exchanges can be conceived of as a network of objective social relations among actors occupying specific social positions, as they are possessors of different commodities which are exchangeable in principle. While these are social relations, these are curiously enough impersonal, as they are mediated through things and things alone. Simply by virtue of the exchangeability of their commodity, any owner of a commodity stands in relation to other owners. Not only is he or she connected with those entering with him or her into a contract of purchase and sale, but in fact by a thick network of indirect relations, with innumerable other people (for example, with all buyers of the same product, with all producers of the same product, with all the people from whom the producer of the given product buys means of production, and so on), in the final analysis, he or she is connected with all buyers and sellers of society (Rubin, 1928). As also argued by Karl Polanyi (Machado, 2010), these relations have a profoundly dis-

embedding influence on local economies, as economic actors are now forced to take into account the working activity of all other members of society, to the extent that it influences the movement of commodity prices on the market (Rubin, 1928).

Of course, the existence of these impersonal social relations, which Richards (2018) refers to as the “basic structure of the market”, is predicated upon the constitutive rules of the market such as the institutions of property and contract law, and the general adherence of actors to these rules. The continued reproduction of this system also relies on broader norms and customs which have long been internalized by market participants, given that economic actors don’t need to reach for a manual or consult a therapist to know what to do when the prices change. In fact, to most people in our society, these rules appear as the natural way of doing things, and they are accepted and reproduced in every act of exchange. These cultural rules and objective social relations pre-exist the understanding of members of capitalist societies, as they are literally born into a world with such rules and relations. Yet through experience they develop an understanding on how to act upon this reality. While actors are not condemned to specific roles, for instance a rich person may choose to give away his or her fortune, or advocate for the abolishment of private property, they do tend to act in a predictable fashion. An owner of commodity tends to exchange his/her commodity for another commodity, insofar as it is of better use to him/her. And as most buyers figure that it is in their interest to secure a purchase at the lowest possible price, they tend to act accordingly. Indeed, at a micro-level, the existence of such social structure can explain a substantial set of beliefs and actions of members in such a society. Moreover, because commodity owners follow a consistent and predictable pattern of behavior, it also leads to particular tendencies at a macro-social level, for instance, the emergence of a self-correcting price mechanism of over- and underproduction, which, is precisely what various economic thinkers have argued to exist (Richards, 2018). By virtue of these relations, buyers and sellers set in motion through the exchange of commodities, independently from their will or knowledge of this laws regulating social production and consumption. As this systems of social relations does not require economic actors to know much about the world to act effectively in it, it relieves economic actors from directly organizing production in society (Morozov, 2019). Then again, as argued compellingly by Moishe Postone (2017), it constitutes an extremely resilient form of abstract social domination, which subjects people to impersonal and increasingly rationalized, structural imperatives and constraints.

Personal social relations

Actual market exchanges occur under circumstances that diverge from anonymous role playing, as sellers and buyers may be loyal or bound to each other and thus swayed by things other than price. Jackson proposes that such trading behavior is mediated through other social structures too, and he discusses in particular the ‘personal social structures’ developed through enduring trading, between and among buyers and sellers. Likewise, these structures are objective and of social consequence, but they are a softer form of social structure. As they are constituted by rules negotiated at a lower-level, but also are more intelligible to actors involved, they are more subject to change. The rules that are established at this level include those that Tordjman (2004) refers to as procedural rules, by which exchange is concretely organized. Jackson studies three interactions in particular: between sellers, between buyers and between buyers and sellers, through which market exchanges gain a more personal character. We would, however, also include other actors such as governments and state bureaucracies, sector organizations, and family members, personal friends, and employees, which create particular cultures within social networks e. g. Abolafia, (1998), thus redefining the particular social positions commodity owners find themselves in. As it is through this personal network that commodity owners forms an opinion about what, who and how commodities should be traded, they play a vital role in explaining actual trading behavior. Insofar that these personal relations are endowed with power, these are direct power relations between individuals or between groups of individuals, such as we can find in the patriarchal family, or in tribal or feudal society.

Layering of social structures

By making a distinction between actual events and the mechanisms that generate them, in accordance with a critical realist ontology, we can explain market exchanges in terms of a layered social structure. This social structure exists out of both impersonal and personal social relations among social positions, constituted by two sets of cultural rules at different levels of society. These two sets of relations co-exist and define together objective social positions which motivate, enable and constrain actors' behavior. Following Jackson (2007), a layered approach can accommodate a wide range of competitive and relational trade within a definition of markets that distinguishes them from purely direct reciprocal and redistributive economic arrangements. Based on an analysis of the varying prominence and combinations of these personal and impersonal ties among buyers and sellers, Jackson (2007) demonstrates that a typology of markets can be constructed, which include particular roles actors in these various positions tend to play. However, given the indeterminateness of agency, it remains crucial to study how cultural rules and impersonal and personal relations are reproduced in different contexts.

Grounding the analytical framework: materials and methods

So far, we presented the development of this analytical framework as a product of critical reflections on existing literature. However, these reflections occurred simultaneously with the analysis of semi-structured interviews gathered on 37 Flemish beef farms (Tessier, Bijttebier, Marchand, & Baret, 2018), spurring us to entertain the possible existence of objective personal and impersonal relations underlying the market exchanges referred by the farmers. We therefor return to our own fieldwork to show how these data gave us reason to believe existing frameworks were incomplete. The data include 37 semi-structured interviews with beef farmers in Flanders, who were selected along the range of three axes a priori established (table 1). In 25 cases we spoke with only male identified members of the farm household, in 5 with only female identified, and in 8 cases with both male and female identified members of the household. All farmers were from white ethnic background. The main goal of this data collection was to explore which actions are taken, by what kind of farmers, on what kind of farmers in line or against agroecological principles, and in a further analysis why (Tessier et al., 2018). For the purpose of this paper, we re-read the transcripts, and coded revealing instances where farmers referred to the existence of market forces controlling their lives, chain actors and consumers. However, in the analysis of these parts, we also note the role of personal relations and farmers' agency in creating diverse outcomes.

Table 18 Distribution of cases along the three a priori axes used for purposive sampling: Organic or in transient to Organic or not; Direct Sale of meat or not; Diversified Agricultural Activities, defined here as rearing other livestock species than bovines for sale or growing cash crops (excluding wheat).

Organic?	Direct Sale of Meat?	Diversified Agricultural Activities?	Tot #
Yes	Yes	Yes	10
		No	1
	No	Yes	1
		No	0
No	Yes	Yes	5
		No	3
	No	Yes	14
		No	3

Results and analysis

Whereas the analysis of sets of practices mentioned by individual farmers is still ongoing, we can already foreshadow that the cases are remarkably diverse and distinct along multiple dimensions of farming. This is no coincidence as we aimed at including a wide range of beef production systems in order to explore with this sample the full scope of agroecology on Flemish beef farms. There is, however, a noticeable uniformity in terms of social organization of production, as these farmers strongly depend on markets to socially reproduce: they sell their products of labor in order to buy means of production. Yet this dependence on markets varies on a case-by-case basis. Some farmers acquire goods and services by gift or reciprocal arrangements with neighbors, consumers or nature organizations, or they acquire means of payment through state subsidies, lending or inheritance, or through non-agricultural activities such as wage work, tourism, etc., or they are in part subsistent. These observations show that there remains scope for a diversity of agricultural practices, which tie into a varying ability of farmers to socially reproduce without having to sell their products of labor. Nonetheless, even though these farmers may produce beef very differently, they all rely on market exchange to some degree, revealing they are confronted with a similar objective situation, and in many respects act upon similarly.

Closer analysis shows, however, that the dependence of farmers on market exchanges has also a qualitative side. Farmers regularly buy and sell commodities through arrangements which differ markedly from the text-book competitive market definition. For some inputs (straw, forage, calves, land, veterinary services, manual labor, and many household and consumer goods), it appears there exists a competitive market, as there are many buyers and sellers of these commodities. Farmers regularly work with the same people to obtain these goods and services, but, these enduring relationships are not interpreted as a source of un-freedom by farmers. The mere ability of farmers to easily change to a competitor is said to be a sufficient deterrent on overpricing to such suppliers. What we established from this observation is that while exchange is an act between two individuals, it appears to be influenced by the activities of other buyers and sellers in society, often unknown to these actors. For some inputs (pesticides, concentrates, seeds, planting material) there are but a few supplying companies. Many farmers say that this results into direct appropriation of economic value from them by these companies. Nonetheless, it appears that some farmers are not content to accept the terms of exchange, but are in a position to bargain individually by turning commercial partners against each other or collectively through group purchases. It was also said that these abilities are greatly diminished if farmers are in an immediate need for cash or indebted to their commercial partners. Going back to the concepts developed earlier, situated behavior reveals itself here as the varying ability and choice of farmers to challenge the rules constituting their position in relation to powerful suppliers.

Analysis of relations underlying the sale of agricultural products reveals an even richer picture, given the diversity and combinations of sale channels called upon among the interviewed farmers. Majority of farmers argue that for most agricultural products there is an oligopsony of food manufacturers and retailers, exerting undue influence on production conditions and terms of trade. In many of the cases studied, this belief has prompted farmers to partly organize processing and distribution activities themselves or find alternative partners. Yet, it may also translate into a shared sentiment among many whole selling farmers that they are playing a rigged game. Yet, the degree of this extraction of value is disputed: some farmers argue these companies have colluded against them to set prices and drive up their profits; others argue that downstream actors are also under the pressure of competition, which forces them to push down prices on farmers. This observation shows that actors are not determined to reach the same understanding of a similar situation. A few whole-selling farmers, not coincidentally larger farmers often with some personal experience in cattle trading, argue that there still is a free market. They say that current low prices are but temporary and due to overproduction, which will and should drive so-called inefficient farmers out of production. From, this vantage point, there is a form of fairness in market valuation: farmers are free to speculate, or move to on to produce different commodities, even though many conditions of production such as factor prices are to their frustration mostly beyond their control.

Leaving aside whether going market prices within whole selling chain are fair or not, farmers selling their products directly to the consumer appear to operate in a much more favorable price-environment. These farmers report that they are able to set the prices to their own production costs. An enviable position to most whole selling farmers, begging the question why the latter have not moved on to replicate it. Taking into account previous discussions, we would suggest that the different position is due to an altered relationship between the consumer and producer. Yet, this position is not arrived at easily, nor are the conditions present for each farmer. We've identified two main difficulties in setting up a viable direct selling system. The first is finding a way to organize processing the product without mainstream processing companies. This ability of farmers to process their product themselves depends on commodity-specific legal and technical, training and skills, labor and investment requirements to set up such a processing unit. For fresh vegetables in relatively small amounts, this is relatively easy; for meat however, this appears to be a high bar. Instead, many farmers resort to working with a local butcher to pack the meat, and sell the packages themselves. Looking back, we read that differences in social positions may influence farmers ability and willingness to establish particular personal relations with other actors. We notice, however, some antagonisms between such forms of cooperation, as some butchers see these direct selling farmers as direct competitors. Another option is setting up such processing units with other farmers to share investments and creating economies of scale, which appears at local level hard to set up, given the lack of trust among farmers; but if completed, worthwhile according to farmers engaged in such initiatives.

The second challenge for direct selling is to secure and expand a consumer base, which is willing to accept these presumably more fair trading conditions. On the one hand, this appears to be a question of investing time and resources in marketing activities (publicity, organizing festivities, social networking, personal contact with consumers), and on the other hand, of creating a distinct and desirable product. For farmers producing very large quantities, these are both rather daunting tasks. Instead of organizing distribution themselves, by-passing traders and the retail industry are also accomplished by selling to local butchers, supermarkets retailers, restaurants, or local food networks such as "Boeren en Buren" and "Voedselteams", which appear to offer terms of trade more fit to the specific situation of their enterprise. The commodities sold by direct-selling farmers, or farmers selling to alternative partners appear indeed to have a distinctive utility to their customers, meriting a higher price, which is clearly influenced by the farmer's specific production and marketing activities. This sets them apart from more generic commodities offered at mainstream outlets. Yet, one can question the extent to which these favorable price arrangements are isolated from the economic conditions faced by whole-sale and conventional farmers. Direct selling farmers admit they have to take into account the prices offered by local supermarkets and butcheries, as their customers do too. This shows that even relational exchanges are structured by impersonal relations. The same principle could also be applied to the restaurant owners, local food distributors, and butcheries farmers work with to circumvent the retail industry. Moreover, other farmers may jump into such niche markets as well, making appeals to the same customers, by undercutting prices and even overflowing the market, potentially leading to similar experiences as in the whole sale chain. Whereas buying appears to result in a different dynamic amongst farmers compared to selling, we do see this competitive logic replicated when farmers seek to secure a purchase of scarce resources such as land.

That farmers often act like competitors for resources and customers on the market, farmers say, strains the development of enduring personal relations and collaborations between farmers. This would constrain farmers to break the power of agro-food companies, and to take full advantage of the willingness of local consumers to pay more for agricultural products. Emery (2015) has argued that this lack of cooperation among farmers is a result of the individualist ideology among the farmer population, cultivated by agro-food companies. While some farmers indeed hint this could be a cultural phenomenon specific to the Flemish region, our framework implores us to take a step further to argue that there is an objective basis for such individualism. Given the particular nature of the social system farmers are inserted, they tend not only to believe they are competitors for resources and costumers,

but they actually are. The existence of such impersonal relations between farmers across the board would explain the frailness of more relational arrangements. On one hand, such relations tend to hamper the constitution of stable solidarity networks favorable to agroecological production methods. On the other hand, the relative autonomy of farmers granted by this social system, also gives farmers the ability to get out of direct exploitative arrangements and to establish arrangements with other autonomously acting actors, which may be more lenient to their personal interests and perhaps to agroecology.

Perspectives

In this paper we outlined an analytical framework through which we sought to resolve some of the paradoxes surrounding market exchanges, that we came across during interviews with farmers. We touched upon several observations from our own field work that catalyzed these reflections, yet a full-fledged application of this framework on our data is still in the works. In future research, we will look how this framework allows to explain in causal terms paying equal attention to cultural rules, social relations and agency, why certain farmers take certain actions in line or against agroecological principles, and where it may fall short. In no way is the construction of an analytical framework specifically on market exchanges intended to trivialize the contribution of gendered, (domestic in particular) social relations and cultural rules to resolve our question. In fact, we believe that the layered approach proposed allows and encourages the flexible integration of critical perspectives on gender, class, ethnicity, animal subjectivity, into the analysis of alternative and not so alternative market-based food systems.

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