Reconnecting crops and livestock on a territorial scale : multifaceted cooperations and a range of brakes and levers

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Agronomic Innovations 93 (2024), 24-35

Reconnecting crops and livestock on a territorial scale : multifaceted cooperations and a range of brakes and levers

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Systems based on crop-livestock interactions, at farm and territorial scales, are today presented as "agroecological prototypes". If, at the farm scale, these interactions are numerous, at the territory scale their implementation becomes more complex due to the diversity of the associated actors and therefore the multiplicity of objectives. This diversity, which has been the subject of recent characterisation works, seems to be increasing for different reasons (agroecological transition, regulations, local food sovereignty, etc.). To illustrate the diversity of these forms of cooperation, 3 examples chosen from the numerous Crop Livestock Interactions initiatives at the Territory scale observed in the field, are presented here. They are based on different forms of cooperation and modes of governance and are anchored in different territorial archetypes. They are described through the motivations of the actors for their implementation, their forms, the obstacles encountered and the levers activated. Finally, a transversal analysis was carried out, at the successive stages of cooperation (from emergence to sustainability), in a comparison based on 5 cases, which showed generic brakes and levers. Among the lessons, support in the emergence phase is crucial and requires rethinking the postures and support methods of advisory structures.

Key-words: crop-livestock interactions, agroecological transition, collective management, exchanges between farmers

1. Introduction

Mixed crop-livestock systems are now seen as possible models for the agroecological transition. Whether in terms of mitigating and adapting to climate change (Delandmeter et al, 2023), conserving biodiversity (Balent et al, 2015) or reducing the use of plant protection products (Chartier et al, 2015), these systems offer solutions to the main challenges facing agriculture. Nevertheless, the specialisation of farms and regions that has taken place over the last few decades, with the disappearance or concentration of livestock farming in certain areas, is one of the main limits to the widespread use of such systems.

A return to mixed crop and livestock production at farm scale, while it may be possible on a one-off basis, for example by reintroducing a livestock unit on a cereal farm, is not feasible on a large scale because of the many obstacles farmers face: work overload, economic profitability of the livestock unit, need for skills and knowledge (Ramonteu et al, 2019), loss of upstream and downstream services, etc.

While farms have become more specialised, in many regions crop farms and livestock farms coexist (Figure 1). Hence the idea of recreating the benefits of animal-plant coupling not at farm level, but at the level of groups of farms in the region, or even between neighbouring regions (e.g. plain-mountain). Numerous initiatives of integration of crops and livestock on a territorial scale (Territorial-ICLS) have emerged in recent years (Ramonteu et al., 2019). The aim of this article is to present the obstacles to their implementation and the levers that can be mobilised, based on 3 contrasting examples, and to draw some generic principles to help with their implementation in territories.

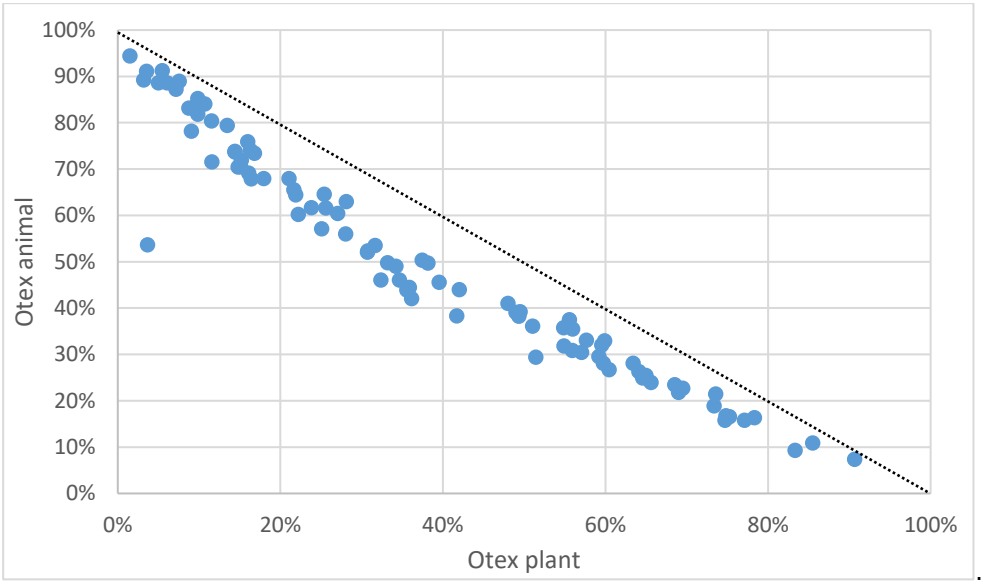

Figure 1: Distribution of Otex* plant specialisation and animal specialisation by Department (% of total farms) (source: 2020 agricultural census data)

The departments are more or less close to the dotted line (total specialisation). The difference is made up of the polycrops-poly-breeding otex The departments are evenly distributed between very high crop specialisation and very high animal specialisation. * Technical and economic orientation of farms.*

2. Materials and methods

In order to contextualise and analyse the forms of Territorial-ICLS that can be implemented by farmers and associated stakeholders, several analytical tools have been developed as part of the Mixed crop-livestock systems Joint Technology Network (RMT-SPyCE): a characterisation of territories into 'archetypes', a typology and a Territorial-ICLS analysis grid.

The first support distinguishes 8 archetypes of territories, according to the respective place of animal and plant production and their agronomic potential (Ramonteu et al., 2021). The archetypes are characterised by their specific issues and by a grid of Strengths, Weaknesses, Opportunities and Threats.

The first example illustrates the prospect of reintroducing livestock farming into an *arable farming area*. The other 2 examples concern exchanges between *arable* and adjacent *grassland areas* in diversified regions.

The Territorial-ICLS typology (Table 1) distinguishes, firstly, between the size and complexity of the organisations and, secondly, between the objectives pursued and the resources mobilised (Moraine et al., 2019; Ramonteu et al., 2019).

Collective size	Category	Resources mobilised
Direct (bilateral) trade between farmers	Material exchanges or transactions	Straw/manure exchange; Material purchase/sale transaction (feed, etc.)
	Provision of land surfaces	Grazing of additional areas (cover crops, vineyards, etc.)
Farmers' groups	Sharing processing infrastructures	Presses, soya bean crushing/toasting or fodder drying units...

	Joint marketing of short-circuit products	Specific sectors, baskets of products...
	Pooling land management Provision of land surfaces	Joint crop rotation, Grazing of vineyard
	Collective methanisation (shared infrastructure)	Collective management of livestock manure
Association of farmers with other "operational" actors	Creating a local supply chain	Non-GMO soya, local cereals for animal feed...
	Collective methanisation (shared infrastructure)	Variety of substrates used for methanisation and heat uses

Table 1: Typology of forms of integration between crops and livestock on a territorial scale

The illustrations cover the 3 main types of Territorial-ICLS: i) direct exchanges between farmers with, on the one hand, the search for autonomy through grass management (for livestock farmers) and, on the other hand, intermediate cover crops (for cereal farmers), ii) and exchanges within a group of farmers (collective alfalfa dryer) and iii) the structuring of a local supply chain (via plain-mountain exchanges).

The characterisation grid includes various sections aimed at analysing the initiatives: the actors involved, the exchange and pooling practices put in place, the objectives pursued; geographical and historical context; organisational arrangements, success factors or difficulties; prospects envisaged (Moraine et al, 2019). The various sections were filled in on the basis of qualitative interviews conducted with those involved in these initiatives or on the basis of public communications. These are therefore objectives and motivations expressed by these actors.

Furthermore, to illustrate situations that vary in terms of organisational complexity, we have selected an example of the 3 organisational forms identified by Moraine et al. (2017). The 'multi-relational' form, set out in the 1st example, is the simplest as it is based on direct exchanges between cereal farmers and livestock farmers (via an on-line exchange market identifying offer and demand, for example), the 'polycentric' form refers to the organisation of exchanges in small groups of farmers around an infrastructure (collective alfalfa dryer in the 2nd example). Finally, the 'centralised' form is illustrated by the construction of a lowland-mountain exchange network as part of the Kintoa protected designation of origin (PDO).

3. Results

For each of the 3 examples, we will present the area (by positioning it within an archetypal territory) and its issues, the motivations behind the cooperation, the forms of ICET and the obstacles and levers to their implementation.

3.1. Roaming grazing of cover crops

This initiative, promoted as part of the POSCIF (Pâturage Ovin en Système Céréalier en Ile de France) project, is located in the Pithiverais-Gâtinais, in the south of Ile de France region (Emonet et al., 2022; Moesch, 2020). This area is representative of the archetypal "specialised arable farming area" with high yield potential. Suckler sheep farming was historically present in this area. Its decline has coincided with the development of arable farming.

Some cereal growers are faced with yield stagnation, and in general with a recent rise in input costs (for the 2 farms in conservation tillage, total input costs are around €430/ha in 2020). For agronomic reasons, they have decided to diversify their crop rotation, lengthen their rotation, and plant intercropping cover crops, in order to reduce their dependence on synthetic inputs (pesticides, fertilisers) and preserve the soil's potential. Some farmers plant cover crops for regulatory reasons. But in all cases, the destruction of these cover crops or their potential use is an issue.

The interests/objectives and motivations of livestock farmers and cereal growers who are developing cooperations by making land available for roaming sheep grazing of cover crops or immature cereals are complementary and converge.

From the breeder's point of view, the objectives and motivations are to benefit from low-cost, high-quality fodder (financial savings) and to limit building costs (both in terms of mulching and labour). The 2 lead to greater economic viability for the livestock unit, but also to improved health (by reducing parasitism) and animal welfare.

The objectives and motivations, on the cereal growers' side, are to facilitate the management and destruction of cover crops, but also to improve soil quality (by promoting soil life, to which animal manure contributes), which ultimately leads to savings in fertiliser inputs and makes the system more resilient. By introducing livestock on an occasional basis, cereal farmers are able to restore agronomic coherence to their system. In addition to the benefits objectively assessed by multi-criteria evaluations and appreciated by cereal farmers, these cooperations enable them to save working time and mechanisation and fuel costs by avoiding the mechanical destruction of cover crops *("20 ha not destroyed represents around 6 hours' work and between 20 and 30 litres of fuel/ha"*).

Both livestock farmers and, to a lesser extent, cereal growers express the shared objective of recreating a dynamic social bond around a common cooperative project, as well as testing and experimenting together.

The principle of partnership is to consider a free exchange on a win-win basis, with the respective services considered to be balanced. The agreement is generally oral and based on a moral commitment. Responsibilities are shared as follows: the livestock farmer and the cereal farmer agree on the species of cover crops to be sown and the indicative grazing plan (location of the parcels concerned, grazing areas and periods). The farmer alone is responsible for the animals: putting up the fencing, monitoring the herd, organising watering and shelter facilities if necessary.

In the case illustrated below (Figure 2), the livestock farmer is in contact with i) a cereal grower, with whom he will graze his cover crops from October to March and possibly immature cereals (wheat before bolting stage, from January to February) and ii) a natural area manager, with whom he will contract an eco-pasturing service for the spring and summer. For example, in the case of this farmer, 74 ha of grassland are grazed by a flock of 80 ewes.

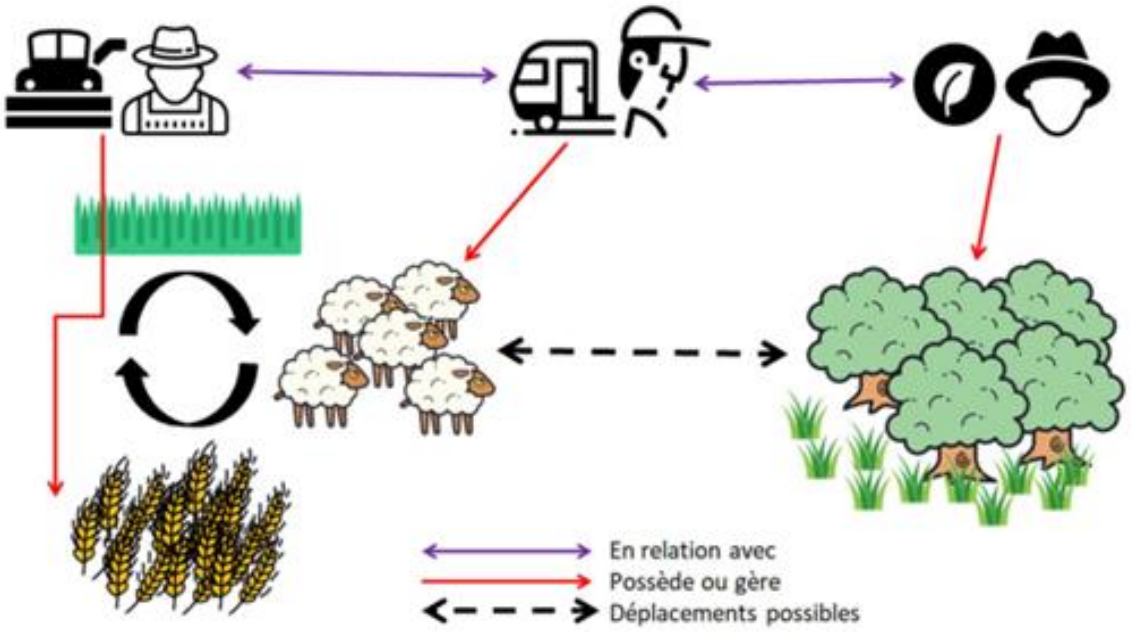

Figure 2: Operating diagram of "making land available for roaming sheep grazing" (Moesch, 2020).

The deployment of this type of cooperation comes up against several difficulties. The main one is the low number of livestock farmers in the area, or of 'mobile' shepherds who might be interested, or of potential livestock farming project holders. The reasons for this are multi-factorial: the low attractiveness and profitability of the livestock farming profession (compared with that of cereal farming), the difficulty of accessing land (in an area where land potential is relatively high) and the very high level of investment required to set up or take over a business. As a result of the loss of a livestock farming environment in this area specialising in arable farming, the development structures have gradually lost their livestock farming expertise among their advisors (the majority of whom are arable farming advisors) and their knowledge of livestock farming constraints. As a result, they are less able to support the installation of livestock farmers, who are also unable to join producer organisations, which do not exist in the region. In addition, veterinary and breeding services (identification, genetics, etc.), as well as industrial facilities for processing and marketing animal products, have become rarer or even disappeared altogether with the decline in livestock farming.

Opportunities for revitalising livestock farming include the regional support plan for livestock farming put forward by the Loiret Chamber of Agriculture, the increase in skills of certain local development structures that have participated in or benefited from the results of the Poscif project, and the potential outlet represented by the huge Parisian consumer basin.

3.2 Pooling of equipment - alfalfa drying

The study area is located in Normandy, in the Calvados region, straddling 2 territories: the *livestock-oriented* Pays d'Auge and the *arable-oriented* Falaise Plain (Mancel, 2022).

The findings on the livestock farmers' side are typically those observed in areas that have specialised in livestock farming: a surplus of livestock manure and the need to secure their fodder stocks. On the cereal-growing side, there is an associated lack of organic matter and technical impasses, prompting a search for crop rotation diversification.

Alfalfa was an obvious choice for all concerned: it is an excellent starter crop that provides residual nitrogen, and a forage rich in total nitrogenous matter that can be used in cattle farming.

The initial idea was for livestock farmers and cereal growers to exchange livestock manure for alfalfa. The cereal farmers wanted to plant legume, and more specifically alfalfa, for agronomic reasons and to anticipate regulations, while the livestock farmers saw it as a way of securing their supplies, becoming less dependent on price fluctuations and anticipating the demands of dairies (non-GMO). In addition, mutual aid between farmers was a value shared by the small core of farmers who initiated this initiative.

To facilitate these exchanges, a price calculator was initially developed. The project eventually evolved into a more structured investment: the setting up of a collective alfalfa dryer located close (within a 10 km radius) to the cereal farms that would supply the dryer. This collective facility would supply member farmers with alfalfa hay and pellets within a 35 km radius of the dryer. Farmers can also make their surplus manure available to cereal growers and receive alfalfa in exchange. The dryer is scheduled to come on stream in 2024. The terms of trade between farmers will take the form of contracts committing them to alfalfa production and consumption volumes. Commitments take the form of membership of the SICA (agricultural collective interest company) for a minimum of 7 years, with shares proportional to the volumes committed. Prices vary according to products (hay, pellets) and services, and are published online on the SECOPPA collective website (http://www.secoppa.fr/produits-et-tarifs.html). Similarly, the energy used by the dryer is produced from wood chips that the farmers supply to the collective structure in exchange for alfalfa (Figure 3).

The project currently has 25 members, 9 of whom are alfalfa producers and 18 of whom are alfalfa consumers. The imbalance observed at this stage of the project's emergence is due in particular to the low level of incorporation of alfalfa into the animals' rations to begin with, as the breeders first want to test the impact of the introduction of this feed on production before committing to significant volumes.

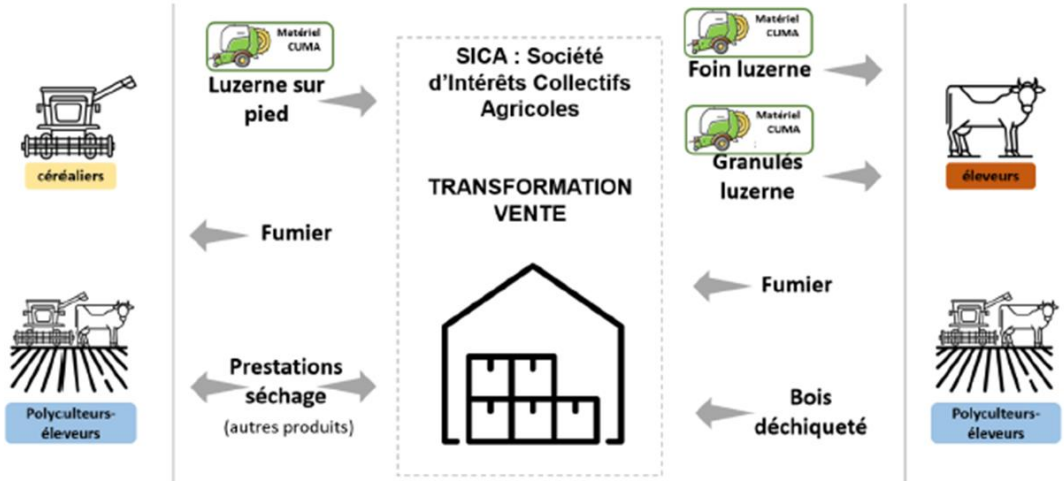

Figure 3: Operating diagram of "provision of equipment" type, in the case of the collective dryer (Mancel, 2022).

The main difficulties in setting up this cooperation in practice were due to cultural distance, with, according to the actors surveyed, mistrust between livestock farmers and cereal farmers and a reticent attitude on the part of the livestock farmers, despite the fact that they were working together in the Cooperative for the Use of Agricultural Equipment (Cuma). These "postures" had repercussions on the organisation of the exchanges, with the difficulty of finding common ground for an exchange price with a view to mutual benefits; the livestock farmers were attached to a price proposal and the cereal farmers to an agreement based on volumes. In addition to these socio-organisational difficulties, there were i) technical issues concerning the adaptation of livestock rations, ii) logistical conditions, with the need to agree on a maximum supply radius to limit transport costs, iii) legal issues concerning the choice of the Société d'Intérêt Collectif Agricole (SICA) status (the Cuma status being unsuitable), and iv) financial issues concerning investment in collective drying equipment.

Among the levers used to launch the project, prior knowledge and mutual identification of the partners through membership of a Cuma provided appropriate support. Dialogue and clarification of expectations and motivations by a neutral mediator to support negotiations on an equilibrium price are key to resolving misunderstandings or tensions between cereal growers and livestock farmers. In terms of technical expertise, the Cuma's support was valuable in coordinating the technical feasibility study, by calling on: i) the milk recording services, for farm forage balances, ii) SEGRAFO Ouest, an association of farmers providing technical support for dryer projects, iii) the Calvados Chamber of Agriculture, for a study of the buildings, and iv) in the pre-project phase, alfalfa trials on plains with the support of Cérience (seed company) and Arvalis. As a result, the collective structure was created in 2022, the year in which the dryer site was purchased, members were recruited and the structure's internal rules were drawn up. The first alfalfa plants were planted in advance of the launch of the dryer, scheduled for the 2024 season.

3.3 Plain-mountain exchange and setting up a local livestock feed supply chain in the Kintoa PDO area

This collective project was initiated by the Kintoa PDO (2 designations: pork and ham), located in a mountainous area of the Basque Country, in the Atlantic Pyrenees (Trilha, 2019). This area is not very conducive to growing cereals, even though feed represents 56% of the production cost of a pork-butcher pig, and the farms that rear and fatten pigs do little on-farm production (only 20%) and generally buy the compound feed (wheat, maize, rapeseed and sunflower oilcake) from a cooperative.

The PDO specification stipulates that 70% of the feed (100% of the cereals) must come from the geographical area.

In order to free itself, in part, from the volatility of raw material feed prices, the objective identified by the Kintoa PDO is to create a local cereal supply chain for Kintoa pig farmers based on the following sub-objectives: i) To agree on a fair and remunerative price between all the actors (cereal growers, storage companies, collecting bodies, feed manufacturers, transporters and breeders), ii) To guarantee transparency at every stage: from the field to the finished feed, iii) To ensure traceability at every stage, from field to feed, and iv) To make a commitment over several years to ensure the long-term future and security of the local feed supply chain.

This plan for the Kintoa Basque Pork Sector (figure 4) would be based on 2 contracts: i) one between the cereal growers in the Kintoa area who would deliver their cereal and field crop production to the feed manufacturer at harvest time via a storage organisation, ii) the other between the feed manufacturer who would deliver the local feed to the Kintoa livestock farmers.

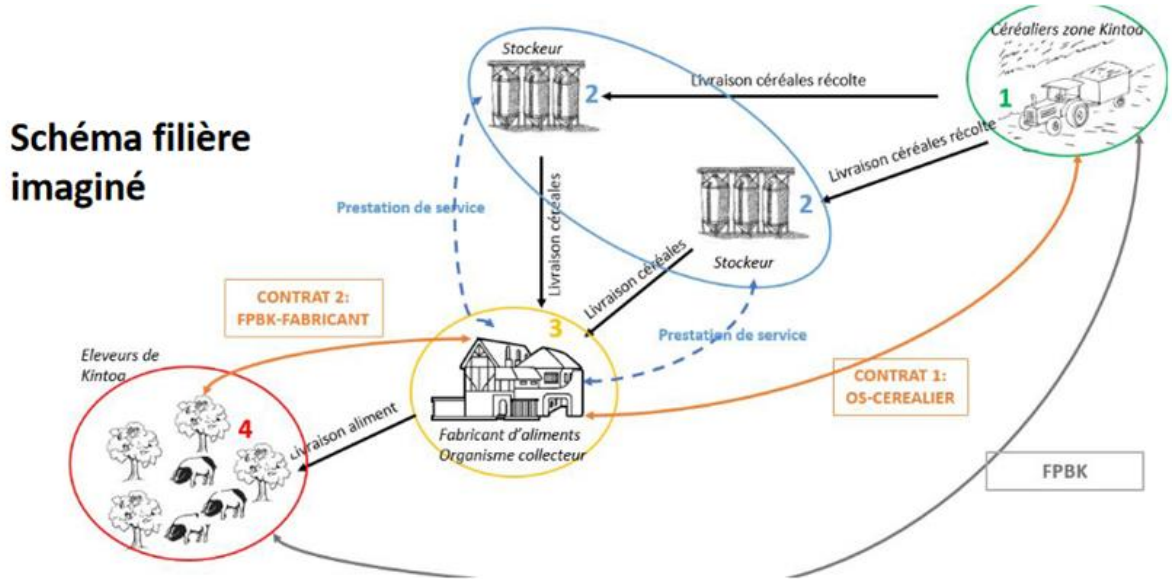

Figure 4: Operating diagram of " Territorial-ICLS meso local supply chains/plain-mountain exchange" (Trilha, 2019)

Among the obstacles identified are the difficulties of : i) Getting all the actors involved in the process (cereal growers/storage operators/food manufacturers) and over time, ii) Signing contracts with cereal growers over several years, iii) Sourcing straw cereals in the Kintoa area (small surface area + seasonal effect on availability), iv) Mobilising human and financial resources to coordinate the process, and v) Risk of tension in the PDO area with other processes (Herriko wheat, other cooperatives, etc.).

The levers identified, a priori, are based on the ability to: i) Mobilise cereal growers in the Kintoa sector as a priority, ii) Unite and raise awareness among a group of cereal growers who are 'independent' of the cooperatives, iii) Provide technical support to cereal growers in the production of straw cereals, and iv) Draw inspiration from other comparable initiatives.

4. Discussion

As part of the REVE (Reconnexion Elevage-Végétal) project (Mancel, 2022), a comparative cross-sectional analysis of the obstacles and levers of Territorial-ICLS in 5 case studies was carried out. These case studies complete the range of interaction types presented in the 3 previous illustrations.

Table 2 presents all the case studies used in our article, specifying the types of Territorial-ICLS, the modes of governance and the archetypes of territory in which they are embedded.

Table 2: Case studies used in the article, in the results and/or discussion

Type of interaction (governance)	Case study (Archetype)
Exchange of materials between farmers (manure, fodder, grain protein crops, etc.) (bilateral or multi-relational governance)	• DiverIMPACTS *project* (Diversified rural productive area archetype)
Provision of plots for roaming sheep grazing (multi-relational governance)	• **Roaming grazing of cover crops, POSCIF project** (archetypal area specialising in arable farming) • *Roaming grazing of cover crops in the Gers* (archetypal area specialising in arable farming) • *Roaming grazing between rows of vineyards (archetypal specialised crop area)*
Pooling of agricultural materials processing facility and collective organisation of supply and product development (polycentric governance)	• ***Collective alfalfa dryer*** (Archetypal diversified productive rural area) • *Collective soya toaster (archetypal diversified rural productive area)*
Setting up a local supply chain, including contractualisation (central governance)	• **Plain-mountain exchange: Kintoa PDO** (archetypal grassland mountain area and diversified area with low agronomic potential)

In bold: cases covered in the results. *In italics:* additional cases covered in the discussion (from Louise Mancel's study as part of the REVE (Reconnexion Elevage et VEgétal) project.

Depending on the case study, the level of interaction between farmers and other stakeholders varies. In some cases (exchange of biomass, for example), no coordination in space or time is necessary between farmers; on the other hand, other cases involve a higher level of interaction (coordination of interventions on plots between a winegrower and a shepherd, for example). A cross-sectional analysis of these cases does not reveal any correlation between the obstacles and levers mentioned and the level of interaction.

There are two distinct phases to characterise the obstacles and levers: an initial set-up phase, followed by an ongoing phase when the interaction takes shape.

In the emergence phase, the obstacles identified are of various kinds. The most common difficulties relate to identifying partners, setting a common objective and legal issues. The difficulties in identifying partners are all the more marked when the Territorial-ICLS is part of a specialised area. The case of vineyard grazing is part of an area specialising in specialized crop production (particularly winegrowing) and the absence of a network of livestock farms in the area is a major distinguishing feature, justifying the difficulties encountered in identifying the shepherds. These difficulties were overcome by drawing on existing networks and expertise.

Finally, in the emergence phase, the main obstacles identified concerned the operational aspects of studying the technical feasibility of the interaction and logistical constraints (mentioned in all the interaction cases). The projection of the various stakeholders (via trials, demos and workshops) helped to refine the interaction systems and encourage their implementation. This operational projection phase was also an opportunity for farmers specialising in livestock or crop production to examine in greater depth the implications of the interaction specific to their system. Once again, this required the support of experts to assist the farmers. For example, if a new feed resource is introduced into a herd's ration (made possible by the Territorial-ICLS), the new ration can be recalculated with the help of an animal nutrition expert.

In all cases, the technical hesitations of farmers potentially interested in interactions were overcome by experimentation (their own or that of their peers) and a 'snowball' effect was observed by the initiators: "*The first people who were interested had the opportunity to have equipment from the Gers. That's what got those who were motivated off to a flying start.. After that it spread like wildfire [...]. The others quickly saw that it was a success*.

While the funding of a Territorial-ICLS may be the linking phase between the emergence stage and the implementation of a project, over a longer period, various perceived imbalances may disrupt the sustainability of collective organisations. Thus, in the Territorial-ICLS sustainability phase, the obstacles are essentially linked to the human aspects of the interaction (distribution of responsibilities, trust, etc.) and in particular to the perception of imbalances between partners.

Initially, from the experience of some of the case studies, sharing the workload between the partners is a prerequisite for the sustainability of the collectives. The case of CUMA soybean toasting illustrates this point. As a reminder, this interaction is based on the collective use of a facility that encourages the self-consumption of soya for the livestock of the farmers involved, and does not require the exchange of materials. The organisation of the toasting circuit relies in particular on the involvement of the site managers, who install the machine on their farms, help the farmers to get the machine up and running and are on hand if any difficulties arise during these periods. One of the site managers also mentions additional "invisible" constraints that are not taken into account in the financial compensation they receive for on-call duty. These constraints are of various kinds: preparing the machine before the member arrives (topping up with fuel, for example), monitoring the trailers (risk of fire starting), cleaning up after a member. For the manager, there is the workload associated with these additional tasks, but also the lack of consideration for "these services" by members. This imbalance can threaten the continuity of the interaction and requires adjustments to be made so that each partner is satisfied with the balance of the

relationship: "*Sometimes it's complicated because at that time it's the maize [...]. That's when I complain a bit sometimes, when the guy finishes at 10 or 11 in the evening, he doesn't necessarily clean up, it's for me the next day. This year I said to myself, if this continues I'm going to charge for time. Cleaning time isn't counted yet*".

Beyond the balance of workload and involvement, the discrepancy between the actions expected by the partners and the practices actually carried out is a difficulty observed in the example of roaming grazing in the Gers. In this case, the practices of the shepherd, and in particular the duration of grazing, were at odds with the performance of the cropping system: "*He was too lax [...] he tended to leave too much for me, and then I paid for it in terms of soil structure. He leaves, he doesn't care, I stay and live off cereals*". This imbalance contributed to the interaction not being repeated the following year.

In the face of these imbalances, an essential lever for the sustainability of the Territorial-ICLS, and one spontaneously mobilised by the partners, is adaptation. In the various cases, "progress" linked to different learning processes was noted by the interviewees. Whatever their dimensions (technical, logistical, etc.), these adjustments are a major lever during the Territorial-ICLS implementation period.

From a technical point of view, adaptation means changing practices to overcome the obstacles encountered. In addition, from an organisational point of view, the experience gained from the Territorial-ICLS and the various adjustments have made them more sustainable. Two cases illustrate this point: grazing vineyards and toasting soya. The notion of 'habit' is cited in both cases as a factor in improving interactions. In the case of soya toasting, the experience acquired through practice and the associated habits also enable farmers to better control feed stocks.

Beyond these aspects, the inter-knowledge between the partners, strengthened over time, is also conducive to the sustainability of the Territorial-ICLS. Interknowledge helps to improve the organisation of interactions by strengthening spatial, temporal and social coordination between partners. In the case of vineyard grazing, for example, which is based on synergy between the systems and therefore strong temporal and spatial coordination, the fact that the partners know each other enables them to "work things out" better, particularly when it comes to coordinating the passage of the herd and pruning operations in the vineyards: "*Overall, from year to year, they know when I'm passing by and we manage to stagger [...] they tell me you're coming between, I'm passing by on one side or the other and we always manage to get along*".

Finally, dialogue between the partners is essential at every stage of the project (in the emergence phase as well as for the sustainability of the interactions) and is transversal to all cases, whatever the level of integration of the interaction under consideration. However, this dialogue is all the more important, and is even a potential factor in the success or failure of the interaction, when there is a distance between the partners, linked to the specialisation of the territories. The challenge in these cases is to rapidly establish a balanced relationship between the partners based on trust. In these cases, the role of a third party to accompany the farmers seems essential.

5. Conclusion

The few examples discussed in this article illustrate the many different forms of crop-livestock cooperation at local level, which adapt and adjust to the objectives and constraints of the actors involved and the local area.

The analysis of the generic obstacles and levers shows that support is crucial, especially during the emergence phase, but also during the long-term development of cooperations, especially when the organisation is complex and involves a large number of actors. The absence of support can lead to failure in setting up the collective project or in sustaining it.

Depending on the archetypes of more or less specialised areas, it is not always easy to identify support structures that can bridge the gap between animal and plant world and adopt a systemic approach.

To support these multi-faceted forms of cooperation, development organisations need to act as mediators, facilitators and intermediaries, as well as experts, and this requires an in-depth review of their organisation, business lines, skills and methods.

The Casdar projects Inter-Agit+ (on grazing additional areas) and Ficelle (on a diversity of forms of crop-livestock interactions at territory level in 4 study areas) are currently working on these issues and should shortly be providing recommendations for good practices and a toolbox of methods to support the emergence and consolidation of these cooperations.

Ethics
The authors declare that the data were collected in compliance with the applicable national regulations.

Declaration on the availability of data and models
The data supporting the results presented in this article are available on request from the author of the article.

Declaration on Generative Artificial Intelligence and Artificial Intelligence Assisted Technologies in the Drafting Process.
The authors have used artificial intelligence-assisted technologies to translate from French to English.

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Authors' contributions
All the authors contributed to the writing of the text. Louise Mancel also conducted interviews and analysed the information obtained from them.

Declaration of interest
The authors declare that they do not work for, advise, own shares in, or receive funds from any organisation that could benefit from this article, and declare no affiliation other than those listed at the beginning of the article.

Acknowledgements
The authors would like to thank the funders of the studies whose results have been presented, namely the GIS on different sectors for the REVE mission, MASA via the Casdar for the RMT SPICEE and Ademe via the AAP Graine for the Poscif project.

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