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Understanding the role of regional governance in environmental conflicts through the example of digestates markets

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Abstract

The use of digestates – a nutrient-rich by-product of biogas production – as cheap fertilizers in agriculture is experiencing an important increase in the European Union. The growth of digestate markets is promoted as a tool to develop a circular bioeconomy in rural areas. However, regional and local conflicts around digestates use are on the rise, due to potential negative externalities. One of the major externalities lies in the fear of nitrates, phosphates and pathogens pollution of water resources. These conflicts threaten the very existence of digestate markets. The recent literature on circular economy emphasizes the importance of regional governance for circular economy implementation and success in rural territories. By governance, we understand here the coordination of stakeholders to organize economic activity. The aim of this paper is therefore to understand the role of the regional coordination of stakeholders to manage conflicts affecting digestate markets in situations of information asymmetry or shared uncertainty. We present in this article the regional governance of two antagonistic case studies of digestate markets in France. We mirror the two cases as one is experiencing severe conflicts over the protection of water resources with a poor regional coordination of stakeholders, and the second one is experiencing almost no conflict as digestate use has been designed and implemented through intense regional coordination in order to help protecting the water resources. We identify regional and sub-regional governance mechanisms and we analyse their success or their failure in preventing and managing conflicts over water resources protection.

Keywords: regional governance, regional planning, environmental conflicts, digestates, water protection.

1. Introduction

The protection of water resources and the access for all to clean water supplies is at the core of our century's global challenges, as stressed by the 6th Sustainable Development Goal of the United Nations. Agriculture plays a key role in this challenge as it is a major cause of water consumption worldwide (Hoekstra & Mekonnen, 2012) and can be an importance source of negative environmental externalities. The pollution of water resources by nitrates, phosphorous, pesticides, heavy metals and pathogens from agricultural activities are among major threats to water protection (Mekonnen & Hoekstra, 2015, 2018; Parris, 2011; Smolders et al., 2010).

In parallel, to fight climate change and meet its renewable energy targets, the European Union has been supporting the development of biogas production from renewable resources in the past two decades (Scarlat et al., 2015, 2018). This energy policy has led to an important and fast increase of the number of biogas plants in Europe with nearly 19 000 plants operating in 2019 (EBA, 2020). However, up to 80-90% of the volume of the substrates (agricultural residues, food waste, sewage sludge...) used to produce biogas are actually turned into digestates, the by-product of biogas production (Martel & Desmeules, 2013; Turley et al., 2016). Therefore, the fast increase in the number of biogas plants is naturally leading to an important growth of the amount of digestates produced in the European Union (EU). The European Commission estimated in 2019 that 180 million tons of digestates were produced annually in the EU. Digestates are mainly spread on agricultural soil as cheap nutrient-rich fertilizers. The interest and enthusiasm for digestates relies on their content of nitrogen, phosphorous, potassium and other trace elements such as sulphur and calcium that are needed to increase yields and feed the crops, and their content of organic matter that is supposed to increase the soils' carbon content and feed the soils' micro-fauna (Logan & Visvanathan, 2019; Selvaggi et al., 2021). However, the increasing production and use of digestates are a source of growing concerns on their potential contribution to water pollution by nitrates, phosphorous, heavy metals and pathogens (Koszel & Lorencowicz, 2015; Monlau et al., 2015; Theuerl et al., 2019). These controversies often play an important role in local conflicts around biogas plants or plants projects (Galibert & Kosuth, 2019).

One major challenge influencing the rise of these controversies is the relative newness of digestates. The impacts of digestate use on the environment are still insufficiently known and long-term scientific research is still needed (Couturier, 2019). At the local level, this lack of knowledge is sometimes shared by all the stakeholders that are directly and indirectly involved in digestate use. This corresponds to a situation of shared uncertainty, as described by Lupton (2005), i.e. a situation in which no stakeholder holds sufficient information on digestates qualities and impacts. In other cases, some stakeholders can be better aware of digestates qualities and impacts than others (Dahlin et al., 2017; Pappalardo et al., 2018), which creates a situation of information asymmetry that

can be prejudicial to digestate use (Pappalardo et al., 2018). Recent literature emphasizes the importance of local governance in preventing and managing the conflicts around biogas plants (Bourdin, 2020; Bourdin et al., 2020; Bourdin & Nadou, 2020; Niang et al., 2021). However, these studies mainly focus on ex-ante conflicts arising before the biogas plant is built and they explore the negative externalities affecting the very close neighbourhood (smell, explosion risk, loss of property values...). Very little is said about related digestate markets and their specific conflicts. Therefore, the originality of our research lies in the investigation of two case studies of existing digestate markets, in France, that have been evolving for years. It allows us to explore ex-post conflicts related to digestates' impacts on local water resources and to analyse the emergence and evolution of these conflicts over time. It enables us to observe the role and the impacts of governance mechanisms over the lifetime of these markets. In addition, our analysis goes beyond the local spatial scale and involves the study of the regional scale, as the spreading of digestates can extend to dozens of miles away from the biogas plants and affect a whole regional hydric system such as a watershed or a groundwater. Consequently, our paper aims to answer the following question: how does regional coordination of stakeholders around digestate markets impact the emergence of conflicts over water protection?

The first section of the paper consists in the present introduction. The second section presents the qualitative case study method used and a description of the two case studies selected. The third section exposes our results. We mirror the two cases as one is experiencing severe conflicts over the protection of water resources with a poor regional coordination of stakeholders, and the second one is experiencing almost no conflict as digestate use has been designed and implemented through intense regional coordination in order to help protecting the water resources. Finally, the fourth section provides the reader with a discussion and concluding remarks.

2. Materials and methods

2.1. Qualitative case study method

We selected the qualitative case study method following Yin's (2003) justification of this method. First of all, we wanted to answer "how and why questions". The main question of this article, "how does regional coordination of stakeholders around digestate markets impact the emergence of conflicts over water protection?", can be divided into multiple "how and why sub-questions" that were investigated in our research: how and why did tensions and conflicts emerge? How did stakeholders react to these tensions and conflicts? How do stakeholders collect information and knowledge on digestates' impacts? How do they coordinate around this knowledge? How does their coordination impact situations of information asymmetry and shared uncertainty? Secondly, the coordination of numerous stakeholders around environmental issues in a complex social phenomenon that we wanted to understand in a comprehensive and holistic way. The qualitative approach allowed us to dig deep into the phenomenon and to collect as much details as possible. Moreover, case study research is especially recommended when the barrier between the context and the case are porous. We precisely aimed at analysing the specific contexts of our case studies and their impacts on the cases. We wanted to analyse present events in a real-life context and to understand the past evolutions of our cases and the consequences of this past in the present situation.

2.2. Selection and investigation of the case studies

2.2.1. Overall research project

The two case studies we present in this article are part of a broader on-going research project investigating holistic multiple case studies in France and in Germany. In this project, we selected centralized biogas plants, i.e. they are not agricultural plants run by one or a small group of farmers, but their management involves farmers, industrialists and public authorities. These biogas plants do not represent the most common model of plants in France and in Germany, where the agricultural plants are a majority, but it's a model that is often even more subject to criticism by opponents.

2.2.2. Selection of the cases

The cases were chosen during a prior investigation for being either notorious cases for environmental protection, or cases considered as models for environmental protection. Our aim with this choice was to compare the governance structures and mechanisms between the "notorious" and the "model" cases with an inductive approach, to provide hypothesis and theoretical propositions on the impacts of governance on the observed conflicts. We also selected cases from different regions to understand the influence of the context and the adaptation of governance to the specific context. The two cases of digestate markets we selected for this article are iconic for water protection issues, according to the previous exploratory talks we carried out with experts. One case is often mentioned as a model of governance for water protection while the other case is notorious because

of the many conflicts around water protection that echoed at the national level (Galibert & Kosuth, 2019; Le Monde, 2019).

2.2.3. *Unit of analysis*

As mentioned in the introduction, our unit of analysis for these case studies differs from the literature on biogas governance that focuses on the local governance involved in the location of the plants and the very surroundings. In our cases, digestate can be applied dozens of miles away from the biogas plants and these applications are recorded in an official document called the spreading plan. Therefore, our unit of analysis is the territory of the spreading plans of our digestate markets, which reach the regional or at least the sub-regional scales.

2.2.4. *Data collection*

We used the triangulation of data to collect information from a wide variety sources and get ensured of their validity. We conducted semi-structured interviews with relevant stakeholders and we analysed documents from many different origins, including national and regional press, social networks, website articles, official reports, official statements. We specifically conducted 19 interviews for these two case studies among more than 70 interviews for the overall project.

2.3. Description of the two selected case studies

2.3.1. *The biogas plant of BioQuercy*

The biogas plant of BioQuercy is located in the municipality of Gramat, in the department* of Lot, in the South-West of France. The plant is run by Fonroche Biogaz (majority shareholder of the plant), a renewable energy industrialist that is now a subsidiary of the energy group Total Energies. A regional agricultural and food cooperative, La Capelle, is associated to the plant as a minority shareholder. The plant uses 48% of agricultural residues as substrates (mainly poultry manure) and 52% of wastes from the food industry. It collects wastes from the department of Lot and from 8 other neighbouring departments. The plant was initially allowed to produce 45 000 m³ of digestates per year and to spread them on 4 625 ha of agricultural lands, involving around 70 farmers (Galibert & Kosuth, 2019). The plan started its activities in 2016 with a first spreading plan. The spreading plan was updated in 2019 and should be updated again in 2022 to include more farmers and more lands. The spreading plant expands on the territory of the Lot department and especially on the territory of the PNRCQ, the natural regional parc of the Causses du Quercy.

2.3.2. *The biogas plant of Terragr'eau*

The biogas plant of Terragr'eau is located in the municipality of Vinzier, in the department of Haute-Savoie, in the East of France, in the vicinity of the Swiss border. The plant is run by SERFIM, an industrialist from the recycling sector, but is owned by the Communauté de Communes** Pays d'Evian Vallée d'Abondance and has been desired and politically and economically supported by the multinational group Danone. The plant uses 90% of agricultural residues (mainly manure) and 10% of food industry and municipality wastes as substrates. The plant started its activities in 2016, and was initially allowed to produce 27 000 m³ of liquid digestates and around 5 000 tons of compost-based digestates annually, and to spread the digestates on 1 379 ha, involving more than 40 farmers. The spreading plan expands on the territory of 15 municipalities and on the Plateau de Gavot, which holds the impluvium of the famous Evian water exploited by Danone.

*France is administratively divided in regions that are themselves divided in departments.

** The Communauté de Communes is an administrative and political reunion of multiple municipalities.

3. Results

3.1. Tensions and conflicts observed

In our analysis of our cases, we use the distinction between tensions and conflicts made by Torre et al. (2006). Tensions reflect disagreements between stakeholders whereas conflicts involve an official involvement from some stakeholders, such as demonstrations, protests or judicial complaints, occurring when tensions could not be solved.

3.1.1. *BioQuercy*

The spreading of digestates from the biogas plant of BioQuercy takes place in the territory of the PNRCQ, that is renowned for its cultural and natural heritage (Galibert & Kosuth, 2019). Traditional agriculture in the territory mainly consists in extensive breeding of sheep, maintaining open landscapes and using sheep manure as

fertilizers. However, according to interviews, the territory is experiencing a shift from to a more intensive breeding, especially intensive poultry farming. The digestates of the BioQuercy plant are made from poultry manure and wastes from the food industry. The PNRCQ holds a UNESCO label for its remarkable geological heritage made of karstic landscapes and subsoils and is renowned for tourism. Karstic landscapes are very specific and fragile subsoils made of a variety of caves, faults and chasms sheltering underground lakes, rivers and waterfalls. Surface water is rare and underground water is very pure. In addition to the geological heritage, many caves hold a human prehistory heritage too. Therefore, according to interviews, the major sources of tensions and conflicts rely on the fear of the pollution of the rare water resources available for the local inhabitants and the degradation of the natural and cultural heritage by polluted water. The recorded pollution of caves after manure spreading increase the fear of a similar pollution due to digestates spreading, but, on the contrary, some stakeholders argue that digestates should not be regarded as more harmful than manure, as accidents with manure happen too. The interviews with stakeholders and the document analysis reveal that no major conflicts happen before the beginning of the spreading of digestates. It confirms our interest of studying ex-post conflicts, that can occur even though there were no ex-ante conflicts. Major ex-post conflicts were recorded, including many local protests and demonstrations, and echoed in the national press. In the face of such intense situation, an official investigation was realized by the Ministry of Environment in 2019 (Galibert & Kosuth, 2019).

3.1.2. Terragr'eau

The spreading of digestates from the biogas plant of Evian takes place in the territory of the impluvium of the Evian water, i.e. the catchment area of the water flows supplying the groundwater. Traditional agriculture mainly consists in extensive cow breeding for milk and cheese production. The protection of the impluvium's environment and of the water quality represents a major economic challenge for Danone, the multinational company that owns the Evian water brand (the Evian water is exported worldwide), and is a challenge for the whole territory that benefits from this economic activity, as highlighted during the interviews. The territory is also a place of summer and winter tourism and interviewees have mentioned issues of snow coloured in brown because of manure or digestates spreading in winter when storage capacities have been prematurely reached. Despite the important challenges, no major conflicts have been recorded. However, many tensions have been mentioned during the interviews and have been found in the document analysis, especially concerning the problems of storage capacities of digestates. But for now, these tensions have always been managed between stakeholders without resulting in a conflict.

3.2. Knowledge acquisition on local water resources

The global lack of information and knowledge on digestates' qualities and environmental impacts is reflected at the regional level where the specificities of each territory require knowledge on how digestates impacts the local milieu.

3.2.1. BioQuercy

Karstic subsoils are very specific, heterogenous and complex. The dynamics of water flows in these subsoils are often poorly known and the territory of BioQuercy's digestate spreading is no exception to this lack of knowledge. Interviewees stress the important need of scientific research on the dynamics of water in these subsoils. This lack of knowledge creates a situation of shared uncertainty on how digestates leakages or infiltration could damage the subsoils and the water resources. This shared uncertainty is an argument put forward by local environmental and speleology associations against the existence and the growth of the local digestate market. Additionally, the plant's owner has been accused by opponents of a lack of transparency in the dissemination of information on the quality of digestates, creating a situation of information asymmetry. This information asymmetry also fuels the conflicts.

3.2.2. Terragr'eau

The subsoil of the Evian impluvium is very different from the karstic environment of BioQuercy. The region was shaped during previous glacial periods and the subsoil contains moraine, a glacial stone, that is supposed to protect the underground water from pollution. However, interviewees pinpoint that surface and runoff water are vulnerable. The economic importance of this water resource for Danone has led the firm to intensively study the regional geology and the regional dynamics of water flows with the human and material resources of a multinational company, including teams of hydrogeologists. Two points help creating trust towards Danone's knowledge on the territory: the protection of water resources from pollution is fundamental to their private interests and they have acquired a consequent amount of data and knowledge on regional water dynamics, that they share and disseminate when necessary to mitigate information asymmetry.

3.3. Stakeholders coordination over water protection

3.3.1. *BioQuercy*

The lack of knowledge on digestate impacts on the territory seems to be correlated to a general lack of involvement and coordination of important regional and sub-regional stakeholders over local digestate markets. During the 2019 inspection by the Ministry of Environment, many projects to acquire and disseminate knowledge were evoked, such as a collective and participatory observatory of methanation and digestates impacts in the region (Galibert & Kosuth). However, three years later, our interviews revealed that almost none of these projects have yet emerged. Interviewees point out the lack of human and financial resources to set up these projects, whereas some opponents criticize the lack of political will.

One core mission of the PNRCQ is the protection of the environment and therefore the park has been developing specific scientific knowledge on local ecosystems. In this perspective, the PNRCQ provides comments and requests on each modification of the digestate spreading plans, including asking for some parcels to be kept out of the spreading plan. However, knowledge remains incomplete and the PNRCQ does not get more involved into the projects evoked above, arguing that digestates are not a priority because of their scarce investigation resources. Similarly, the sub-regional Agricultural Chamber does not consider the topic as its priority, although the Chamber is now getting involved with BioQuercy to accompany the new 2022 project of revision of the spreading plan. In addition, the two main Communauté de Communes (Grand Figeac and Causses et Vallée de la Dordogne) concerned by the spreading of digestates are not involved at all in the operations. On the contrary, many local and regional associations for environmental protection are asking to get more involved in the information and knowledge acquisition and dissemination processes. Finally, sub-regional state services still play a key role, although sometimes contested, in bringing together the biogas plant's owner and the other stakeholders in a site-monitoring committee, to start collaboration and cooperation on the territory, especially in the perspective of the 2022-revised spreading plan, and to mitigate the conflicts.

3.3.2. *Terragr'eau*

The territory where Terragr'eau is located has a long history of cooperation over environmental protection, mainly under the aegis of Danone. The private group formed an association in 1992 with local municipalities of the territory, called the APIEME. Through the APIEME, local and regional stakeholders have been able to coordinate over several successive projects aiming at protecting water resources, such as a former project of manure composting with farmers, or a collaboration with the Haute-Savoie department's services to reduce the impacts of winter road salting on water resources. Interviewees stress the workforce, the investments and the position of Danone as the first employer of the territory as key elements to favour the cooperation with local public powers. The biogas plant and the spreading of digestates are the results of years of collaboration and collective thinking between farmers, Danone and regional public-powers through the APIEME. The project came from a collective aim to better manage regional manure use through a centralized digestate spreading market. In addition to all the knowledge and information acquired and shared through this collaboration, and through several formal and informal bodies involving all the stakeholders directly concerned by the plant, the sub-regional Agricultural Chamber has been very much involved alongside farmers and Danone, as Danone privileged technical regional partner. Also, cooperation and information sharing with State services are considered as very strong and transparent by interviewees. Thanks to this long experience of cooperation and transparency, interviewees claim that the current tensions around storage capacities have been an opportunity to implement even more cooperation and coordination.

4. Discussion and concluding remarks

Our comparison of our two case studies highlighted the importance of the regional contexts of digestate spreading markets in the rise of conflicts. The regional environment of BioQuercy's digestate spreading market is very fragile and a lot of scientific uncertainties remain on digestates' impacts on water resources. The protection of the regional environment of Terragr'eau is also an important concern as it holds the famous water springs of Evian, but the regional ecosystems and subsoils have been more deeply and extensively studied thanks to Danone, a major regional stakeholder. Our results echo the importance of site-specificity of biogas plants as highlighted by (Chodkowska-Miszczuk et al., 2019). BioQuercy has been experiencing a lot of conflicts over water protection and major regional stakeholders have been little involved in the governance of digestate markets, with the biogas plant and digestate markets being managed by private actors. Several projects of regional coordination to acquire and share knowledge have been mentioned during the past years, but very few have been implemented yet. On the contrary, Terragr'eau is experiencing tensions but no conflicts, and the governance of the plant and of digestate markets has been involving all the major regional stakeholders. Regional and local stakeholders have been coordinating themselves to acquire and shared information and knowledge through many formal and informal governance structures. Therefore, our results seem to confirm the importance of knowledge dissemination highlighted in the literature (Bourdin, 2020; Bourdin et al., 2020; Giuliano et al., 2018) but we go beyond by emphasizing the need for knowledge acquisition in the situations of shared uncertainties. The literature also

emphasizes the importance of one central or pivotal actor to coordinate other stakeholders and to play the role of intermediary. The intermediary helps building networks among stakeholders and exchanging information and skills (Bourdin & Nadou, 2020; Chodkowska-Miszczuk et al., 2019; Niang et al., 2021). The literature mainly considers local public authorities as potential pivotal actor and intermediary but our results tend to highlight the role of a regional pivotal actor. For Terragr'eu, the APIEME seems to have played this role of regional coordinator since the beginning of the project although there is a clear lack of such coordinator for BioQuercy. Regional State services have been playing this role to mitigate the territorial crisis due to a peak of conflicts before 2019 but this State action underlines even more the previous lack of regional coordination on the territory. Finally, our results confirm previous research from (Soland et al., 2013) on the positive impacts of tensions and conflicts on structuring and boosting coordination.

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