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ROLE OF INTERMEDIATION IN THE MANAGEMENT OF COMPLEX SOCIO-TECHNICAL TRANSITIONS

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Abstract

In this paper, we analyse intermediation activities at play in situations of sustainability transitions and in relation to what we call the 'environmental paradox'. While sustainability transitions are strongly related to political or social expectations in terms of efficiency and measurement, they are characterized by some generic attributes of 'wicked problems' that make these expectations partly unachievable. We argue that the core properties of wicked problems related to environmental issues (interdependency, complexity, uncertainty and controversy) are conditioning the understanding and the concrete achievements of intermediation activities. As a consequence, we argue that these activities imply to favour processes of transformational change and social learning asking to better articulate both positivist and interpretive perspectives to knowledge, which we respectively defined as objectification and inter-subjectification processes. We draw upon four narratives of complex situations of change involving intermediary actors to propose a comprehensive analysis of intermediation activities in context of action. The confrontation of our cases allows us to identify some key functions fulfilled by intermediation activities involving strong articulation of objectification and inter-subjectification processes. We finally identify some key properties that can help to understand how intermediation activities become efficient.

KEY-WORDS: SUSTAINABILITY TRANSITIONS, INTERMEDIATION, WICKED PROBLEMS, TRANSFORMATIONAL CHANGE, OBJECTIFICATION, INTER-SUBJECTIFICATION

INTRODUCTION

Intermediation has been studied across a variety of scholarly fields and in a variety of contexts (Howells, 2006; Meyer and Kearnes, 2013). Myriad terms are used to name individuals or organizations involved. They are mainly described as 'match-makers' aligning two (or more) entities and bringing them into contact to address business information and knowledge gaps or technological issues occurring in system failures or innovation networks. They are named: 'innovation intermediaries' (Burt 2004; Hargadon, 1998; Howells 2006), 'knowledge or innovation brokers' (Gassmann and Reepmeyer, 2005; Klerkx and Leeuwis 2008; Lomas 2001), 'systemic intermediaries' (Klerkx and Leeuwis, 2009), 'boundary spanners' in education (Stevens, 1999), public management (Willimas, 2002) and in business organization management (Aldrich and Herker, 1977).

By naming intermediaries, scholars mainly try to identify the new actors (individual or organizational) working at the boundary of organizations and the ways they act as a third party in one-to-one or many-to-many relationships. Some authors, such as Bussant and Rush (1995), Howell (2006), Guston (1999) or Klerkx and Leeuwis (2009) go further and characterize the functions that intermediaries fulfil within innovation and knowledge systems. Nevertheless, other theoretical foundations of intermediation can be found in the sociology of science and technology with the notion of 'boundary object' as introduced by Star and Griesemer (1989) or in anthropology of development with the idea of 'development brokers' (Olivier de Sardan, 1995) or 'knowledge brokers' in medicine (Ward, House and Hamer, 1997) and 'knowledge inter-mediation' in science shops (Meyer and Schlierf, 2013). Such studies pay more attention to the diversity of perspectives that people have on a reality and their diverse ways of building interpretation and of acting in situation.

Extending this point of view, this chapter is a contribution to a stream of enquiries that particularly investigates the functions and properties of intermediation activities in sustainability transitions, with an attention to learning processes in situations of change (Van Mierlo et al., 2010; Elzen et al., 2012.; Klerkx et al., 2012; Barbier et Elzen, 2012). Focusing on intermediation in transition studies requests to associate the study of learning processes, the exploration of governance principles and institutional arrangements or evaluation instruments in order to cope with issues for which various narratives and innovation pathways are explored at both local and global levels (Smith & Stirling, 2007). Indeed, what can be considered to be obviously innovative by some is often ill defined or contested by others. In this context, developing the conditions for social learning in sustainability transition appears to be key but tricky as socio-political choices are made in transition pathways. Intermediary actors can hardly claim their neutrality as they capture and embody many tensions at play. As a consequence, intermediation in sustainability transitions cannot only be described as providing new flows of knowledge and objects within a given network of interests for technological innovation. Nor can it be described as a functional role of filling knowledge gaps in system failures. Rather, intermediation performs specific functions that are related to the kinds of problems that are at stake and therefore plays a political role by supporting the interactive work of problem framing, goals definition, means setting and solution finding within a dynamic set of relations. Therefore its epistemic dimension is to be acknowledged. To achieve this, we assume that we need to study the practices of intermediary actors from the perspective of their underlying assumptions regarding the relationship between knowledge and action, what Baert & Rubio (2012) called the 'politics of knowledge'. We claim that this type of politics of knowledge needs more attention in transition studies.

In this chapter, we first explain our interpretative perspective and provide the main reasons for which we believe research on intermediation activities must be renewed while crossing social learning backgrounds and politics of knowledge insights about sustainability transitions. After some important methodological concerns that explicitate our interpretative position, we present the four case studies about intermediation taking place in different situations of change. Based on a crosscutting analysis of those case studies, our discussion section reflects on the role of intermediation in fostering transformational change and we follow up on this by analysing the functions that actors of intermediation fulfil in that process. We then propose three main generic properties, which we identify as key for intermediation activities to become efficient. We conclude by arguing that the analysis of the systemic interplay between these functions and properties can become a basis for the development of new research on intermediation.

SUSTAINABILITY TRANSITIONS AS TRANSFORMATIONAL CHANGE TO ADDRESS WICKED PROBLEMS

Sustainability has become a public problem that entails a large array of contradictions (producing climate change vs adaptation to climate change, biodiversity conservation vs compensation for biodiversity loss, food security vs food securing, etc.). Thanks to -or because of- many local or global conflicting political arenas, its recognition in decision making layers occurs once actors begin to ask questions about how their environment evolves and is transformed under both natural and anthropogenic conditions. The claim for the recognition of *anthropocene* as a new geological age echoes this recognition pattern in the realm of science. In other words, the biophysical, technical or economical dimensions of sustainability are definitively known to be socially constructed. Sustainability is then a kind of public problem that recognises the necessity and the complexity of a reconciliation between the many and specific dramaturgies of the wide range of issues that contribute to its definition (Gusfield, 1981). Within this framework, sustainability can be described as a 'wicked problem' (Batie, 2008; Levin et al., 2012); that is a problem which cannot be tamed by the solely legitimating chorus of techno-science and administration together because of inherent contradictions and changing requirements.

If one takes the concept of 'wicked problems' seriously, sustainability transitions are better explained as processes of re-assembling the Social, the Technical and the Natural (Barbier, 2010). We assume that re-assembling these dimensions relies on processes that need to be analysed in the specific circumstances of situations of change and during collective experiments

through which the establishment of the matters of concern and matters of facts are simultaneously materialized in specific promising organizational arrangements. Based on these assumptions, we propose that dealing with sustainability transition problems related to natural resources involves four types of emerging features: (i) bringing to the fore existing but previously invisible interdependencies, (ii) confronting stakeholders with complex issues of change, (iii) revealing numerous uncertainties and (iv) generating controversies about the goals and means of action. These features – interdependencies, complexity, uncertainty and controversy – can be identified as the conditions and context in which intermediation activities take place once we consider sustainability transitions as a process in the making dealing with ‘wicked problems’ that are particularly difficult to handle within a managerial perspective (Rotmans et al., 2001). Those features are intertwined but have to be specified for our analytical purpose.

Interdependencies. The agriculture modernization, which took place on large scale during the last century, resulted in a lack of consideration - if not deny- of what has been described as negative externalities. Environmental issues (like pesticides use reduction, water protection or landscape management for wildlife, etc.) became public issues at the end of the last century and practitioners or stake-holders started to become aware of the connections between what they did and knew about their own activity and the ecological processes which take place at various spatial and temporal scales. As a result local interdependencies between the social, natural and technical became visible and now constitute the core of what has to be managed. But, at the same time, these environmental issues cannot be separated from a broader context made of policies, markets, norms and organizations. To put it differently, the increase in nature and number of interdependencies in every local level leads to an increase in nature and number of local-global interdependencies, phenomenon labelled by Robertson (1994) as ‘glocalisation’.

Complexity. Snowden (2002) makes a useful distinction among the complicated and the complex nature of systems and its consequences for management issues. The former are so termed because “*cause and effect can be separated and by understanding their linkages we can control outcomes*” (ibid p.116). The latter are irreducibly complex systems in which “*the components and their interactions are changing and can never be quite pinned down*” (ibid p.116). Adaptive properties, feedback loops, and threshold effects leading to irreversibility of a trajectory are some of the phenomena, which make it very difficult to pin down the underlying dynamics. Increased complexity results from interdependencies and their dynamic interactions over time.

Uncertainty. From a ‘techno-scientific’ perspective, to increase the available knowledge in order to be able to objectify the underlying processes of ecosystem functioning (i.e., the interplay between biophysical and technical

processes) is often considered as the key activity needed to manage sustainability problems. However, uncertainties result from the radically unaccomplished character of the scientific representation of nature or human activities. What is done here and now can lead to consequences elsewhere and later; acting on a specific dimension of a problem may lead to unexpected effects on another. Therefore, the scientific enterprise involved in much problem definition or problem solving processes contributes as much to release uncertainty than to raise new challenges and new issues.

Controversy. Finally, sustainable transitions are highly disputed because of definitional struggles, co-ordination stakes and goal definition issues. They lead to confrontations of various systems of interest by demanding that actors identify and implement 'win-win' solutions, when contradictions are driving forces. But more importantly, they result from the various conceptions people have of their own actions and from their level of acceptance of the inherent uncertainties that sustainable transitions cover (Stirling, 2014). Controversies can reveal the role in transitions that people assign to knowledge mobilization and production and the ways in which they take over this knowledge as a resource for their own action. For example, do such processes lead to struggles around knowledge production and possession in order to reinforce particular social positions? Are they used to inform and convince people about the relevance and need of public decisions? Or should they also be used to support people in exploring controversies and building new arrangements?

While the management of sustainability transitions confronts people with the wickedness of problems and the lack of means to even frame them, at the same time action is goal-oriented or purposive (Smith & al., 2005). Put differently, action is strongly related to political or social expectations in terms of efficiency (management performance) and measurement (measurable results and effects) of the pressing environmental issues. To a certain extent, this constitutes a kind of 'environmental paradox': the generic characteristics of environmental problems make these expectations partly achievable. But, concomitantly, as Connors and Dovers (2004) observe, there is a "*need for policy discourse and learning, especially in the case of sustainability as a profound social goal pervaded by complexity and uncertainty*" (p.226). Therefore, if one calls for a more holocentric approach of sustainability transitions (Bawden, 2003), an understanding of how people are involved in processes of 'transformational change' is needed. Hence, we assume that this needs to be analysed in the specific circumstances of situations of change and during collective experiments through which the establishment of the matters of concern and matters of facts (Latour, 2004) are simultaneously materialized in specific promising organizational arrangements.

Under such assumptions (which target the wickedness of problem and the need of transformational change) and in local experiments to deal with the 'environmental paradox', intermediation activities can be defined by their main

purpose: situational articulation. This articulation concerns two main communicational processes. On one side intermediation activities support some clarification and coordination processes that are meant to objectify the issues that are at stake, based on the instrumental mobilisation of proofs and evidences with denial of subjectivity. After Nussbaum (1985), we call it objectification. On the other side, intermediation activities recognise and empower elicitation processes of actors' viewpoints (their own subjectivity) based on the exchange and confrontation of opinions and arguments of those who shape the problem and are concerned with its solving. There, the attention is put on the development of interpersonal meanings that requests concern about how the self-image of actors is addressed in discourses. After Traugott (2010), we call it inter-subjectification. Finally, since the issues that are at stake are partly unknown, objectification and inter-subjectification have to be built through deliberative processes involving not only the mobilisation of knowledge but also the confrontation of various points of view, values, and perceptions, which can lead to social learning processes (Steyaert & Jiggins, 2007). Thus, intermediation activities are performed to manage both objectification and inter-subjectification processes, as well as their interplay to support people in expanding their understandings of the situation and in working and reworking the stock of available knowledge used to analyse and transform this situation. In so doing, intermediation activities have to cope with the various ways people think about action and knowledge and, as a consequence, their various expectations regarding the ways to link knowledge to action.

The four above mentioned features and the recognition of transformational change ground our analytical perspective through which we expect to deliver new insights about intermediation as an activity, which enables objectification and empowers inter-subjectification. In order to mobilize this interpretative model, we shall now present some methodological considerations of our empirical understanding of intermediation in agricultural sustainability transition.

METHODOLOGY

As advocated in the special issue edited by Meyer and Kearnes (2013), analysing intermediation activities implies studying empirical questions such as: how and why intermediary actants (individuals, organizations, and objects alike) mobilize, reframe, structure and condense expertise or policy imperatives? How do they foster and facilitate interactions between deliberative arenas in which sustainability issues are framed and addressed? How do become performative the discourses of intermediary actors, says produce effects in the 'real'? Those empirical questions have been at play to set up the empirical materials needed to establish narratives of the four case

studies to be presented hereafter. It is to be noticed that each case study had its own field research dynamic, i.e. based upon a specific set of shared research methodologies like participatory observations, interviews, interventions, but also some documentary analysis of reports, cover-up and documents that trace the socio-political dynamic at play.

Each case study has developed over a significant period of time (from three to ten years), allowing us to capture the dynamics of transformation. Thanks to this duration, each offers a relevant example of the interplay that takes place between intermediary actors and transformational change in collective settings. Three of them concern agricultural adaptation to environmental concerns: water pollution due to intensive use of inputs (nitrogen, pesticides) in an arable crop farming area; nature preservation and land use in the French Atlantic Coastal Wetlands; struggles against green algae proliferation in French Brittany. The last case encompasses many dimensions of sustainable agriculture through the study of standards development at transnational and local levels.

The methodological challenge was then to assemble basic empirical questions and materials, and finally to bring these research experiences together in order to compare and contrast them. For that purpose, we have first built a narrative of each case in order to put light on the process of transformational change and the way intermediation activities fostered it/them. Those narratives are built upon the knowledge and understanding we have of the situation and its transformation. They are built in order to identify “critical events”, e.g. “*events, incidents or factors that help promote or detract from the effective performance of some activity or the experience of a specific situation*” (Butterfield et al., 2005: 482). Critical events therefore are those which led to the reorientation of goals and means of collective action and might also reorient intermediation activities. The narratives also point out the ‘deliberative arenas’ in which political action occurs as a result of the confrontations and interactions of a potentially large number of actors between or inside different social worlds (Dodier, 2003). By tracing actions in deliberative arenas as part of specific situations, we can account for the framing of problem and the reorientation of goals and means of collective action. This is a process that involves not only exploring natural or technical phenomena, but also challenging the legitimacy, power relationships and identity of human communities, as many works of Actor-Network-Theory have pointed out (Latour, 1999; Callon et al., 2001).

In a second step, we have iterated between those narratives and the interpretive conceptual model several times in order to confront our model with a variety of cases in the tradition of grounded theory (Glaser & Straus, 1967; Olivier de Sardan, 2008; Detienne, 2009). The output of this iterative reflection was a common grid to be used to cut across our case studies. Following symbolic interactionism (Strauss, 1978), the study of those arenas

enables to understand how humans interact and how meaning is created and interpreted in and through interactions (Blumer, 1971). We then used our conceptual model to cut each narrative into phases by systematically identifying the critical events and illustrating how (i) the generic dimensions of the wicked problems (i.e. interdependencies, complexity, uncertainties and controversies) were redesigned and tackled; and how (ii) intermediation activities operate the interplay between objectification and inter-subjectification processes. Therefore each case can be described according to the grid proposed in Table I.

Table I: Intermediation activities *in situ*

Evolution of the perceived dimensions of the wicked problems

Critical event leading to reorient goals and means of action	Critical event 1	Critical event 2	Critical event 3
Interdependencies			
Complexity			
Uncertainties			
Controversy			

Situational articulation in process

Critical incidents	Critical event 1	Critical event 2	Critical event 3
Objectification			
Inter-subjectification			

Each case study has thereby been *mangled* (Pickering 1995) through this interpretative work. As a result, we issued a synthetic table like the one presented in Appendix I. Finally we have conducted a crosscutting analysis of the four cases in order to identify generic functions and properties of the intermediation work in processes of transformational change. The results of this analysis are given after the presentation of the case studies.

We are aware of the very interpretive nature of our work, which may be contested. Apart from the consistency of our conceptual model, a way to improve its relevance is to discuss our interpretative analysis and findings with intermediary actors involved in our cases. While this was partly done, not in all cases, it constitutes a logical development of this research and a relevant way to consolidate our interpretive framework.

INTERMEDIATION ACTIVITIES OBSERVED IN FOUR CASE STUDIES

Case study n°1: developing low-input cropping systems for arable farming in the Parisian Basin

Presentation

This case study accounts for a long-term dynamic that started during the 1990's in one arable cropping (wheat, rape seed and barley) area, the Parisian Basin, where the intensive use of inputs (nitrogen, pesticides) is still very common. Local public authorities pointed out the need to reduce nitrogen pollution of the aquifer by farming practices within the auspices of the new public management focus on meeting environmental objectives. At the time, a new national public instrument was institutionalized (PDD for “*Plan de Développement Durable*”), enabling contracts to be signed between the State and single farmers through which the latter expressed some means and goals to achieve sustainability at the level of the farm, in line with local objectives for environmental achievement. The farmers' board and the managers of the Chamber of Agriculture proposed to hire a new advisor (B.O) to provide advice to the farmers who were contracted to reduce the use of inputs; the intermediary in this case. This case study is based on a longitudinal approach of tracking advisors as practitioners of change (Maxime et al., 2002; Cerf et al, 2011) and explains the specific role of the B.O. in networking various activity systems at both local and national levels in order to support the search and development of on-farm pathways towards sustainability.

Intermediation as practice and process

After the PDD was launched, few farmers signed such contracts. Nevertheless, a group of farmers and advisors was formed constituting a socio-technical arena in which low-input practices were discussed. The B.O. bridged this local socio-technical arena to two others: an administrative and political one involved in the follow-up of the contracting process at the national level; and a techno-scientific arena called the “hardy wheat network” in which experiments were developed for arable crop areas, in order to assess integrated production methods. In these arenas, a systemic approach at the field level was promoted. The B.O. proposed that the group ground the design of low-input practices in such an approach and invited some of the people of these networks to feed the discussions among farmers. Managing the nitrogen pollution problem was in the background, but was not addressed as such by the group. The B.O. also encouraged it in order to keep an eye on the proposals of a national scientific committee delivering recommendations on how to reduce nitrogen pollution.

In 2001, the State stopped its support to the PDD, and at that time, the “hardy wheat network” also faced some legitimacy and financial problems as a techno-scientific arena supported by public authorities. At the local level,

farmers were nevertheless keen to continue exploring low-input cropping systems and asked the board of the Chamber of Agriculture to support the process by dedicating a part of the B.O.'s time to their experimental initiative. It was quite an issue as the practices explored were seen as more political than technical in a local context of intensive farming systems. One farmer of the group was part of the board of the Chamber, and acted as an intermediary and promoted the opening of the group to newcomers willing to develop environmental-friendly practices as well. Indeed the group expanded, and newcomers started to develop low-input practices. The B.O sought to create a renewed techno-scientific network in order to feed the group with a broader systemic approach, e.g. at the agricultural landscape level and with a longer time span (crop rotation). This was particularly helpful when, in 2005, the group identified that farmers were facing a problem of weed invasion, which resulted paradoxically to a rather high level of herbicide use. The B.O. suggested the group to start redesigning their cropping systems and he introduced a methodology, which he had just built within a new techno-scientific network which he had suggested to become involved. This network (called "RMT SdCi" for Mixed Technological Network towards Innovative Cropping System) was mainly composed of agronomists belonging to various organizations of the French agricultural knowledge and innovation system. It was meant to develop innovative and sustainable cropping systems and, primarily, methods to design and assess them. The B.O. adapted these methods and the group started a process of co-designing and co-assessing new cropping systems for each farmer within the group. More time was allocated by the collective to support each farmer in his pathway towards his targeted cropping system, e.g. in identifying weak and strong features of each cropping system, in designing monitoring indicators, and in suggesting alternative solutions whenever failures were pointed out. This deliberative arena was viewed by the B.O. and the group as a "safe" space in which debates about the professional norms of farmers could take place. Additionally, farmers started to discuss initiatives taken by some of them individually. For example, one farmer was involved in a network seeking recognition of the role of pesticides in the development of professional diseases and another began exploring agroforestry solutions. Therefore, discussions about their shared values took place as the practices developed by the farmers became more and more controversial among the local farmers and were met with suspicion by farmers on the board of the Chamber.

In fact the group had to face the controversial debates which were amplified when the *Grenelle de l'Environnement*, (a national political process in 2007 to frame sustainability objectives across many sectors), created a new political agenda under which the intensive use of pesticides was addressed, if not discarded. This resulted in tensions among different professional norms and values within the agricultural world both at the national and local levels. But the main tensions were found along the pathways of sustainable

development in terms of pace and depth. In the follow-up to this *Grenelle*, but mainly as a consequence of the Pesticide European Directive, a national action plan (named *Ecophyto 2018*) was designed by the Ministry of Agriculture. The goal is to reduce pesticide use by 50% between 2008 and 2018. The *Ecophyto Plan* was composed of 115 actions to support a transition to reach this 50% reduction goal. One action, labelled *FERMECOPHYTO*, was setup to create a large network of farmers' groups (a total amount of 2 000 farmers) in which farmers would experiment with pathways of pesticide-use reduction with the part-time support of an advisor paid for. In the first stage, the design of this network was supported by the knowledge produced within the national techno-scientific arena in which the B.O. was involved (the "RMT SdCi"). But the national organizations of the French agricultural knowledge and innovation system contested the target and the chosen frame for *FERMECOPHYTO* network. As one of those actors involved in the first stage, the B.O. had to deal with this controversy. Nonetheless, his position was clearly reinforced in the subsequent stages, thanks to the work he undertook in between 2008 and 2011. During this period, he took part in various R&D projects through which arenas were built to invite advisors to discuss and reflect upon their advisory practices in facilitating change of agricultural practices. He played the role of facilitator in these arenas and developed his ability to support advisors to reflect upon their own practice. Right from the beginning, he was hired to join the national facility point, which was designed to support the *FERMECOPHYTO* network and kept this role even after the controversy took place. His legitimacy was two sided: first the group of farmers was involved in the national *FERMECOPHYTO* network, and their practices were involved and discussed as credible solutions for reaching the goal; second, he was seen as a person who had the ability to support the work of the other advisors who were supporting the farmers' groups within the network. This new position and the dynamic of his group resulted in a greater emphasis on supporting farmers to cope with uncertainties. These were: i) those that take place in monitoring change at a systems level (cropping and farming system); ii) those that appear while assessing the impacts of the change on the environment; and iii) those that remain around the target and professional identity the farmers wish to assume. This case highlights how local and national intermediation appears more and more intertwined over time.

Case study n°2: implementing Natura 2000 Directive in the Rochefort Marshland

Presentation

This case study deals with the Territorial Collective Action Device implemented under the *Natura 2000* policy framework (Steyaert, 2006). Its

aim was to build an action plan for preserving wildlife biodiversity in the marshland area of Rochefort (13.500 ha), in the West of France. It brought together a set of various institutional stakeholders and land users deliberating in formal and informal arenas in order to identify goals and means of action. Two people have coordinated the design of this action plan: one was a member of an environmental protection association, the other one was appointed by the Chamber of Agriculture. In this paper, we analyse their joint activity as an intermediation activity, which has played a significant role in the deliberative process that successfully issued the local *Natura 2000* action plan. Both were mandated by the regional public services for environmental protection of the Poitou-Charentes region. The design process assigned and involved a set of deliberative arenas with the following objectives: to inform and enrol citizens into the working process through public meetings (arena 1); to design practical proposals in thematic working groups (arena 2) in order to elaborate the items of the action plan; to follow the process and validate its outcomes within the steering committee (arena 3).

Intermediation as practice and process

During the first information meetings and the first steering committee meeting, crop farmers and land owners contested the *Natura 2000* policy framework by addressing the problem of area delimitation. With the help of a national Deputy who became their spokesperson, they created a landowners association to block the whole process through legal means. They mainly contested the inclusion of cropping land in the protected area because these parts of land could not correspond to the nature conservation specifications that environmentalists used for area delimitation (i.e. CORINE biotopes classification). This first stage of the process led to concerns about the legitimacy of one of the intermediary actors. Although the one appointed by the Chamber of Agriculture had been designated to play a main role in coordinating the process, the extensive use he made of biological knowledge to convince people of the relevance of the *Natura 2000* policy reinforced claims and contestation. In this way, by coining the problem as it is defined within the policy (to preserve natural habitats and their biological richness) the coordinator turned himself into a spokesperson for nature. His local legitimacy decreased in favour of the other coordinator, the member of the Chamber of Agriculture, who took the main responsibilities and initiatives in what will be described hereafter.

To reduce contestations, the coordinators decided to adapt the deliberative process. While the work in thematic groups started, they implemented so-called “cartographic” and “open marshland” meetings. Organized at the municipality level and involving all land owners and farmers holding a plot in the area, the goal of the first meetings was to integrate into the map’s legend some agricultural categories like permanent and natural

grasslands, cultivated grasslands and fallow land. In doing so, they corrected some errors in land classification, but more importantly they created the pedagogical conditions that opened up the whole process to deliberative practices. They reduced fears, provided more precise and adapted information to all, and individually invited everyone to take part in working groups. Afterwards, many of the people they met decided to be involved, which led to a change in the social configuration of those arenas by increasing the number of land users compared to institutional stakeholders. The second series of meetings were organised to challenge the problem that most of the marshlands users did not know what ecologists were speaking about when they were speaking about nature. These meetings consisted of visiting some interesting parts of the marshland to encourage an ecological point of view. Land users asked ecologists to explain what a habitat is, why they believe that some species are important to preserve, how to recognize biological richness, what a biological inventory is, and so on. This led to a sharing of the scientific knowledge held by ecologists with other people: what was considered initially as “bizarre” or unimportant became mundane and was recognized. This has clearly helped to build a common understanding of the ecological dimension of wetlands.

Being reinforced in their facilitators’ position and having gained confidence from all parties, the coordinators were mainly involved in facilitating the deliberative processes during those meetings. Rather than focusing exclusively on nature protection goals, they opened space and time to take account of the diversity of social preoccupations that were linked to the development of human activities and water management. In some way, they left out the policy framework of Natura 2000, so to be better involved in the stakeholding processes (Steyaert & Jiggins, 2007). Each of the stakes was discussed and gave rise to action proposals and rules, which progressively constituted the content of the action plan. When heavy controversies arise, like for example concerning allowance and management of hunting areas, they helped people to explore those controversies rather than closing them down. When knowledge was made available, about the spatial distribution of hunting ponds, their owners and users, and hunting pressure, for instance, they created the conditions to make this knowledge public and shared. Finally, they built a progressive support of the diversity of actors involved in the working process.

All this was possible because of the social structure of the deliberative arenas, which were made up of institutional stakeholders mixed with diverse and heterogeneous land users. However, despite the progress made in establishing an action plan, contestation around the area delimitation was still alive during the steering committee meetings where power relations were perennial and fierce. To overcome this impasse, the coordinators made use of a scientific concept classifying wetlands according to their functional ecological potential (Steyaert, 2008). That led to a qualification of the area in a way that

is different from how administrative services were used to do it up to that point in time. The use of this concept in several arenas, especially in the land owners association, and its blending with local knowledge, led to the total dissolution of social contestation into deliberations oriented toward the construction and appropriation of the action plan. As a result of the work completed and the trust of all participants in its outcomes, the national Deputy became the spokesperson for the process, playing an intermediary role between collective action and administrative services. While administrators insisted on a strong conformity of action rules with the policy, he asked for an integral validation of the action plan while accepting modifications only if they would have been discussed and negotiated earlier with the people involved.

Case study n°3: Preventing green tides in Brittany

Presentation

Based upon a three-year long ethnography in Brittany (Western France), this case study focuses on the local co-construction of action plans to reduce nutrient flows released by farming activities in a rural watershed severely affected by coastal eutrophication phenomena. In Lannion Bay, massive algal blooms appeared in the 1970s' simultaneously with the rise of intensive livestock farming and major disruptions within the social organization of rural communities (Canevet, 1992). "Green tides" have hence been part of local life in some bays for two generations. The amplification of public policies dedicated to the reduction of blooms and agricultural nutrient leaks challenges the effects of agricultural modernization on public goods like water resources. In the early 90s', local representatives and local leaders of the main farmer union engaged in a dialogue with local authorities, which aim was to avoid both resignation and rising conflicts and criticism towards the environmental impacts of farming: they could neither give up the idea of agriculture contributing to the common good, nor ignore the coastline affected by what was largely perceived as an environmental disaster, compromising tourism and local development. This commitment gave birth to successive action programs, aiming mostly at adjusting fertilization practices, managing structural evolutions of the landscape and reducing the dependency of dairy farmers to external inputs.

As green tides affected other bays in the region, local means for action were limited and European policies on water quality were implemented, specific programs progressively emerged at the regional and national levels, which became more and more stringent in the 90s' and 2000s'. Local intermediaries including farmers, elected representatives, multiple advisors as well as researchers faced successive changes that transformed their role, the

nature of the interactions between stakeholders and the meaning they gave to the dialogue they all tried to maintain under increasing external pressure.

The empirical work has specifically shed light on the reduction of dissonance in situations of change during sustainability transitions (Levain, 2014), and therefore has particularly paid attention to public management settings and collective action at the level of watersheds. Within the scope of this paper a focus is put on the functions of intermediary actors in settings that were dedicated to reducing dissonance between agricultural modernization on the one hand and sustainability goals in policy-making processes on the other hand.

Intermediation as practice and process

Lannion Bay is known for its high sensitivity to algal blooms, which generated great concern of local representatives and the population in general since the 70s'. In the 80s', the bay received much attention of scientists and experts, who first hesitated in their analysis of the causes of the phenomenon (What was the limiting factor, nitrogen or phosphorus? Why there, whilst local farming practices were less intensive than in neighbouring areas? Was the responsibility to allocate to domestic wastewaters or to farms? Etc.). Green tides proved to be highly dependent on nitrogen availability in water, mainly emanating from fertilization. Thus, in 1995, the local representative of the main Farmers Trade-Union (FDSEA) and one elected politician representing the municipalities of the watershed initiated and institutionalised an Agricultural Professional Committee (Comité Professionnel Agricole, CPA). This committee had been intentionally shaped as a arena for incumbent professionals, with the purpose of organizing and concretizing the contribution of farmers to the "fight" against green tides. Institutionalization of such a cooperation system required accepting the idea of sharing, beyond the main "union family", the concerns that environmental issues posed for Breton agriculture. This sharing concerned two fronts: on the one hand, the CPA brought together farmers who belonged to different professional unions, with different political leanings and agricultural practices; on the other hand, a sound partnership between professional and political representatives was established. For the local stakeholders – elected representatives and, even more, environmental activists and tourism operators - who were largely excluded from agricultural politics and had very few levers to change agriculture, the CPA was a gamble that opened an unprecedented field of possibilities, since the organization guaranteed them stable spokespersons representing the diversity of the farmers. The establishment of this committee was a clear signal that any improvement would come from farmers themselves and that something was lacking in the incumbent farmers' contributions to coastal management. It also paradoxically meant that conventional farming

organisations could not be directly involved, as new local structuration had to be performed.

The setting up of this committee opened two controversial “fronts”: one among the farmers (the advocates and antagonists of “green agriculture”), and the other between environmental stakeholders and the committee itself considered by some of the former as “too agricultural”, which meant they feared that the protection of mainstream intensive agriculture would prevail in the end, whereas the situation required radical change in farming systems.

At the end of the 90s', the committee initiated a “Watershed Programme” based on voluntary commitment of farmers and the organization of collective actions (pasture management, peer-to-peer training etc.). It aimed at articulating public action, environmental mobilization and farmers' efforts with the intent of negotiating change and enhancing collective action. A situated “exploration regime” of coordinated actions through deliberations was established between various intermediaries acting at the level of Lannion Bay, that consisted of the local representative of the Farmers Trade-Union (FDSEA), one elected politician representing the municipalities, farmers' advisors, watershed management facilitators, and representatives of the water resource agency. The local stakeholders initiated the participation of researchers at an early stage by involving them in the reflection and diagnosis that was part of the first so-called “preventive” control programs in the late 1990s. This partnership provided support for new developments in agricultural practices – optimization of fertilization, for example – and access to new knowledge (Levain et al., 2014, 2015).

After 10 years of this “exploration regime”, it was noticed that, if they produced significant results on nutrient leaks and on local dialogue, all the actions undertaken were ineffective as regards to their final target, since algal blooms remained massive. This led in 2007 the local authorities in charge of water quality and the CPA to look for more science-based action programs, more systematic action and to consider radical changes in farming systems. To do so, they asked for the support of research scientists from the National Institute for Agricultural Research (INRA) for a structured action-research program. Considering the characteristics of the watershed, mechanisms for action compatible with the technical, economic and environmental sustainability of farming were sought and proposed. The defined agronomic framework leaving farmers with a space for personal reflection and choice was innovative and facilitated the design and implementation of various measures, leading to several types of systems, which in turn could inspire other livestock farmers. A group of ‘pilot farms’ was settled, as well as a collective objective of reducing nutrient leaks. Two main mechanisms were selected: i) reducing nitrogen inputs and ii) promoting its recycling in the system, to increase nitrogen use efficiency. The reflection led to proposing the development of permanent crops (without bare soils) suitable for feeding ruminants, for example developing grass-based production systems in cattle farms. Both the

characteristics of farming systems and the experiences of the stakeholders were quite specific for the watershed: many farmers already complied with technical specifications that allowed them to qualify for agri-environmental support, thus subscribing to voluntary EU agri-environmental plans. Their attachment to a “bottom up” approach and their wish to avoid further undifferentiated regulations also kept them in these plans. But the aim to contribute to a major reduction in nitrogen flows and, ultimately, in green tides, also placed them on the edge of result-oriented plans. Since farm capital was usually quite low in the area, the project was part of a collective attempt to reduce cognitive uncertainties and risks associated with technical and economic transition, and to help farmers find their own way between these two approaches (Levain et al., 2015).

Though this technological solution and transition pathway promoted by the CPA was at the beginning consensual, it triggered many professional debates within the farmers’ community. The issue raised by farmers was more about the techno-economical risks of shifting from maize to grass than on the acceptance of changes due to environmental pressure. The raising of this issue showed the significant uncertainty about the effects of such a transition for farmers and the effectiveness of grazing systems in the reduction of algal blooms was once again questioned. The farmers challenged the legitimacy of the CPA and the activities of intermediaries had to shift from a regime of exploration and negotiation based on “soft schemes” to a regime of conviction and change, because a collective transformation had to be managed. Intermediaries were involved in its promotion. The introduction of this regime opened channels for stronger contributions of researchers that were convened by the CPA to “measure” risk and uncertainty, at the level of farms. Therefore, researchers joined the setting as knowledge brokers, through expert meetings or dedicated action-research projects with the network of pilot farms accompanied and monitored by agricultural advisors.

Suddenly a disruptive event challenged the process of objectifying the pathways for a sustainability transition in July 2009. On the beach, the leakages of sulphuric gas produced by beached algae killed a horse and injured its horseman. This event was covered by local and national media, and became proof that algal blooms could be extremely dangerous. Green tides suddenly became a matter of national health security and the Prime Minister ordered a Governmental Action Plan to fight against “green algae”. This event directly questioned the local consensus established by the CPA and challenged the goals of the transformative setting. The Lannion bay became a “template”, which concretely implied that, as much had already been done there, it had to rapidly comply to the new framework and to serve as an example for other bays, and the regime of conviction was turned into a regime of public evidence making with objectives and subsidies established by this new “Green Algae Plan”. The process of voluntary engagement by farmers shifted to a forced process of participation in change, before regulatory measures were taken by

public authorities. Under this pressure, farmers felt stigmatized (“we did not sign up for that at the beginning”, they claimed). Intermediary actors were bounded to a different type of rationalized action, reinforcing evidence-based public action: they had to quantify the expected effect of each measure they proposed to governmental authorities, to prioritize them, and to engage in an obligation of results within five years. Actors involved found themselves caught in an operational plan, with external assessment. The network of pilot farms was de-legitimated in its role of actionable knowledge production. The CPA was also affected and its President himself considered that the reorientation of the setting towards a new external objective was a fundamental change, since the participants were obliged to drive their collective action differently. Intermediary actors thus were trapped in a very different situation of boundary-work, since their function henceforth became to interact between two organisational and political levels, the Lannion pilot-bay and the regional stakeholders of the “Green Algae Plan”, while preserving the local partnership which was the result of 10 years of negotiations. Their aims and functions turned to sustaining their initial programme, and to keep farmers in. Thanks to the very meticulous intermediary work of advisors that bridged the maintenance of local commitment and the technical support to pilot farms, the local programme was signed as a “Territorial project” that responded to the public authorities’ objectives. But after a difficult discussion, the CPA also decided to stop its collaboration with researchers, as a meaningful way to clearly put “public knowledge” at a distance: the feeling prevailed that to preserve local dialogue and to keep farmers involved, a limit to external assessment and to prescriptive and judgemental interventions had to be reaffirmed.

Case study n°4: “Intermediating the good certifier for sustainable standards supported by ISEAL”

Presentation

The context of the problem of defining the ‘good certifier’ is situated within debates that occurred in the ‘sustainability field’ (Dingwerth and Pattberg 2009; Loconto and Fouilleux 2014) over the legitimacy of private instruments of governance - sustainability standards. Specifically, there are debates over the legitimacy of different models of certification as a means to both create trust in private standards systems and to enforce the compliance of producers (mostly agricultural) with the values and practices encoded in the standards (McDermott 2012; Hatanaka 2010). These debates began in the 1990s when a number of social and environmental standards became formalized through the creation of certification schemes (e.g., Fairtrade International, Marine Stewardship Council, Forest Stewardship Council,

Rainforest Alliance and national Organic regulations). During this period, each scheme developed its own standards, its own verification system and trained its own auditors. This first period was then marked by severe competition between schemes and accusations of 'greenwashing' based on the methods that some standards development organizations (SDOs) used to verify compliance with their standards.

Beginning in 2000, with the creation of the International Social and Environmental Accreditation and Labelling Alliance (ISEAL), the five largest SDOs began to work together to reduce this competition. Since 2005, ISEAL has focused a portion of its work on encouraging its SDO members to work together to find solutions to common problems such as certification. This was possible because at the time most of the SDOs were relying upon the same certification bodies to carry out audits for each individual standard. It was during this period that the collaboration and collective action began to take place within the sustainability field and it is where we find the intermediation activity of certifiers exemplified in this case.

Intermediation as practice and process

Within this context, the deliberative arena consisted of the technical and steering committees setting standards between 2010 and 2012. The author conducted participant observation by sitting on the technical and steering committees for the entire standard-setting process. These two committees met as one group for the majority of the meetings. In this arena, multiple stakeholders (SDOs, certifiers, accreditation bodies, consultants, researchers, retailers and NGOs) came together to create a standard for conformity assessment systems (i.e., systems of certification and oversight). This means that the actors in this situation were discussing technical requirements for how to set up verification, audits and oversight for enforcing standards. This specific context is important to the intermediation process for two core reasons. First, the actors are mission-driven. This means that how they frame their problems is within the context of trying to influence change towards a more sustainable society. Second, they assume that there is something unique about their work that separates them from mainstream practices. Therefore, they are seeking to make their systems of control different from the dominant paradigm that relies upon multiple and not connected levels of third-party certification and accreditation (Loconto and Busch 2010).

The SDOs in the group were dissatisfied with some of the results of third-party certification, meaning that they had to rely on an externally appointed certifier. They complained about conflicts of interest between certifiers and farmers that influence the certification decisions taken by the SDOs. The SDOs also accused some certifiers of outright fraud and others of incompetence. All participants, including the certifiers, were quick to insist on oversight (including accreditation and market surveillance of labelled products)

to combat fraud. They developed a nuanced understanding of conflicts of interest recognizing that such conflicts were a risk that could hardly be avoided in all cases.

Therefore, the core problem that the actors needed to solve was that of the auditor competency. The results of initial scoping showed that: “auditor competence has been the top challenge” (authors’ notes). Therefore, the challenge posed to the group was to create criteria within the broader standard for conformity assessment systems for the ‘good certifier’ who would be able to competently and efficiently deliver credible audit results and thereby testify to the credibility of farmers. The starting point for intermediation were the current practices of certification bodies and the existing International Organization for Standardization (ISO) standards for conformity assessment systems and auditor competence (17065 and 19021 respectively). The key question was: who should take responsibility for ensuring that auditors are capable of conducting credible audits: the SDO who hires the certification body, the certification body who hires its audit staff or the auditors themselves? Answering this question entailed debates around the knowledge that different actors had. For example, how can one judge whether an auditor will be competent and how can you measure if the auditor has been competent? These questions are directed at individual skills and knowledge of auditors.

The SDOs in the arena argued that they maintain a systems’ focus (meaning that they are looking at how audits fit into a whole system of standards, conformity assessment, technical assistance, etc.). Therefore, they argued that ISEAL advice should be to focus SDO attention away from generic competencies of certification bodies and their personnel, and instead towards other types of knowledge and skills. The reason given was that the ISO 17065 and 19021 standards require a ‘competencies approach’ that is based on a prescriptive set of personality traits that can be identified through a human resources evaluation. In contrast, the SDOs took a qualifications approach based on the experience and education of the auditor rather than on their actual performance. An accreditor argued that: *“ISO did not give us enough guidance, so we became more prescriptive. The new standard (17065) is better in auditor competency. But we trained auditors when we started our system because no one else was doing it!”*

The intermediation by ISEAL and certifiers brought the debate back towards performance, but of a different kind. They achieved agreement that auditors must be able to ‘audit to the intent’ of the standard (subject matter content) and not just to the criteria on audit checklists (generic audit competency). The result of this intervention is that all stakeholders came to recognize that auditors must truly know the content and the intent of the standard, which links the problem of auditor competency to the SDOs’ missions of influencing societal change towards a sustainable future. The idea is

that even the auditors who are not part of these standards systems must share the mission of the SDOs. This poses a problem to the practice of auditing, as many of the auditors are hired on an *ad hoc* basis and therefore conduct audits for numerous standards systems, not just one standard. Traditionally, the SDOs have dealt with this, as the above quote notes, through auditor training. Indeed, the main criterion for training for each standard was undisputed and was reinforced through the recommendation by the accreditors and certifiers that SDOs should put a system of 'auditor calibration' into place. In other words, like machines, auditors' knowledge and competence should be tinkered with until they are calibrated to produce consistent results over time (Loconto and Barbier, 2014).

The intermediary actor in this debate was actually not the designated facilitator for the code development. Rather, after about a year's debate over what to do with the generic requirements proposed by the ISO regime, a certifier stepped up to influence the direction of the debate. He was a director of a mission-driven certification company. This "capture" was possible because the nature of the arena was promoting reflexive rather than defensive discussions. The other actors in the room argued their positions in a very passive manner, such as "*well we do this and we want this...*". Therefore, when the certifier voiced his dissenting view on auditor competence, he was able to push everyone in the desired direction as an intermediary. This occurred particularly on the issue of defining a 'good certifier'. The 'good certifier', according to this intermediary actor, is a person who has first-hand experience in the region; one who can speak the local language. "*A young person, it does not matter what education or qualification, but one who is a critical thinker*" (author's notes). The important competencies of the 'good certifier' are thus based on an inquisitive personality and a desire to 'learn-by-doing'. The certifier argued that ensuring this type of a 'good certifier' also means focusing on the moral fibre and personality of the auditor him/herself that can be cultivated through a mentor-mentee relationship within the certification body.

By advocating this approach, the intermediary actor argued that the responsibility sits with an organized certification body, which could properly train an auditor in both the intent of the standard and the practicalities of audits. This resulted in an annex to the standard that explains in detail the types of personality traits and qualitative competencies (such as interviewing and report writing) that auditors should have and is based on the justifications provided by the intermediary. The required criteria switched the responsibility from being solely held by SDOs to a division of responsibilities for different aspects of the certification process between SDOs and certifiers.

In this case, the intermediation process took place between the standard for conformity assessment that was being developed by ISEAL and its members, and the localized practices of conducting certification audits. Here

certifiers were seen as taking on the role of interpreting/translating the standard in the face of real agricultural and agro-forestry practices. Their contributions modified the requirements for how auditors will be judged as competent and who must take the responsibility for this. It represents a major change in these systems as the increased accountability of more actors in the network, beyond just the SDO, distributes the responsibilities for sustainable agriculture more broadly and ties certification bodies more closely to SDOs than was previously the case.

CROSSCUTTING COMPARISONS

A heterogeneous set of case studies

Our set of case studies offers a variety of situations of transformational change meant to address sustainability issues in agriculture. All have involved intermediation activities. In Table 2, we summarize the main characteristics of these situations and we roughly outline the intermediation activities, which took place in the process of transformational change.

Table 2: A synthetic account of situations and intermediation activities in each case study (CS)

	Forms of sustainability transition situations	Characteristics of intermediation activities
CS 1	A goal oriented action (reduce the use of chemical agricultural inputs), framed by successive public policies, involves an increasing number of crop farmers into transformational change processes	An advisor taking stock of his working experience starts to play an intermediary role among a set of heterogeneous social arenas and is involved in 'outscaling' and 'upscaling' processes
CS 2	A sectorial public action framework (N2000) is transformed, through its implementation, in a territorial development plan of a marshland	Named and mandated coordinators by public authorities build their own legitimacy through a set of initiatives in order to produce a management plan for the area
CS 3	An ecological disaster (algal bloom) leads to a local public action implementation covering various, successive, collective action regimes due to ineffectiveness, uncertainty and regulatory frames	A heterogeneous group of local stakeholders plays an active role in enrolling local farmers to adapt their farming activities and practices
CS 4	A search for greater legitimacy of private sustainability standards brings a set of stakeholders to redesign the definition of a 'good certifier', which leads to educational and organizational changes	A certifier shifts the debates from impersonal to personal traits that enable the standard-setters to reframe certification activities in line with their missions

Despite the variety of goals and social configurations, our cases show that sustainability transitions always involve some public or collective action, defined as “*a set of relations, practices and representations which contribute to the production of politically legitimated regulatory patterns of social relationships*” (Dubois, 2009). Initiated under community based or local policy but also under private initiatives, these situations are dynamic and evolve over time under internal and external conditions. They are made of relations between the natural, the technical and the social, and are goal-oriented and purposive in the sense that social expectations are very high and intense with regards to what has to be reached (fighting against biodiversity erosion or algal bloom, reducing water pollution, implementing sustainable agricultural production through standards).

In all cases, we observed practices dedicated to intermediation. Some intermediary actors were designated and had to gain legitimacy through their actions; others decided to play such a role based on what is needed in the given situation and founded in their own professional experience; still one other emerged as being the most suitable person in the context of how the situation was evolving. So, intermediation may be carried out by a specific intermediary actor (CS 1 and 2) or by a group of people building alliances and sharing a common perspective about how change can be facilitated (CS 3), or even by the agency of human and non-human agents (a certifier and a code of conduct, CS 4).

How can we better understand intermediation activities as a practice and as a process that support efficient collective action in situations of transformational change? We will first discuss some characteristics of intermediation situations before developing function and proprieties of intermediation activities.

A common trait of situations of intermediation: dealing with ‘wicked problems’ in the flow of action.

In all our cases, an ‘environmental paradox’ is clearly at stake for intermediary actors that have to face the concomitance of high expectations in discourses and institutional arrangements and of low effectiveness in the concretization of sustainability in practice. The ineffectiveness of action against algal bloom, non-measurable effects of changes in practices on water quality, a disputed role of certification in fostering sustainable agricultural production and an unknown role of human activities in increasing the quality of wildlife habitats provide some evidence that these goals remain more or less immediately ‘unreachable’. Intermediary actors, who have to address a given environmental issue, are reflexively conscious that it cannot be pre-set by some external authority, even if environmental regulations might provide a direction and frame for how to reach it. Unreachable goals are constitutive of intermediation work in our situations of transformational change. In many

cases, these unreachable goals relate to the four features of wicked problems that we have identified: they are complex management problems where cause-effect relations cannot be pinned down. In that sense, when sustainability transitions are not depicted as a simple technological innovation to be adopted, promoted and implemented, actors find themselves in messy situations where uncertainty prevails.

This invites us to pay attention to the way intermediation activities take on board the key features of wicked problems and to the way these dimensions evolve over time. All our case studies demonstrate that these key features cannot be separated from the flow of actions: interdependencies and complexity are sometimes reduced; sometimes they increase and change in nature.

For example, the main focus on a descriptive appraisal of nature in CS 2 led to a reinforcement of blocking strategies. In that case, opening the black box of how human activities influence ecological functioning was needed to allow for the exploration of the controversy and to build management agreements, even if that kind of relationship remained mostly unknown and if the aim of collective action was displaced from nature preservation to territorial development. In CS 1, an exploration of how agricultural practices could be redesigned to reduce chemical pollution of water led to a more systemic appraisal of farming activities and finally questioned the way farmers could be involved in transition pathways towards sustainability and cultural changes. In CS 3, it appeared that ineffectiveness of action related to the complexity of the problem and the techno-scientific uncertainty has framed the successive involvements (or resistances) of all actors in public action regimes: search, conviction and change, and finally evidence-based regimes. Yet, no one knows how that public action will evolve in the future, with what outcomes. In CS 4, it seems that prescriptive conceptions of auditors' competency struggled with more comprehensive appraisals based on a wider recognition of knowledge and skills. The challenge was to accept auditor's field-based knowledge as proof of competency and to allocate responsibility away from SDOs and towards certification body management. In other words, to take on board the complexity within which auditors are practicing their activity and the ways certifiers must act to inter-relate standards and existing practical realities of standards in the making.

Key functions of intermediation activities

Does intermediation activities mainly consist of 'working and re-working the stock of knowledge' (Barnett, 2004, Hall et al., 2003) and in networking the places where it is produced with those where it is used? While this is clearly a part of intermediary actors' practices, in the case of sustainability transitions, our case studies illustrate that intermediation activities fosters

interactive processes in which goals and means definition are at the core of public or collective action and in which transformational changes might take place. In order to go beyond a restrictive cognitive interpretation of these practices, we propose some generic functions fulfilled by intermediation activities, which we abstracted from our case studies. : (I) building an efficient collective action on one side, (II) maintaining the dialogue and social interactions among participants who do not necessarily value the same politic of knowledge on the other one. This interpretation put forward the dialectic nature of intermediation activities while performing it over time to overcome the 'environmental paradox' in situations of transformational change.

(1) Building an efficient collective action relates to the objectification process and the problem that must be managed. In this context, certified knowledge mobilization and evidence-based decisions are meant to objectify the problem at hand and identify how changes in human practices and activities will influence the interdependencies that the problem reveals. As such, this type of knowledge is often missing, is incomplete or very partial for implementing it in a singular situation. Those involved have to explore the surface of the problem, which is never totally stabilized: what questions does the problem of nature preservation recover and how does that problem meet other social preoccupations of people at territorial level (CS 2)? What are the consequences, constraints and opportunities of changes in farming practices to reduce chemical pollution and how could this be thought of and practiced at a more systemic level (CS 1) or at the territorial level of a watershed (CS 3)?

Without pretending here to be exhaustive, our case studies enable us to identify and propose a set of functions (table 3a) that intermediation can fulfill to foster efficient collective action.

Table 3a: Functions of intermediation to build an efficient collective action

Functions	Outputs
Boundary work around problem definition	Stabilized agreements
Problem finding and problem solving	Permanent iteration between goals and means of action
Co-generation of knowledge	Reduced uncertainties and explored controversies
Networking of human and cognitive resources	Enhancement of collective action capabilities
Problematizing the existence of adequate deliberative arenas	Out-scaled and up-scaled outcomes of action

(2) Maintaining the dialogue relates to the inter-subjectification processes and the functions to fulfil in order to support social interactions over time in

situations of transformational change. Indeed, processes of problem finding and solving not only rely on available knowledge but more importantly on the knowledge incumbent or new actors construct in action, individually and through processes of social interaction. While generic knowledge may be used in such deliberative processes, it is always adapted, reframed and redesigned to align with the natural, technical and social specificities of the local. The three regimes of action that were identified in CS-3 provide a particular appropriate illustration of how knowledge is used and the consequences of its mobilization for collective action. In the search regime, a collective dynamic was organized around identifying cause- effect relationships of algal bloom over a long period of time. But the ineffectiveness of undertaken actions led to the promotion of an exclusive livestock farming model based on grazing through a conviction regime, with unknown consequences on farm income and even more, on algal blooms. Finally, the contingent incident of sulfuric gas leakage led public authorities to implement an evidence-based action regime whereby knowledge was used to provide proof of environmental damage and force farmers to change. Nobody could really know beforehand which regime would be more effective. But according to each regime, the way people interact can change. In this case, it moved from cooperation to conflicts and contestations, requiring different abilities to maintain the dialogue over time. Table 3b proposes a set of functions that intermediation can fulfill to support it.

Table 3b: Functions of intermediation to support dialogue and social interactions in collective action

<i>Functions</i>	<i>Outputs</i>
Convince people through pedagogy	Enrollment of stakeholders and ownership of action
Reduce fears, resistances and contestations and contain overwhelming processes	Space and time for deliberation
Build new interpretative frames	Transformation of identities, legitimacies and social asymmetries Changes in values and systems of interest
Stimulate individual and collective reflexive consciousness	Build a shared understanding of the situation

In all our cases, intermediation activities support the enrollment of stakeholders into collective action according to this dialectic of goals (between I and II). To create space and time for new meanings to emerge (Snowden, 2002), intermediation activities take place to convince, reduce social fears and contestations, gain adhesion by its contribution to the framing of the deliberative process containing overflowing processes. In some way being aware of the complexity of the context within which collective action takes

place, intermediary actors develop the capabilities to ‘hold together’ the various and numerous components involved in collective action. In CSI for example, despite changes in public policy frameworks leading to more coercive ways of action, intermediation is at the core of actors’ willingness to follow-up and deepen the work undertaken in the past and to expand their ideas, findings and change proposals beyond the group. Thus by taking care of the social process and by stimulating individual and collective reflexive consciousness, intermediary actors help transform social identities and legitimacies of collectives.

DISCUSSION

Intermediation work to foster transformational change: articulating objectification and inter-subjectification processes

Often, knowledge is considered as a thing within what Cook & Brown, (1999) called an epistemology of possession. It is viewed as something that can be appropriated, owned, stocked and circulated, in order to be used for innovation. This kind of conception dominates in techno-centric or eco-centric approaches of action (Bawden, 2003), in which already available and science-based knowledge is considered to be sufficient for defining reachable goals, the way to assess the undertaken action as well as the means to be implemented. As shown in our case studies, knowledge can also be seen as a “flow”, a process that emerges in action, encompassing both objective and subjective representations (Whitehead, 1929). Intermediation activities are then more about helping people to transform their own interpretative frameworks of the reality (Muller, 2010), that is their understandings, worldviews, opinions, conceptions of action and values. This is where learning takes place.

Therefore, we suggest that intermediary work can be seen and understood as an activity that articulates processes of objectification with processes of inter-subjectification. The latter term does not mean a radical relativistic approach of reality. On the contrary, it insists on the confrontation of interpretative perceptions people construct on a same reality. As political narratives can inform “*about how people make sense of their lives, about how they construct disparate facts and weave them together cognitively to make sense of reality*” (Patterson and Monroe, 1998), inter-subjectification is key in fostering heterogeneous people to make sense of a shared reality. The key functions that we identified in our case studies are those that contribute to achieving this articulation between objectification and inter-subjectification processes.

Some intermediary actors are designated as such by their profession (like advisors), but it does not mean that this professionalization systematically enables such actors to achieve a functional performance of objectification and

inter-subjectification. To reach this position they have to gain legitimacy in the course of action and to signify, by their commitment, their attachment to a certain community of practice in inter-organizational settings. Others do not have a professional commitment to be intermediary actors, such as scientists or consultants. Their practices of intermediation often emerge through the momentum in a process of transformational change. Their background plays a role in the way legitimacy is gained as they develop their transformative stances. Such legitimacy relies also on their capabilities to develop a new regime of action where existing goals and means are questioned in order to reassemble differently existing heterogeneous practices. Our case studies have illustrated how such capabilities are built by intermediary actors. In our view, these findings can be understood as contributing to a theory of intermediation, which encompasses the diversity of intermediary activities in sustainability transitions.

Intermediation activities: the properties at play to foster transformational change

Our interpretative perspective put emphasis on intermediation activities meant to support transformational change and to tackle sustainability issues that are defined as wicked problems. We suggest here that the efficiency of intermediation activities relies on three interlinked constitutive properties which will need further investigation in a strong research program on intermediation: performativity, contextualization, and reflexivity.

The concept of performativity has been developed earlier by Austin (1962) in the field of philosophy reflecting on the meaning and consequences of speech acts. According to this approach, the performativity of speech acts indicates that the enunciation of utterances is already the realization of an action, the effects of which are to linger in the future. The effectiveness of discourses and performativity analysis have become a common practice in many fields like economic sociology, critical management studies, science and technology studies, and rural sociology (Michael, 2000; Mol 2002; MacKenzie et al. 2007; Busch 2007; Callon 2010; Strati, 2007; Law 2008; Loconto 2010). We take here discourses as collections of interrelated texts that produce both meanings and effects in the real world¹. This vision of achieving performance

¹ As Maguire and Hardy (2009: 150) phrases it their enquiry about discourses in the DDT Ban: discourses “define “who and what is ‘normal,’ standard and acceptable” (Merilinen, Tienari, Thomas, & Davies, 2004: 544), as well as acceptable ways to think, talk, and act (Hall, 2001). Discourses thus shape “the strategies and rules by which we can speak about and act on a domain . . . in such a

through the enunciation of discourses “*focuses attention not only on the rhetoric and narrative of the performance itself but also on the way the performance expresses – and is embedded in – modes of information control*” (Hilgartner 2000). In this perspective, many scholars have paid attention to enrolments of both material devices and their users into collectives after the utterance being delivered, and to the meaning that these collectives produce beyond the initial interaction (Callon, Méadel, and Rabeharisoa, 2002). They have not so much paid much attention to the way a given regime of action gains legitimacy, which in turn gives strength to an utterance and supports its performativity. We propose to consider that such legitimacy is built through the articulation of objectification and inter-subjectification processes that intermediation activities fulfil in order to perform transformative change in sustainability transitions. We thus recognize performativity as a property of intermediation.

The second property we would like to stress is contextualization. In our case studies, we showed that intermediation activities are deeply related to a problematic situation, but also act as a translator between various deliberative arenas in which the problem at stake and the desired futures are framed. Contextualization refers here to this ability to elaborate a transformative purpose, which is sustained in an argumentative discourse. The latter is established in order to support and to frame a promising and deliberative setting within a web of interests and social positions assembled in institutional arrangements. This approach relies on a semiotic perspective like the one developed by Latour (1990) and Akrich & Latour (1992) to give an account of scientific work and scripts of innovation. The construction of successive utterances in deliberative arenas can be taken analogically as a text with a transformative purpose. The translations achieved by the intermediary actors maintain the consistency of utterances in deliberative arenas through time and thus creates a context. The production of a text and of a context expresses the meaning and the practicability of the transformative purpose at work; it shapes a promising future and reframes collective action simultaneously. This is what we label as “contextualization”.

The third property is reflexivity, and it has to deal with learning in processes of change. Much has been said about reflexive practitioners in the area of social learning, following Argyris (1995: 17) famous pragmatic intuition:

way that certain possibilities and outcomes are realized rather than others” (Reed, 1998: 196). As a result, discourses produce “power/knowledge relations, linguistically communicated, historically located, and embedded in social practice” (Heracleous & Barrett, 2001: 757)”...

“we know we learnt something when we are able to realize what we assert we know”. The reflexive consciousness (Giddens, 1984) of intermediary actors about their own position in reflexive modernization settings (see Bos and Grin, 2008) is based on a sense of caring about the (un)intentional effects of their practices in a process of change. This is central to sustaining intermediary activities but also to accommodate their legitimacy in deliberative arenas. The ability to develop this attitude has also been labeled as ‘second order reflexivity’ (Voß and Kemp, 2006). An earlier contribution (Elzen, et al., 2012) has established that various misfits within an existing sociotechnical regime require reflexivity – a questioning of both the taken for granted characteristics of the regime and the beliefs of stake-holders. This reflexive stance is clearly at work within our four case studies.

CONCLUSION

Through an interpretative process based on a crosscutting analysis of four case studies of various types of sustainability transition we have proposed to identify key functions fulfilled by intermediary activities and we have suggested that the efficiency of these activities needs to be analysed as the combination of three properties which we have termed: contextualization, performativity and reflexivity. These findings reflect our iterative and grounded approach of theorising intermediation. In light of some critiques proposed early in this chapter, they also represent a way of doing research with a comprehensive approach of intermediary actors to build a first interpretative model, which must be validated through further research. Despite this potential weakness, the study of both intermediation functions and properties constitutes a contribution to the research agenda for ongoing research about intermediation. Our results seem consistent with results already published by authors who have the intention of creating changes for sustainability drifts in agricultural innovation systems (Klerkx and Leeuwis, 2009; Klerkx et al., 2010). What our theoretical framework adds is the aspect of ‘unintentionality’ and a more fine-tuned understanding of the functions of intermediation.

To conclude we advocate for the development of a strong research program on intermediation as practice and process. In our view, such a program should target the three following issues.

1) The way intermediation acquires its legitimacy. To what extent does it depend upon an intentional long-term engagement of intermediary actors with their own visions of transformative change to address wicked problems within institutional arrangements? How does such legitimacy rest on the intermediary’s ability to develop a regime of action in which goals and means are questioned together in order to reassemble existing heterogeneous practices in the field?

2) The objectification and inter-subjectification processes and the way they are articulated through the different functions of intermediation activities so to achieve transformational change. How this articulation is promoted or, on the contrary, constrained if not refrained by organizations and institutional arrangements? How to design process for transformational change if one wishes to put intermediation efficiency at first? How researchers involved in field research could take into account their mobilization in objectification processes and in inter-subjectification processes as well?

3) The constitutive properties of intermediation remain quite invisible in sustainability transitions. How the interlinked, constitutive properties of intermediation (performativity, contextualization and reflexivity) are actualized in the course of action, and could they be traceable? What could be the consequences of focusing on these properties in professional training and teaching programs?

By opening these three lines of enquiry, we might be able to increase our understanding of intermediation in sustainability transitions.

REFERENCES

- Akrich, M. and Latour, B., 1992. A summary of a convenient vocabulary for the semiotics of human and non-human assemblies, in Bijker W.E. and Law (ed.), *Shaping Technology/building society*, Cambridge, Massachusetts: The MIT Press.
- Aldrich, H. and Herker, D., 1977. Boundary Spanning Roles and Organization Structure, *Academy of Management Review*, 2 (2): 217-230.
- Anderson, D. and Ackerman-Anderson, L., 2010. What is Transformation, and Why is It So Hard to Manage? On line access <http://changeleadersnetwork.com/free.resources/>.
- Argyris, C., 1995. *Savoir pour agir. Surmonter les obstacles à l'apprentissage organisationnel*. Paris : InterÉditions.
- Austin J.L. 1962. *How to Do Things with Words : The William James Lectures delivered at Harvard University in 1955*, (ed. J.O. Urmson and Marina Sbisa), Oxford (published posthumously in 1962).
- Baert, P., and F. D. Rubio, F.D., 2012. *The politics of knowledge*. London ; New York, Routledge.
- Barbier, M., and Elzen, E., 2012. *System Innovations, Knowledge Regimes, and Design Practices towards Transitions for Sustainable Agriculture*, Paris : INRA Editions, 374p.
- Barbier, M., 2010. The ecologization of agricultural development and the treadmill of sustainable development, a critique in a state of transition. *Przegląd Socjologiczny (Sociological Review)*, 59(2) :9-28.

- Barnett, M.L., 2004. Are globalization and sustainability compatible? A review of the debate between the World Business Council for Sustainable Development and the International Forum on Globalization. *Organ. Environ.* 17 (4), 523–532.
- Batie, S.S., 2008. 'Wicked Problems and Applied Economics', *American Journal of Agricultural Economics*, 90 (5), 1176-91.
- Bawden, R., 2003. *The Essential Learning & 'Inclusive Cognition'. A workbook.*
- Bessant, J., Rush, H., 1995. Building bridges for innovation: the role of consultants in technology transfer. *Research Policy* 24, 97–114.
- Blumer, H., 1971. Social problems as collective behavior. *Social Problems* 18, 298–306.
- Bos, A.P., and Grin, J. 2008. "Doing" Reflexive Modernization in Pig Husbandry: The Hard Work of Changing the Course of a River. *Science, Technology, & Human Values*, (33) 480-507.
- Bourblanc M. (2007). *Les politiques de reconquête de la qualité de l'eau face aux pollutions.* Thèse, Université de Rennes.
- Burt, R., 2004. Structural holes and good ideas, *American Journal of Sociology*, 110: 349–99.
- Busch, L., 2007. Performing the economy, performing science: from neoclassical to supply chain models in the agrifood sector, *Economy and Society*, 36, 437-466.
- Butterfield, L. D., Borgen, W. A., Amundson, N. E., and Malio, A.S.T., 2005. Fifty years of the critical incident technique: 1954 - 2004 and beyond. *Qualitative Research*, 5 (4): 475–497.
- Callon, M., 2010. Performativity, Misfires and Politics, *Journal of Cultural Economy* 3(2):163-69.
- Callon, M., Lascoumes, P., and Barthe, Y., 2001. *Agir dans un monde incertain: Essai sur la Démocratie Technique.* Seuil, Paris.
- Callon, M., Méadel C. and Rabeharisoa V.,2002. The Economy of Qualities, *Economy and Society*, 31, 194-217.
- Canévet C., 1992. *Le modèle agricole breton.* Rennes, Presses Universitaires de Rennes.
- Cerf M., Guillot M.N., Olry P., 2011. Acting as a change agent in supporting sustainable agriculture: how to cope with new professional situations? *Journal of Agricultural Education & Extension*, (17), 7-19.
- Connor, R., Dovers, S., 2004. *Institutional Change for Sustainable Development.* Edward Elgar Publishing, Cheltenham.
- Cook, S.D.N., Brown, J.S., 1999. Bridging epistemologies: the generative dance between organizational knowledge and organizational knowing. *Organization Sci.* 10 (4), 381–400.
- Detienne, M., 2009, *Comparer l'incomparable*, Paris, Le Seuil.

- Dingwerth, Klaus, and Philipp Pattberg. 2009. World Politics and Organizational Fields: The Case of Transnational Sustainability Governance. *European Journal of International Relations* 15 (4):707-743.
- Dodier, N., 2003a. *Leçons politiques de l'épidémie du SIDA*. Editions EHESS, Paris.
- Dodier, N., 2003b. L'espace et le mouvement du sens critique. *Colloque Convention et Institutions: Approfondissements Théoriques et Contributions au Débat Public*. CNRS, Université Paris X, Paris, Décembre 2003.
- Dubois, V., 2009. L'action publique. In *Nouveau manuel de science politique*, Cohen (A.), Lacroix (B.), Riutort (Ph.). (Ed.), pp.311-325.
- van Eemeren, FH, 2011. In Context Giving Contextualization its Rightful Place in the Study of Argumentation, *Argumentation*, 25 (2): 141-161
- Elzen B., Barbier M., Cerf M., Grin J., 2012. , Stimulating transitions towards sustainable farming systems., In Ika Darnhofer, David Gibbon, Benoît Dedieu (Eds.), *The farming systems approach Into the 21st century : The new dynamic*, Springer, 2012.
- Gassmann, O. and Reepmeyer, G., 2005. Organizing pharmaceutical innovation: From science-based knowledge creators to drug-oriented knowledge brokers', *Creativity and Innovation Management*, 14: 233-45.
- Geels, F.W. 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, *Research Policy*, 31 (8-9), 1257-74.
- Geels, F.W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticism. *Environmental Innovation and Societal Transitions*, 1: 24-40.
- Giddens A., 1984. *Theory of structuration* , Cambridge, Polity Press.
- Glaser , B. and Strauss, A., [1967] 2008, *La production de la théorie à partir des données*, Enquête (on line).
- Gusfield, J.R., 1981. *The Culture of Public Problems*, Chicago, University of Chicago Press.
- Guston, D.,1999. Stabilizing the boundary between US politics and science: The role of the Office of Technology Transfer as a boundary organization, *Social Studies of Science*, 29: 87-111.
- Hall, A., Rasheed Sulaiman, V., Clark, N., and Yoganand, B., 2003. From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research. *Agric. Syst.*, 78: 213-241.
- Hargadon, A. B., 1998. Firms as knowledge brokers: Lessons in pursuing continuous innovation, *California Management Review*, 40: 209-27.
- Hilgartner S., 2000. *Science on Stage. Expert advice as public drama*, Stanford University Press
- Hatanaka, M. 2010. Governing sustainability: examining audits and compliance in a third-party-certified organic shrimp farming project in rural Indonesia. *Local Environment*, 15 (3): 233-244.

- Holling, C. S., 2001. Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems* 4: 390-405
- Howells, J., 2006. Intermediation and the role of intermediaries in innovation. *Research Policy*, 35: 715–728
- Klerkx, L. and Leeuwis C., 2009. Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. *Technological Forecasting & Social Change*, 76: 849–860.
- Klerkx, L. and Leeuwis, C., 2008. Balancing multiple interests: Embedding innovation intermediation in the agricultural knowledge infrastructure, *Technovation*, 28: 364–78.
- Klerkx, L., Aarts N., Leeuwis. C., 2010. Adaptive management in agricultural innovation systems: the interactions between innovation networks and their environment, *Agric. Syst.*, 103: 390–400.
- Klerkx L., Van Mierlo B., Leeuwis C., 2012. Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions in *Farming Systems Research into the 21st century: The new dynamic*, Springer, pp. 457-483.
- Latour, B. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Milton Keynes, England: Open University Press.
- Latour B. 1990. Drawing things together, in Lynch M. et Woolgar S. (ed.), *Representation in scientific practice*, Cambridge, Mass. : The MIT Press.
- Latour, B., 1999. *Politiques de la nature. Comment faire entrer les sciences en démocratie*. La Découverte, Paris.
- Latour, B., 2005. *Reassembling the social : an introduction to actor-network-theory*. Oxford ; New York, Oxford University Press.
- Law, J., 2008, On sociology and STS, *Sociological Review*, 56: 623-649.
- Levain, A., 2014. *Vivre avec l'algue verte, Médiations, épreuves et signes*, Thèse de doctorat en anthropologie Muséum National d'Histoire Naturelle, Paris.
- Levain, A., Vertès, F., Ruiz, L., Delaby, L., Gascuel, C. Barbier, M., 2015. 'I am an intensive guy': The possibility and conditions of reconciliation through the ecological intensification framework. *Environmental Management*, in press.
- Levin, K., B. Cashore, S. Bernstein, and G. Auld, 2012. Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change, *Policy Sciences*, 45 (2): 123-52.
- Loconto, A. 2010. Sustainably performed: Reconciling global value chain governance and performativity. *Journal of Rural Social Science* 25 (3): 193–225.
- Loconto, A., and Fouilleux, E., 2014. Politics of Private Regulation: ISEAL and the shaping of transnational sustainability governance. *Regulation & Governance* 8(2): 166–185.

- Loconto, A., and Busch, L., 2010. Standards, techno-economic networks, and playing fields: Performing the global market economy. *Review of International Political Economy* 17 (3): 507 - 536.
- Loconto A., and Barbier M., 2014. Transitioning Sustainability: Performing 'governing by standards', in S. Borraz and J. Edler (ed), *The Governance of Socio-Technical Systems – Explaining change*, Edward Elgar Publishing: 70-95.
- Lomas, J. (2001) 'The in-between world of knowledge brokering', *BMJ*, 223: 129–32.
- MacKenzie, D. A., F. Muniesa and L. Siu (2007), *Do economists make markets? : on the performativity of economics*, Princeton, NJ: Princeton University Press.
- Maguire S and Hardy, C., 2009. Discourse and deinstitutionalization: the decline of DDT, *Academy of Management Journal*, 52 (1) 148–178.
- Maxime F., and Cerf M., 2002. Apprendre avec l'autre : le cas de l'apprentissage d'une relation de conseil coopérative. *Education Permanente*, 151, 47-68.
- McDermott, C. L. 2012. Trust, legitimacy and power in forest certification: A case study of the FSC in British Columbia. *Geoforum* 43 (3):634-644.
- Meyer, M., and Kearnes, M., 2013. Introduction to special section, intermediaries between science policy and markets, *Science and Public Policy*, 40 (3): 423–429
- Meyer, M., and Schlierf K., 2013. Situating knowledge inter-mediation: insights from science shops and knowledge brokers, *Science and Public Policy*, 40 (3): 430-441.
- Michael, M., 2000. Futures of the Present: From Performativity to Prehension, in N. Brown, Rappert, B., Webster, A. *Contested Futures - A sociology of prospective technoscience*. Aldershot, Ashgate: 21-39.
- van Mierlo B., Leeuwis C., Smits R., and Woolthuis R.K., 2010. Learning towards system innovation: Evaluating a systemic instrument, *Technological Forecasting and Social Change*, (77), 2: 318-334.
- Mol, A., 2002. *The Body Multiple: Ontology in Medical Practice*. Durham: Duke University Press.
- Muller, P., 2009. *Les politiques publiques*. Coll. Que sais-je ? Editions PUF, Paris.
- Nussbaum, M.C. 1985. Objectification. *Philosophy & Public Affairs* 24 (4): 279–83.
- Olivier de Sardan, J.-P. , 1995, *Anthropologie et développement. Essai en socio-anthropologie du changement social*, Paris, Karthala (translate in English in 2005).
- Olivier de Sardan, J.-P., 2008. *La rigueur du qualitatif. Les contraintes empiriques de l'interprétation socioanthropologique*. Louvain-La-Neuve: Bruylant.
- Pickering, A. (1995). *The mangle of practice: time, agency, and science*. Chicago, IL, University of Chicago Press.
- Robertson, R., 1994. Globalisation or glocalisation?, *The journal of International Communication*, (1)33-52

- Rotmans J., Kemp R., and van Asselt M., 2001. Transition Management: a promising policy perspective, *Interdisciplinarity in Technology Assessment / Wissenschaftsethik und Technikfolgenbeurteilung*, 11 : 165-197.
- Schlierf, K., and Meyer, M. 2013. Situating knowledge intermediation: Insights from science shops and knowledge brokers, *Science and Public Policy*, 40(4): 430-441.
- Smith, A., Stirling, A. and F. Berkhout, F., 2005. The governance of sustainable socio-technical transitions, *Research Policy*, 34 (10), 1491-510.
- Smith, A., and A. Stirling, 2007. Moving outside or inside? Objectification and reflexivity in the governance of socio-technical systems. *Journal of Environmental Policy & Planning*, 9: 351-373
- Snowden, D., 2002. Complex acts of knowing—paradox and descriptive self-awareness. *J. Knowl. Manage.* 6 (2), 100–111 (special issue).
- Sonnenwald, D. H. 1996. Communication role that support collaboration during the design process. *Design Studies*, 17: 277–301.
- Star, S.L., and Griesemer, J. (1989). Institutionnal ecology, 'Translations' and Boundary objects: amateurs and professionals on Berkeley's museum of vertebrate zoologie, *Social Studies of Science*. 19(3): 387-420.
- Stevens, D., 1999. The Competent Boundary Spanner, *Teaching and Teacher Education*, 15(3): 287–299.
- Steyaert, P., 2006. Dispositif d'action collective : un concept pour comprendre la gestion concertée de l'eau à l'échelle de bassins versants. In Ph. Mérot (éd.) *Qualité de l'eau en milieu rural. Savoirs et pratiques dans les bassins versants*. Quae Editions, INRA, Paris.
- Steyaert P., 2008. Des concepts intermédiaires producteurs de sens pour la gestion environnementale : une étude de cas sur les zones humides côtières en France. In F. Mélard (éd.), *Écologisation : Objets et concepts intermédiaires*, Editions P.I.E.-Peter-Lang, coll. Écopolis, Bruxelles.
- Steyaert, P., Jiggins, J., 2007. Governance of Complex Environmental Situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. *Environ. Sci. & Policy* 10(6), p. 575-586.
- Stirling A., 2014. Towards More Reflexive Governance of Vulnerability, In A. Hommels, J. Mesman and W. E. Bijker (Eds.) *Vulnerability in technological cultures: new directions in research and governance*. MIT Press, Cambridge, MA.
- Strati, A., 2007. Sensible Knowledge and Practice-based Learning, *Management Learning*, 38(1): 61–77
- Strauss, A., 1978. A social world perspective. *Stud. Symbolic Interact.* 1, 119–128.
- Traugott, E.C., 2010. Revisiting subjectification and intersubjectification, in Kristin Davidse, Lieven Vandelanotte, and Hubert Cuyckens, (eds.), *Subjectification, Intersubjectification and Grammaticalization*, 29-70. Berlin: De Gruyter Mouton

Voß, J.-P. and Kemp, R., 2006. Sustainability and reflexive governance: Introduction. In J.-P. Voss, D. Bauknecht and R. Kemp (Eds.). *Reflexive governance for sustainable development*. Cheltenham: Edward Elgar, pp. 3–28.

Ward, V., House A., and Hamer, S., 2009. Knowledge Brokering: The missing link in the evidence to action chain?, *Evidence Policy*, 5(3): 267–279.

Whitehead A.N., 1929. *Process and Reality: An Essay in Cosmology*, corrected edition, edited by David Ray Griffin and Donald W. Sherburne, Free Press. (Ed. 1979).

Williams, P., 2002. The Competent Boundary Spanner, *Public Administration*, 80(1): 103-124,.

APPENDIX I: SAMPLE OF THE USE OF THE ANALYTICAL GRID

Critical Events Features	1. Heavy contestation about the limits of the nature preservation area.	2. Get round institutional contestation by diversifying deliberative arenas	3. Struggle between local actors involved in collective action and administrative agents
Interdependencies	Unexplored and limited to a "descriptive" approach of nature	Increases by the integration of social preoccupations linked to human activities (livestock farming, hunting, fishing, water management, invasive species, etc.)	Between the local (collective action and what it produced) and the global (political framework and its translation by administrative services)
Complexity	Reduced to the description of nature and land use focusing on area delimitation	Diversification of components and interactions. Shift from marshlands' description to marshlands' functioning	Reduced to political and administrative aspects (validation, funding)
Uncertainties	Socio-political about the consequences of nature protection policies and their future development on human activities	Techno scientific: cause-effect relationships between human activities and ecological functioning of the marshes are unknown	Political about the acceptance of the action plan and its funding through a set of administrative and political frameworks
Controversy	Quality of biological inventories is contested in order to exclude crop land from the area	Specific around management stakes and related technical objects emerging from deliberations (e.g. hunting areas, water levels, etc.)	Related to how public action is conceived and implemented (deliberative vs prescriptive)

Objectification	Extensive use of descriptive knowledge: habitats' presence and richness. Agricultural data (typologies, maps)	Validation of land use maps and new map's legend. Use of a new concept to qualify different marshland areas	A shared and collective action plan defining stakes, management goals and a set of means for achievement
Inter-subjectification	Confrontation of conflicting social interests.	Technical debate develops leading to build a shared understanding of stakes and to restore a so called "marshland integrity"	Confrontation of values around top-down and bottom-up approaches of public action