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Knowledge transfers in University–Industry R&D projects: A situated approach

Julie HERMANS

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A situated approach

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In today's economy, universities are seen as a central source of knowledge for the firms. Innovation policies therefore encourage University–Industry collaborations in the hope that it will lay out the overall framework for an efficient transfer between partners. In this work, I recognize the central role of universities in the innovation process but I question the belief that knowledge is per se flowing between private and academic partners in such collaborations. Focusing on the joint R&D projects financed by the Competitiveness Clusters of Wallonia, the thesis explores knowledge exchanges as they happen, influenced by their material and social circumstances, through a situated approach. In particular, I propose to explore the impact of power exercises between partners on what is learnt, how, and by whom.

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FACULTES UNIVERSITAIRES NOTRE DAME DE LA PAIX

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Julie Hermans

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du grade de Docteur
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Chapter 1 INTRODUCTION

1.1 TOWARDS A SITUATED APPROACH OF KNOWLEDGE TRANSFER

Today, knowledge is seen as a significant innovation factor, allowing for long-term economic growth and business competitiveness (Hitt et al. 2000). In order to access this desirable resource, firms adopt various sourcing strategies: knowledge creation through internal Research and Development (R&D) departments, knowledge sharing with suppliers and transfer from knowledge institutions such as research centers and universities. In Wallonia, firms also benefit from formal regional clusters to connect with other Walloon actors, to materialize their partnerships in joint R&D projects and to subsequently co-create new knowledge. Regional authorities actively support this approach: the interconnection of actors and the pool of competences should lead to innovations and subsequent economic growth (Gouvernement Wallon 2005).

As an example, the *Competitiveness Clusters of Wallonia* were recently launched by the Walloon Government (Gouvernement Wallon 2005). Those clusters are defined as the combination on a given territory of companies, training centers and research units which (1) engage in partnerships to create synergies around *innovative joint R&D projects* and (2) experience critical mass that allows for international visibility (Bayenet & Capron 2007). While insights from economic clusters (Porter 1998) or National (Lundvall 1992, Nelson 1993) and Regional Innovation Systems (Cooke et al. 1998, Asheim 2003) allow to grasp the rationale behind such a policy, an important gap subsists in the understanding of the learning process triggered by these inter-organizational interactions. To make sure that such relationships keep their promises, it is important to understand what kinds of learning mechanisms are at stake and how partners ensure that the newly created knowledge is of actual interest for their parent organizations.

In this doctoral work, I recognize that universities are a central source of knowledge for the firm (Dasgupta & David 1994, Klevorick et al. 1995, Nerkar & Shane 2003) but I question the general belief that knowledge is per se flowing between private and academic spheres through the conduct of University-Industry (U-I) relationships. Focusing on one particular instrument – the joint R&D project – displayed in one particular context – the Competitiveness Clusters of Wallonia – the

thesis explores two fundamental learning processes (Lubatkin et al. 2001, Jiang & Li 2009), namely knowledge creation and sharing, to make sure that those interactions are actually “*good and should be encouraged*” (Katz & Martin 1997).

Up to now, U-I knowledge transfer has been treated as a one-way flow from research institutions to firms, focusing on publications and patents citations as sophisticated spillovers indicators. By providing evidence of spatial effects, studies such as Jaffe (1989) or Audretsch and Feldman (1996b) have been crucial for our understanding of the role of tacit exchange in U-I knowledge transfer but this literature fails to uncover the sharing processes at stake in specific relationships. In fact, the way by which tacit and codified knowledge is exchanged between partners through consulting, innovative joint R&D projects or even sponsorship is still relatively unknown (Agrawal 2001). As suggested by Agrawal (2001), “*there is a need for further research that specifically examines the nature of those channels less studied*” by which “*firms may benefit significantly*”.

In this thesis, I partly fill this gap by investigating one of those less studied channels – the joint R&D project– as an instrument for targeted knowledge transfer: the interactions that occurred between partners within a common covenant for the co-creation and sharing of knowledge. This choice implies three basic assumptions:

- (1) The recognition of U-I relationships as a two-way relationship rather than a linear arm’s length transaction (Harmon et al. 1997, Meyer-Krahmer & Schmoch 1998, Santoro & Saparito 2003).
- (2) The importance of knowledge co-creation and sharing rather than just transfer (Lubatkin et al. 2001, Faems et al. 2007, Tywoniak 2007, Jiang & Li 2009).
- (3) The importance of action, especially social interactions, for creating and sharing knowledge rather than formal appropriation (von Krogh & Roos 1996, Pfeffer & Sutton 1999, Bozeman 2000, Nooteboom 2000).

These three assumptions call for *a **situated approach*** of U-I knowledge transfer. They suggest that “*thinking beings ought therefore be considered first and foremost as acting beings*” (Anderson 2003 p. 91) and that planned transfers depend in essential ways on the circumstances that shape its dedicated social interactions.

At first, Knowledge-Based streams (i.e. Kogut & Zander 1992, Nonaka & Takeuchi 1995, Kogut & Zander 1996, Spender 1996, Nahapiet & Ghoshal 1998, Cook & Brown 1999) seemed like promising frameworks for the development of a situated approach (see next chapter) and were therefore applied in a preliminary study: an interview-based survey conducted from June 2005 to August 2006 toward academic professors, academic researchers, Technology Transfer Officers (TTO) and R&D managers. The goal was to initiate a first empirical contact with the field, thereby gaining a deeper understanding of the context of U-I R&D projects and reducing the research scope (see Hermans & Castiaux 2007).

Data were collected through 20 semi-structured interviews and analyzed by explanation building techniques guided by the theoretical framework of the SECI (Socialization – Externalization – Combination - Internalization) process (Nonaka & Takeuchi 1995). It identifies some Knowledge-Based limits to the reconciliation process between university's interests and company's needs but it also confirms the importance of the third role of university, namely participation to economic development. In other words, this study confirms the feasibility of reconciliation when engaging in technology efforts (Van Looy et al. 2006).

1.2 RESEARCH QUESTIONS

The preliminary study offers strong evidence supporting the interest of Knowledge-Based streams as theoretical tools for a situated approach of U-I knowledge transfer. But it also allows for the identification of gaps and inconsistencies in existing Knowledge-Based streams, in particular their failure to take into consideration the political dimension of knowledge creation or the process of interest alignment between the knowledge-creating actors and the social collectivity to which they belong. A first research question emerges from this reflection:

Q1 – How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer?

In other words, the goal of this work is to determine the leverages that individual partners can mobilize so that collaborative knowledge exchanges contribute to organizational goals. As the achievement of organizational goals might conflict with inter-organizational and individual interests, this research question requires a

theoretical framework that complements the Knowledge-Based approach by taking into account alignment processes and power interactions. On the basis of ontological and epistemological affinities with the work of Anthony Giddens, I finally selected the Structuration Theory (Giddens 1984) to fill the gap. In this doctoral work, power is therefore defined as the “*capability to secure outcomes where the realization of these outcomes depends upon the agency of others*” (Giddens 1976).

Such a research question calls for *in situ* observations of power interactions through qualitative and longitudinal methods. For these reasons, I studied knowledge transfers at stake in U-I R&D projects through an in-depth longitudinal case study: MEGAPROJECT¹, a joint R&D project associated with MecaTech, the mechanical engineering Competitiveness Cluster. MEGAPROJECT was observed from June 2007 to May 2010. It brings together more than twenty partners: 12 firms, 7 universities and 3 semi-public research centers. This mega-project is part of the first call for projects of the Competitiveness Cluster; it was even considered by the respondents as the main structuring tool of MecaTech.

¹ All names of projects, firms and laboratories are disguised to ensure confidentiality

² The response rate of the survey is 14% (140 responses). Respondents are either head of an academic laboratory or a senior associate professor. To assess the reliability of the sample, we performed a Fisher exact test on their responses at the question: “does the laboratory have links with the industry” (binomial outcome: Yes or No).

³ Please note that this affiliation is the result of my analysis and has not been endorsed by the authors involved.

⁴ More precisely, I consider that, per definition, sharing entails creation. This idea is better expressed by Tywoniak (2007): “*Much like remembering for an individual involves the re-production of a memory, the process of sharing knowledge within a community of practitioners involves knowledge creation and dissemination.*” A knowledge

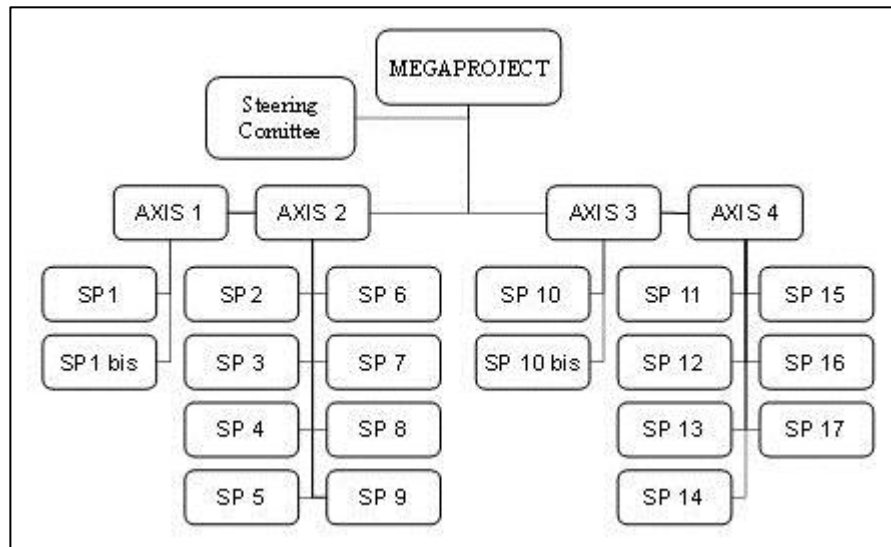


FIGURE 1 MEGAPROJECT AS A PORTFOLIO OF PROJECTS, ADAPTED FROM KUTY (2008)

Nevertheless, it was constructed as a portfolio of projects (see Figure 1): the relevant unit of collaboration for front-line researchers was not MEGAPROJECT but rather the subproject (SP), or the “Axis” when collaborative exchanges were undertaken at the axis level. As a result, the relevant case of this work is Axis-1: when speaking about “partners”, respondents were talking about the “people around the table” who contributed to Axis-1: researchers from MNC1, MNC2, SME1, LAB1, LAB2, LAB3, LAB4 and LAB5.

As the case study evolved, two additional issues emerged (see Table 1):

- (1) The impact of the Competitiveness Cluster policy on the design and conduct of the associated joint R&D projects;
- (2) The role of academics in projects that target different phases of the innovation process, from use-oriented basic research to pure applied R&D (Stokes 1997).

The impact of an R&D policy on the design and conduct of collaborative relationships has been conceptualized by Georghiou (2003) as behavioral additionalities: the differences in partners’ behavior resulting from an intervention of public authorities. Nevertheless, the concept of behavioral additionality is still in its infancy (Autio et al. 2008, Clarysse et al. 2009) and the literature would benefit

from more empirical works about the mechanisms at hand. From a practical perspective, this problem concerns policy makers who want to assess the impact of their policy as well as collaborative practitioners: people actually involved in the Clusters or practitioners who are considering entering the cluster and want to understand the implication of such a move. The following research question was therefore explored:

Q2 – How did the Competitiveness Cluster Policy influence the collaborative behaviors in a joint R&D project?

The third research question also emerges from a practical consideration overlapping with a gap in the literature. In the context of the Competitiveness Clusters, the Walloon Government explicitly proposed two kinds of joint R&D projects: “*those projects either target the **concrete realization** of industrial applications within three years, or the building of a **prospective** vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster*” (Gouvernement Wallon 2005). In both cases, universities are mandatory research partners, without reflections about the specific roles of academic laboratories following the nature of the project. However, the literature on inter-firm R&D (Koza & Lewin 1998, Rothaermel & Deeds 2004, Chanal & Mothe 2005) shows that exploration and exploitation R&D alliances provide partners with different learning opportunities, urging for a dynamic view of knowledge transfers (Faems et al. 2007). As universities are usually associated with exploration (Rothaermel & Deeds 2004, Bercovitz & Feldman 2007) rather than exploitation R&D activities, it should be useful to understand the role of academic laboratories as privileged research partners in the Competitiveness Clusters. From the point of view of the practitioner, it should provide clues to better understand the expected roles of partners and specific knowledge flows in U-I joint projects when the research activities vary between exploration and exploitation. The following research question was therefore explored:

Q3 – How does the nature of the R&D project influence knowledge transfer between partners?

In addition with the three specific research gaps tackled by each research question (see Table 1), the main theoretical contribution is the study of U-I knowledge

transfer as a socially-embedded process, complementing the Knowledge-Based View of the firm (KBV) with a consideration for interest alignment and power exercise. By doing so, the general purpose of this thesis is to provide collaborative practitioners with new insights about the conduct of U-I R&D projects, especially in the context of innovation networks. Findings should be of interest for various strategic actors: public authorities in charge of the policy, industrial and academic partners directly involved in the projects as well as the administrators of the network to better manage its projects' portfolio.

TABLE 1 RESEARCH QUESTIONS

	Q1	Q2	Q3
Research question	<i>How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer?</i>	<i>How did the Competitiveness Cluster Policy influence collaborative behaviors in a joint R&D project?</i>	<i>How does the nature of the R&D project influence knowledge sharing between partners?</i>
Theoretical contribution	Knowledge transfer as a socially embedded process in joint R&D projects		
	Power as an essential factor for knowledge creation (Ekbja & Kling 2003, Lawrence et al. 2005, Peci et al. 2009), especially in innovation (Easterby-Smith et al. 2008) and U-I relationships (Blankenburg 1998)	Behavioral impacts of a publicly promoted policy on R&D practitioners (Buisseret et al. 1995, Georghiou 2003), especially in a cluster initiative through a bottom-up, participatory approach (Diez 2001)	Dynamic view of inter-organizational knowledge transfer (Faems et al. 2005) taking into account exploratory and exploitative innovations (Jansen et al. 2006)
Practical purpose	Provide collaborative practitioners with new insights about the conduct of joint R&D projects		
	Outline the leverages that individual partners can mobilize so that collaborative knowledge exchanges contribute to organizational goals while preserving inter-organizational and individual interests	Understand the rationale of the policy at hand. Outline challenges and broad policy lessons in publicly promoted clusters. Provide collaborative practitioners with new insights about the impact of the policy on their behaviors	Gain more understanding about the role of universities in different types of projects (exploration – exploitation – prospect) and about expected flows in each type of projects

1.3 STRUCTURE

This work is divided into two main parts (see Figure 2):

- The background of the thesis, including problem statement (Chapter 2), the epistemological stance (Chapter 3), the presentation of the integrating theoretical framework, namely the Structuration Theory (Chapter 4) and, finally, the methodology (Chapter 5).
- The empirical exploration of the three research questions and presentation of findings (Chapter 6-Q2, Chapter 7-Q3 and Chapter 8-Q1).

In Chapter 2 – Problem statement, I describe the issues that emerged as research objects for this thesis as well as the process that led to them. First, I describe the context of Belgian U-I collaboration: privileged forms of interactions, motives and outcomes of their conduct. Then I focus on a specific instrument for U-I knowledge transfer – the joint R&D project – and show how its study would benefit from a situated approach. Especially, I present the three research questions that were chosen to explore the knowledge interactions at stake in joint R&D projects. Finally, I propose the Structuration Theory as an adequate theoretical framework to integrate the three research questions.

In Chapter 3 – Epistemology, I present the epistemological paradigm of this work: I identify the specific hypothesis that guided my work as I unveiled or created knowledge (Hatch 2000) about the phenomenon of U-I knowledge transfer. First, I review the three main epistemological paradigms adopted by Management scholars as distinguished by de Nanteuil-Miribel (2008) and Chua (1986): positivism, structuralism and interpretivism. Then, I propose my epistemological stance as a critical interpretivism. Through this paradigm, I found the adequate theoretical and methodological premises to go beyond the traditional factors that influence knowledge transfer and to explore the political processes that have been neglected in this field. Through its coherence with critical interpretivism, I also confirm the Structuration Theory as the integrating framework for the study of targeted knowledge transfer. Such an approach has been used by researchers in Strategy and Organization (Pozzebon 2004) such as Child (1997), Lowe (1998) and Phillips and his colleagues (Phillips et al. 2000, Lawrence et al. 2002).

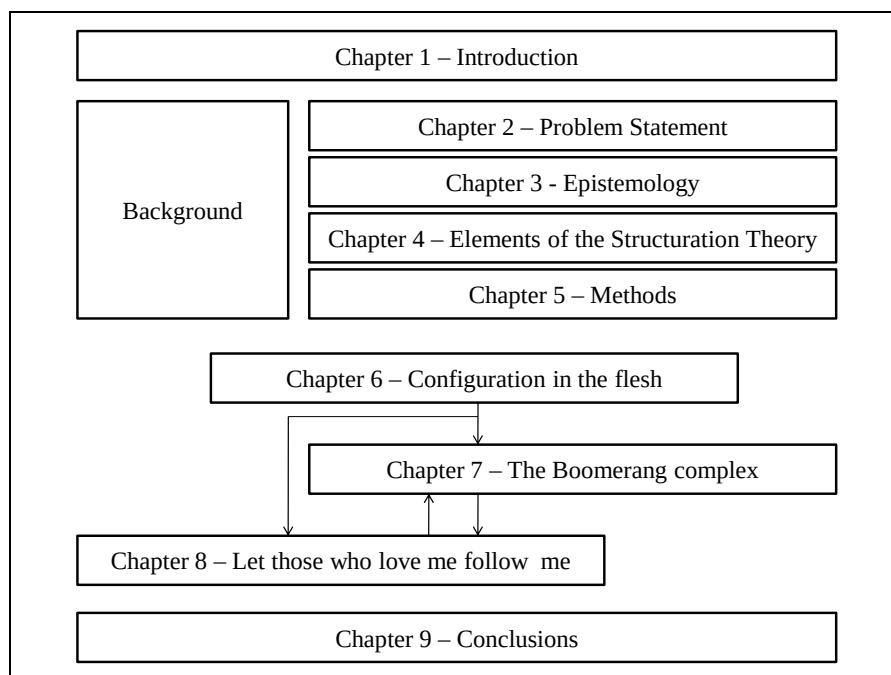


FIGURE 2 STRUCTURE OF THE THESIS

In Chapter 4 – Elements of the Structuration Theory, I present the Structuration Theory (Giddens 1984) as a general framework to understand the political processes of knowledge creation and sharing at stake in joint R&D projects. Through this prism, the collaboration is seen as a social system characterized by interpenetrating structures (Orlikowski 2000, Phillips et al. 2000) as partners come from different kinds of organizations and are “*simultaneously embedded in the webs of obligation and loyalty to the project team, the firm, and to their role as entrepreneur of their own human capital*” (Grabher & Ibert 2006). In this view, knowledge creation in R&D projects is seen as a recursive process involving the enactment of interpenetrating structures: latent knowledge is made empirical through social interactions and made latent again through each individual interpretation of the mobilized modalities (Orlikowski 2000, Hargadon & Fanelli 2002). This theoretical framework helps to make sense of the political processes at stake in joint R&D projects (Q1) but it is also coherent with the emerging research questions of this work: the influence of collective constructs provided by the institutional field (in this case, the Walloon Government) on the way actors subsequently organize their collaboration (Q2), and the influence of the nature of the project on the meaning assigned by the partners to their role and expected knowledge flows (Q3).

In Chapter 5 – Methods, I describe the methods deployed to answer the research questions in coherence with the epistemological paradigm. I firstly introduce the research strategy – the qualitative longitudinal case study – and explain why it constitutes an adequate choice for this doctoral work. Secondly, I discuss alternative units of analysis, propose the collaborative research (Landry & Amara 1998, Debackere & Veugeliers 2005) as an adequate unit of analysis and determine the sampling logic underlying the selection of the cases. Thirdly, I identify the data collection methods and the analysis strategies that were applied to generate findings. Finally, I discuss the validity of the research strategy as well as the coherence of the research designs that were selected to answer the three research questions.

Chapter 5 concludes the background of the thesis. The next chapters focus on the three research questions and present empirical findings.

While the research question about power exercised between partners (Q1) was the one that initiated the case studies, I finally decided to present its findings after the chapters tackling the emerging research issues. In the first empirical chapter, namely Chapter 6, I explore how the configuration of the Competitiveness Clusters policy influenced the collaborative behaviors of MEGAPROJECT participants. This chapter “sets the scene”: it explains the rationale of the Competitiveness Clusters and identifies the emerging modalities that partners mobilize in the project (see Figure 3): interpretive schemes such as “a Marshall Plan Project is a Project for the industrials, led by the industrials”; norms like “it is normal to target industrial outcomes”; facilities and frustrations like for instance the sets of equipment that are shared on MEGAPROJECT.

Building on it, the second empirical chapter, Chapter 7, focuses on a few selected subprojects of MEGAPROJECT and on the knowledge flows that resulted from the collaboration, thereby identifying how the nature of the project influences knowledge transfer between partners. In this chapter, I show how shared interpretive schemes about the nature of the project, its finalities and main goals have an influence on the expected roles of partners and on the subsequent knowledge flows.

In Chapter 8, I finally focus on how collaborative practitioners can take opportunity of power exercise within the project to shape such flows and make them a source of value for their organization. In other words, Chapter 8 focuses on the way the

modalities identified in Chapter 6 were mobilized through power exercises in order to shape the knowledge flows identified in Chapter 7 (see Figure 3).

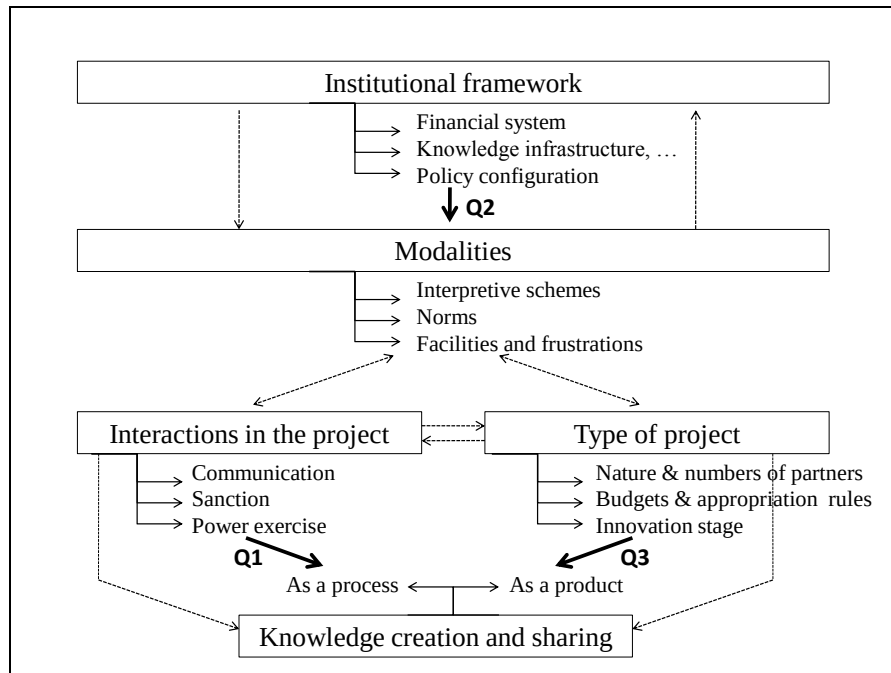


FIGURE 3 LOGICAL LINKS BETWEEN THE THREE RESEARCH QUESTIONS

In Chapter 6 – Configuration in the flesh: challenges in publicly promoted clusters, I study how the configuration of a publicly promoted clusters policy – the Competitiveness Clusters policy initiated by the Walloon Government in Belgium – influenced the behaviors of R&D practitioners (Q2). Informed by the Structuration Theory (Giddens 1984), I explore the background of the policy in an effort to make the program configuration visible. This first step is conducted through the gathering and analysis of data from official documents as well as publications, conference speeches and workshops produced by policy makers, evaluators and their academic collaborators (i.e. Bayenet & Capron 2007, Van Haeperen et al. 2009). Then, I observe the transmission of the six resulting features from the policy level to the project level: I study their appropriation by R&D practitioners involved in MEGAPROJECT and Axis-1. As a result, I show how the six features had a strong impact on the way partners organized their collaborative work.

Beyond the network structure promoted by the policy and reproduced at both the level of MEGAPROJECT and Axis-1, the Competitiveness Clusters provided strong interpretive schemes such as:

- A Struggle against dispersed innovative efforts;
- A focus on direct outcomes and the creation of activities;
- The predominance of the industrial targets;
- The leading role of industrial partners.

Through such interpretive schemes, the Competitiveness Clusters policy influenced collaborative behaviors at hand in the project: they enabled collaborators to make sense of the context they acted in and to communicate this meaning to each other; they defined what was normal in the context of MEGAPROJECT and what was not; what should be done in the project or what should not. By providing evidence of this appropriation, I also show that the particularities of Walloon Competitiveness Clusters make them a powerful instrument to enhance collateral assets (Abernathy & Utterback 1978) while also facing potential lock-in. I finally consider the way those Competitiveness Clusters should evolve to favor the exploitation of the emerged outcomes while exploring future opportunities. A good balance between exploitation and exploration as well as adequate networking and clustering instruments to support both objectives appear necessary to ensure sustainability and growth of the involved actors.

This chapter presents the rationale of the Competitiveness Cluster Policy – the empirical field of the thesis – and describes the case study at the level of both MEGAPROJECT and Axis-1. It also identifies the set of interpretive schemes provided by the institutional field: the configuration of the Competitiveness Clusters policy as appropriated by the actors of MEGAPROJECT. This set of rules and resources has a decisive influence on the way the project was designed and conducted: on the types of projects, including the targeted phases of the innovation process (Chapter 7) and on social interactions during its conduct, including power exercises (Chapter 8) (see Figure 3).

In Chapter 7 – the Boomerang complex: iteration and knowledge transfer in joint R&D projects, I explore knowledge exchanges between academic laboratories and their industrial partners as the R&D activities vary between prospect, exploration and exploitation (Q3). This typology recognizes the distinction between exploration and exploitation which is usually proposed to characterize industrial R&D activities (Cesaroni et al. 2005; Chanal and Mothe 2005) or inter-firm R&D alliances (Koza and Lewin 1998; Rothaermel and Deeds 2004) and complements it with the insights from Stokes (1997) that address R&D activities undertaken by universities.

Building on Leonard-Barton (1990), results are drawn from an in-depth longitudinal case study (Axis-1) combined with multiple replicated cases: SP7, SP9 and SP10, three other subprojects from MEGAPROJECT (see Figure 1). Data were collected through semi-structured interviews, documentation as well as observation during plenary meetings and other events such as conferences and team-building events. This approach allows studying iterations between prospect, exploration and exploitation if the project undertakes accelerations or on the contrary faces blocking points. It also takes into consideration the bilateral nature of knowledge flows between partners (Meyer-Krahmer and Schmoch 1998; Baba et al. 2009) and distinguishes four forms of exchanges: Know-Who, Know-What, Know How and Know-Why (Lundvall and Johnson 1994; Johnson et al. 2002).

The goal of this chapter is to contribute to the empirical micro studies of what is learnt, how, and by whom (Johnson et al. 2002) in the context of publicly funded innovation networks like the Walloon Competitiveness Clusters. By documenting how R&D projects can take various forms and evolve along time – in this case from prospect to exploitation and backwards – it also contributes to the development of a dynamic view of knowledge transfer (Faems et al. 2005). As a matter of fact, findings highlight that exploitative, explorative and prospective projects imply specific knowledge flows. In other words, I show that by agreeing on the nature of the project, partners define specific objectives and ways to reach them. Subsequently, I reveal that academic laboratories are not expected to play the same role in projects that differ in nature and have to negotiate their quest for understanding accordingly.

Findings also show that the alignment between the nature of the project and the expected exchanges is a central issue for successful university-industry partnership, especially when the project does not evolve as planned, for instance when the partners are required to go back to more explorative work. **Such an iteration in the R&D project acts as a boomerang that deviates the team from its original – straightforward – targets**, leading to frustrations and divestments in the project if the original alignment is not rethought accordingly.

In Chapter 7 (Q3), I explore how the nature of the project influences knowledge creation and sharing between partners. By doing so, I also focus on knowledge transfer as a *product* of social interactions. By contrast, Chapter 8 (Q1) focuses on knowledge transfer as a *political process*. It explores how partners continuously compete about the definition of the project and the subsequent knowledge flows. As I observed power exercises in Axis-1, I acknowledged that (1) power is not endemic but rather a powerful driver of human cooperation (Giddens 1984, Friedberg 1997) as well as learning (Lawrence et al. 2005) and that (2) power can be exercised by all contributors of the project – whatever his or her position or function – to shape its course.

In Chapter 8 – Let those who love me follow me: power exercises in a joint R&D project, I explore how power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer (Q1). To answer this research question, I followed Axis-1 longitudinally and documented a set of “critical events” during which partners exercised power. A critical event is an observable incident which starts when an actor of the project makes himself heard through a “voice” attitude and which ends as a solution is adopted by the partners. This event comes from an increasing feeling that “*something has to be done differently*” (Holmqvist 2003): it opens a negotiation space in which each partner can propose a solution and thereby activate a power relationship.

Critical events were witnessed in real-life settings during plenary meetings and team building events. They were also remembered by respondents during semi-structured interviews of partners, allowing a focus on behaviors rather than impressions (Hargadon and Fanelli 2002). Their effects were traced through the minutes of the

meetings, especially through the “further actions” section, as well as during subsequent interactions.

The focus on critical events allows observing the interpretive schemes and norms that are the most relevant in the project: one can observe the modalities that are mobilized by the different actors who propose a solution, as well as the one reinforced (or dismissed) by the managers through decision-making. The longitudinal approach of this work also allows witnessing the evolution of such modalities: their reinforcement, transformation or even dismissal in subsequent interactions. The systematic comparison of critical events therefore allows answering the research question “How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer?”: it allows identifying the leverages mobilized by the individuals working on Axis-1 to make sure that knowledge creation and sharing contribute to organizational goals.

Three kinds of leverages are investigated:

- From a structural perspective: leverages that have an influence on the configuration of the project ;
- From a cognitive perspective: leverages that have an influence on the definition of the project and other important interpretive schemes;
- From a relational perspective: leverages that have an influence on the norms that are guiding the way the collaborative research is handled.

From a structural perspective, I identify four main strategies deployed by partners to stimulate knowledge exchanges at the advantage of their organization: *bonding*, the reinforcement of a link in the framework of the collaborative research; *spinning-out*, the creation of a peripheral research between participants; *bridging* towards external actors for the access to complementary resources and, finally, *assimilating* through the integration of new partners to the project. Such linkages are brought to the collaboration through the closure of critical events. They address dissatisfactions about the conduct of the project by stimulating knowledge exchanges but are also used by actors to shape the direction and usefulness of the flows by taking organizational interests into account. Specific risks and stakes ensue.

From a cognitive and relational perspective, the analysis confirms that project managers are privileged actors when defining the relevant interpretive schemes and norms. As such, it outlines the role of managers as seen through an Knowledge-Based approach: *“the role of managers not as directing other people, but as enabling the performance of collaborators by shaping the (inter)organizational context (rules, values, boundaries)”* (Tywoniak 2007). In this case, the Competitiveness Cluster policy and the Marshall Plan of Wallonia have a decisive influence by two complementary ways: on the one hand through the policy configuration (see Chapter 6) and on the other hand by using the Marshall Plan as an incantation, a metaphor (Wallemacq 1998) mobilized to express the ideal of the collaboration and how it should evolve.

Front-line researchers had the opportunity to mobilize another kind of leverage for value creation: the definition of *the set of possibilities* within the collaborative research. In Axis-1, they were able to propose new exploration paths that were interesting for their organization by mobilizing the project’s norms and interpretive schemes as a way to legitimate the proposed activities. Another condition was the support of the academic professor, the “real expert” (ACA8). Finally, when the legitimization failed, front-line researchers were able to resort to hidden sidetracks in order to develop exploratory activities.

Finally, the last part of the thesis – Conclusions – summarizes the main theoretical contributions as well as managerial implications. More precisely, I formulate a set of recommendations for the various strategic actors involved in innovation networks: on the one hand policy makers and public authorities and, on the other hand, collaborative practitioners: industrial and academic partners directly involved in the projects as well as the administrators of the innovation network as this study may provide clues to better manage its projects’ portfolio. I conclude with the limitations of this work and venues for future research.

Chapter 2 PROBLEM STATEMENT

In the previous chapter, I introduce the main driver of the thesis: the exploration of U-I knowledge transfer as a socially-embedded process through a situated approach. In this chapter, I present in more details the process that led to such an approach: the context of Belgian U-I links, the focus on joint R&D projects, the three research questions of this work and its integrating theoretical framework, namely the Structuration Theory.

2.1 UNIVERSITY-INDUSTRY COLLABORATIONS IN CONTEXT

2.1.1 UNIVERSITY-INDUSTRY MODALITIES IN BELGIUM

In their study of European Industry–Science Relations (ISR), Polt and his colleagues (2001b) find out that Belgium rates above European averages for the majority of their performance indicators. In particular, they show that commissioning R&D projects to universities as well as joint R&D projects are important channels for knowledge and technology transfer in Belgium: with 10 % of higher education expenditures on R&D financed by the industry, Belgium is the leading country ahead of Austria, Finland, Germany, Ireland, Italy, Sweden, UK, USA and Japan. The researchers propose three main explanations (Polt et al. 2001a):

- A low level of public funding and thus a pressure to find alternative sources;
- A strong orientation towards research activities rather than teaching tasks in science fields that are the most relevant for the industry;
- The presence of large, R&D intensive companies in technological sectors such as the multinational corporations (MNCs) that participate in MEGAPROJECT.

Public support was not presented as an explanation as they found that, at the time, there was no major financing program for joint R&D activities.

This picture is confirmed by the survey on Belgian University-Industry Relations (UIR) that Prof. Castiaux and I conducted in 2007². Our results show that 77% of Belgium laboratories are actually engaged in U-I links, with some differences depending on the scientific discipline of the laboratory: 95% of laboratories from engineering and technology have on-going links with the industry while only 65% of laboratories concerned with Medical and Health sciences acknowledged having industrial partners (see Figure 4). A chi-square test confirmed the association between scientific fields and the probability to engage in UIR. Godin and Gingras (2000) and Schartinger et al. (2002) find evidence of a similar phenomenon when paring industrial sectors and science fields.

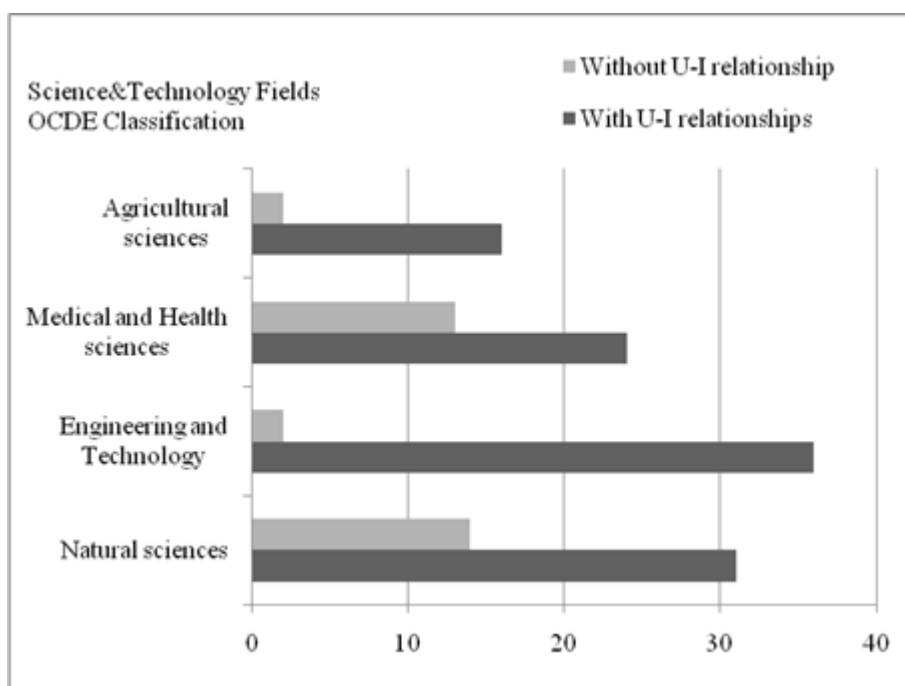


FIGURE 4 UNIVERSITY-INDUSTRY LINKS IN BELGIAN ACADEMIC LABORATORIES

² The response rate of the survey is 14% (140 responses). Respondents are either head of an academic laboratory or a senior associate professor. To assess the reliability of the sample, we performed a Fisher exact test on their responses at the question: “does the laboratory have links with the industry” (binomial outcome: Yes or No).

Industry-Science links refer to the interactions between the industry and the science sector that aim for the exchange of knowledge and technology (Debackere & Veugelers 2005). They are undertaken under various forms, from consulting activities to the mobility of PhDs and students (Debackere & Veugelers 2005, D'Este & Patel 2007). In short, ISR is a multi-faceted phenomenon (Bercovitz & Feldman 2007, Levy et al. 2009) and Belgium is not an exception.

In our questionnaire, we asked the heads of laboratory to assess the frequency of the different forms of U-I interactions (never – rare – frequent – very frequent). In consequence, we got rank-scaled non-metrical data and could only present a ranking of the different U-I modalities (Meyer-Krahmer & Schmoch 1998). The ranking is assessed by a Friedman test with reliability at the 5% level. Table 2 provides the frequency index of each modality, in other words the share of answers with the assessment ‘frequent’ or ‘very frequent’.

TABLE 2 BELGIAN UNIVERSITY-INDUSTRY LINKS: PRIVILEGED MODALITIES

Rank	University-Industry relationships: Modalities	Frequency Index (%)
1	Informal exchanges	66
2	Research services	66
3	Consortium	55
4	Bilateral projects with public support	54
5	Technical services	50
6	Bilateral projects without public support	43
7	Consulting	43
8	Material Transfer Agreement (MTA)	40
9	Committee without financial support	26
10	Formal exchanges of employee(s)	24
11	Seminars	16
12	Patent licenses	14
13	Committee with financial support	13
14	Know-How Licenses	13
15	Training	11
16	Software licenses	6
17	Permanent research structure	3

In Belgium, the most privileged modalities are therefore informal exchanges and contractual research undertaken without the actual intervention of the industrial partner. Joint R&D projects – either on a bilateral or a consortium basis – are also frequently conducted by Belgian academic laboratories and their industrial partners. This is in line with the results of Meyer-Krahmer and Schmoch (1998) who found that collaborative research and informal contacts are the most frequent modalities. Strict technology transfer activities, such as licensing and Material Transfer Agreement (MTA), is less frequent in the Belgian landscape, highlighting the prevalence of pre-industrial knowledge transfer over technology transfer at the level of the laboratory. Results also point to the important role of the laboratory as a subcontractor for research and technical services that can be used to engage and then perpetuate a long-term relationship with an industrial partner. Indeed, like in the context of inter-firm R&D alliances, a formal and punctual arrangement is often part of a richer R&D relationship (Faems 2006). Unfortunately, the survey does not inform about the specific motives of subcontracting which could reveal a dysfunctional relationship if the laboratory considers the U-I link only as a way of doing some cash, delaying its research agenda rather than consolidating it.

2.1.2 MOTIVES FOR UNIVERSITY-INDUSTRY INTERACTIONS

Following Drejer and Jorgensen (2005), universities are less frequent partners of private companies than supplier, customers or competitors. This affirmation is confirmed by Veugelers and Cassiman (2005) in their study of R&D cooperation in the Belgian manufacturing sector. In line with Adams et al. (2001), Veugelers and Cassiman also show that universities are used as a complementary source to existing innovation activities, U-I punctual arrangements being usually embedded in a wider innovative strategy of the firm.

From the point of view of the firm, the motives for engaging in UIR are not to enhance product or process quality (Lee 2000) or to substitute for industrial R&D (Rosenberg & Nelson 1994, Veugelers & Cassiman 2005) but rather to improve their capacity of solving complex problems (Pavitt 1998) and create a “pipe” towards scientific knowledge (Whitley 2003). In other words, firms take opportunity of UIR to access complementary resources and skills, to benefit from research synergies, to keep up with major technological development (Caloghirou et al. 2001,

Carayol 2003) and to access star scientists (Audretsch et al. 2002). From this point of view, the main competitive advantage of universities as a research partner is *“their competence in generating new original findings and new approaches to problem solving”* (Debackere & Veugelers 2005).

From the point of view of the academic partner, a first and general motive for engaging in research collaboration is the social nature of science *“where advances depend crucially on interactions with other scientists”* (Katz & Martin 1997). This is also true in U-I collaborations: as illustrated by Drejer and Jorgensen (2005), *“sole innovators are the exception rather than the rule”*. Other motives for creating links with the industry include additional funds to conduct research and secure staff (Bodas Freitas & Verspagen 2009), access to industrial equipment, field testing of its own research (Lee 2000, Hall 2004), getting industrial technologies and prototypes (Bodas Freitas & Verspagen 2009), enhancing its image (Santoro & Saparito 2003) and developing its network for technology transfer and dissemination of research results (Feller & Roessner 1995, Adams et al. 2005). Finally, other motives are linked to the accountability of universities (Gibbons 1994) that have to legitimize their existence by undertaking research that is relevant for societal progress.

In our survey, respondents were asked to assess the importance (null – marginal – important – decisive) of those motives (see Table 3): direct outcomes of the relationship such as the access to new equipment in the framework of the collaboration, and indirect benefits such as the hiring of students or an enhanced visibility of the laboratory. The relevance index, the share of answers with the assessments ‘important’ or ‘decisive’, reveals that the most important motive is an enhanced visibility of the laboratory, followed by the access to research material, funds to secure staff, data sharing and the generation of new research themes. These outcomes are all significantly more important than the other types of advantages. The ranking is assessed with a Friedman test with reliability at the 5% level.

TABLE 3 OUTCOMES AND ADDITIONAL BENEFITS

Rank	Outcomes and additional benefits	Relevance Index (%)
1	Visibility	61
2	Material sharing	58
3	New staff	57
4	Data sharing	56
5	New research themes	55
6	Technology Transfer	40
7	New equipment	36
8	Equipment sharing	34
9	Student hiring	33
10	Researcher mobility	33
11	New Know-How	32
12	New teaching themes	14

Note that even if visibility is ranked first, other motives were assessed as “decisive” by a higher number of respondents: funds to secure the laboratory staff, data and material sharing, access to new equipment. We explain this result through the importance of industrial cash flows for the conduct of daily research and thus the survival of the laboratory. Another interesting point lies in the fact that the academic laboratory uses its contact with the industrial field to enrich its research agenda but not its teaching activities. This might be explained by the strong orientation towards research activities observed by Polt et al. (2001a).

2.1.3 OUTPUTS OF UNIVERSITY-INDUSTRY COLLABORATIONS

While the literature draws a lot of attention to the motives for ISR, it has somewhat neglected the concrete outputs of those collaborations, such as new products or processes, publications or databases. In Belgian UIR, the most frequent outputs (see Table 4) are knowledge-based products (Santoro & Saporito 2003): presentations in conventions and conferences, publications and thesis (outputs frequent or very frequent for more than 50% of the respondents).

TABLE 4 OUTPUTS OF COLLABORATIONS

Rank	Outputs of University-Industry relationships	Frequency Index (%)
1	Presentation	69
2	Publication	66
3	Thesis	52
4	Co-publication	39
5	New process	32
6	New product	29
7	Prototype	27
8	Co-presentation	25
9	Patent	16
10	Software	15
11	Sample collection	15
12	Database	12
13	Patent lic.	10
14	Software lic.	7
15	Know-How lic.	5
16	Copyright	3

This is consistent with the weak pressure felt by the laboratories concerning their exchanges with the scientific community: 73% of the respondents consider that limitations of exchanges between researchers due to the U-I link are marginal or null. Those results also confirm “*the importance of a perspective of open, non-exclusive exchange*” in U-I cooperation as highlighted by Veugelers and Cassiman (2005).

After the knowledge-based outputs come the pre-industrial outputs: new processes, new products and prototypes. Those outputs materialize the scientific knowledge of the laboratory into concrete pre-industrial applications but are less frequent than publications and presentations. It might be explained by the exploratory nature of the research undertaken by the laboratory (for a discussion on this subject, see Chapter 7) as well as by the development activities that are needed inside the firm after the collaboration.

This phenomenon was clearly showed in our preliminary study (see Hermans & Castiaux 2007). As one respondent pointed out:

There are some research results which allow having something in one or two years but we are not informed. (...) In general, after the work of the university, it takes at least one year for the firm to say “I have finished”. There is still one year of inside work.

After pre-industrial outputs come the pieces of knowledge protected by Intellectual Property (IP) instruments such as patents, software licenses and copyrights.

2.1.4 IMPACT OF UNIVERSITY-INDUSTRY COLLABORATIONS

U-I collaborations contribute to the daily running of the laboratory and its production of scientific knowledge, but it also impacts the conduct of research activities. The research community has devoted some efforts to study those “unintended consequences” (Behrens & Gray 2001) which are usually considered as negative effects (Carayol 2003). Dasgupta and David (1994) for instance question the impact of industrial norms on the collective knowledge production process of the research community. Lee (1996) also draws attention to some potential threats towards basic research. In fact, two main concerns are raised (Azagra Caro et al. 2003): the lock-in (Meyer-Krahmer & Schmoch 1998) that may result from privileged U-I relationships and the negative impact of U-I collaborations on the quality of academic research, or in other words the “contamination” of academic research by the applied orientation of industrial partners (Van Looy et al. 2004). In order to confront those concerns with empirical evidence, Van Looy et al. (2006) study the interactions between patenting and publication activities and find a reinforcing effect of both behaviors. The same conclusion is reached by Blumenthal et al. (Blumenthal et al. 1996, Blumenthal et al. 1997) in their study of the interactions between publication behavior and industrial sponsoring. Finally, Behrens and Grey (2001) found that PhD candidates involved in applied research are less likely to produce knowledge-based outcomes but they also highlight that this production is not influenced by the presence of an industrial partner.

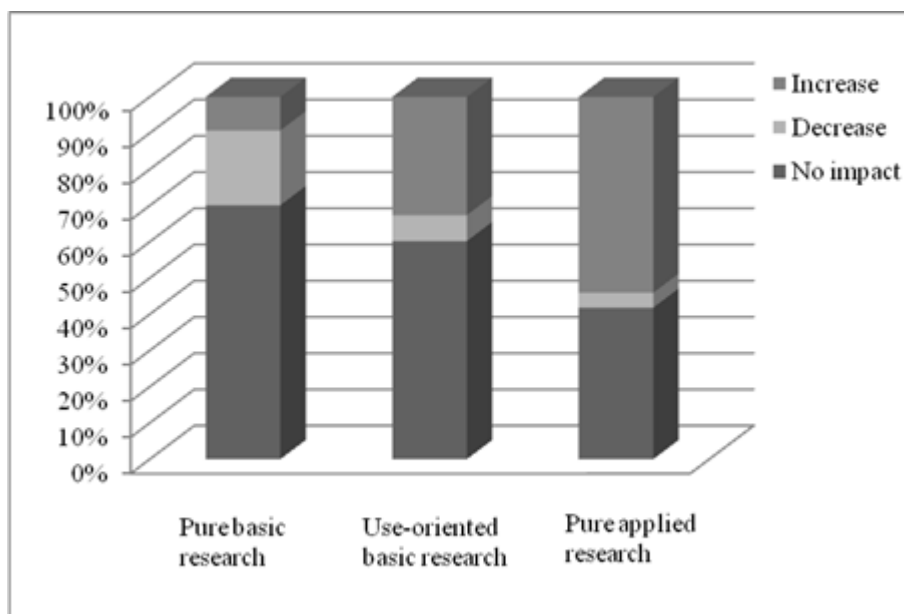


FIGURE 5 IMPACT ON RESEARCH ACTIVITIES

Concerning the impact of Belgium UIR on academic laboratories, 54% of our respondents reported an increase of pure applied research (see Figure 5). Nevertheless, more than 60 % of the respondents also consider that their links with the industry have no impact on their basic research activities. Concerning the publications generated through Belgian U-I collaborations, collaborators usually adopt non-disclosure agreements which include clauses about information withholding or delays. While this phenomenon is quite frequent (40% of the Belgian laboratories are frequently or very frequently faced with delays agreements and 62% of the respondents are concerned with withholding clauses), its actual impact is less problematic: an effective withholding of information is frequent for only 22% of the laboratory while 86% of the respondents consider the inconvenience of the delays as marginal or null.

U-I collaborations also have an impact on the research agenda of the laboratory. As seen supra, the collaboration as a source of new research theme is important for the laboratory (see Table 3 p. 32). But once again, one should distinguish functional relationships, where the laboratory enriches its research agenda through its confrontation to the field, from dysfunctional relationships which are undertaken essentially to preserve funding (Carayol 2003). Concerning research practices, the

impact of collaboration is judged null or marginal by more than 60% of the respondents. Nevertheless, respondents acknowledged a positive impact of industrial collaborations on the enhancement of reliability, the transition from “best-efforts obligation” to “results obligation” and a better respect of delay. Finally, the U-I collaborations tend to limit scientific exchanges with companies not involved in the on-going collaborations. As a matter of fact, more than the half of the 1088 partnerships reported in this survey are more than five years old, allowing the constitution of privileged relationships between the laboratory and its industrial partners and, as expected, limiting exchanges with other companies. The industrial partners of our respondents come mainly from the same Region than the laboratory (42 %), from another country member of the European Union (24 %) and from another Belgium Region (22 %).

2.2 THE INSTRUMENT UNDER STUDY: THE JOINT R&D PROJECT

2.2.1 DEFINITIONS

As confirmed by the literature (Meyer-Krahmer & Schmoch 1998, Schartinger et al. 2002) and our survey, collaborative research is a privileged form of U-I interaction. It is also the modality that was chosen by the Walloon Region to structure the partnerships in their Competitiveness Clusters (Gouvernement Wallon 2005, Bayenet & Capron 2007). In this section, I review the definitions used in the literature about collaborative research as well as the vocabulary used in this work.

From its Latin roots, the word collaboration implies the working together of individuals. In the case of research collaboration, it usually means the working together of scientists to achieve a common goal, namely the production of scientific knowledge (Katz & Martin 1997). As highlighted by Katz and Martin, this definition is not without flaw: it poses the problem of the fuzzy border of collaborations, which at one extreme could include the world scientific community (we are all contributing to the same goal) and at the other extreme would never really exist as it is quite rare that one researcher contributes directly to all the main research tasks over the whole duration of a research project. At the light of U-I collaborations, another flaw shows up: the consensual goal is not always the production of scientific knowledge. Specifically, the joint R&D projects financed through the Competitiveness Clusters of Wallonia “*either target the concrete realization of industrial applications within*

three years, or the building of a prospective vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster” (Gouvernement Wallon 2005). Even if universities are mandatory collaborators, the production of scientific knowledge is left aside in favor of the industrial interests: the development of innovation and of common perspectives about the future competitive landscapes.

When focusing on formal R&D projects and searching for a narrower definition in the literature, one still finds a plethora of possible names and definitions (see Table 5 for a non-exhaustive set) such as R&D cooperative agreements (Mora-Valentin et al. 2004), collaborative R&D projects (Barnes et al. 2002), collaborative research (Landry & Amara 1998, Debackere & Veugelers 2005), collaborative research projects (Davenport et al. 1999) and public-private collaborations (Drejer & Jorgensen 2005).

TABLE 5 UNIVERSITY-INDUSTRY JOINT R&D PROJECTS IN THE LITERATURE

Paper	Name	Definition
Landry and Amara (1998)	Collaborative research projects	Exchange relationship in formal research projects undertaken by universities researchers and other research partners.
Davenport et al. (1999)	Collaborative research Project	Projects undertaken as part of the TBC collaborative R&D program.
Santoro and Gopalakrishnan (2000)	Industry–University collaborative ventures	Collaboration between industrial firms and university research centers (I/U relationships) through R&D projects.
Rogers and Bozeman (2001)	Knowledge Value Alliance (KVA)	Institutional framework binding together, in a knowledge covenant, a set of directly individuals from multiple institutions, each contributing resources in pursuit of a transcendent knowledge goal.
Barnes et al. (2002)	Collaborative R&D project	No formal definition. Six case studies involving Warwick Manufacturing Group and a number of industrial partners.
Schartinger et al. (2002)	Collaborative research and joint research program	Collaborative research and joint research program characterized by the formalization of interactions, the transfer of tacit knowledge and personal contacts.
Mora-Valentine et al. (2004)	R&D cooperative agreements	National cooperation agreement in research and development where at least two partners are involved: a firm and an external organization specialized in the research and provision of technological services.
Johnson and Johnston (2004)	Collaborative R&D project	No formal definition. Cases of projects through which “organizations collaborate to create technical knowledge”.
Drejer and Jorgensen (2005)	Public-private collaboration	Case studies of projects involving a company and a national research lab.
Debackere and Veugelers (2005)	Collaborative research	Collaborative research, i.e. defining and conducting R&D projects jointly by enterprises and science institutions, either on a bi-lateral basis or on a consortium basis.

The articles in Table 5 focus on U-I modalities which are characterized by two important features. First, the U-I collaboration is embedded in a formal research instrument: the joint R&D project (Landry & Amara 1998, Schartinger et al. 2002), either on a consortium or a bilateral basis (Debackere & Veugelers 2005). Second, they imply a specific collaborative relationship between partners within the formal covenant:

- Partners are actively engaged in the definition of the project as well as in its actual conduct (Debackere & Veugelers 2005).
- The knowledge flows are bidirectional (Landry & Amara 1998, Meyer-Krahmer & Schmoch 1998) and include tacit exchanges (Schartinger et al. 2002) thanks to direct interactions (Rogers & Bozeman 2001).

In this work, I thus use the term “joint R&D project” to speak about the formal covenant that links the partners together: the formal instrument used to undertake their research collaboration. The term “collaborative research” is also used when speaking about the “*exchange relationships in formal research projects undertaken by university researchers and other research partners*” (Landry & Amara 1998). In other words, the “joint R&D project” is the backbone of the “collaborative research” which only exists if the academic laboratory and its industrial partners actually work together.

2.2.2 CHALLENGES IN JOINT R&D PROJECTS

The collaborative research undertaken under the framework of a joint R&D project has several strong theoretical advantages. First, the formalization of interactions through a shared covenant defines precisely the objectives and responsibilities of each partner to ensure the success of the collaboration (Barnes et al. 2002). Secondly, it is a strong form of partnership (Landry & Amara 1998) inducing a favorable environment for trust building. Thirdly, the frequent personal contacts result in an efficient collaboration and the transfer of tacit knowledge between partners (Schartinger et al. 2002). On the basis of such assumptions and the general belief that collaborations are “*good things and should be encouraged*” (Katz & Martin 1997), the collaborative research project has received a growing attention in recent years, both from public concern (European Commission 2000, OCDE 2003,

Gouvernement Wallon 2005), the academic world (Davenport et al. 1999, Hall 2004, Johnson & Johnston 2004) and practitioners.

For universities, the U-I collaborative research project is a way to obtain funds for research assistance or equipment (Hall 2004). It also allows for the confrontation of theoretical findings with field testing. Besides, academic research appears as a complementary source of knowledge for firms reluctant to collaborate with competitors on strategic projects. Finally, the collaborative project enables the access to unique competences for the generation of original findings and the development of new approaches to problem solving (Debackere & Veugelers 2005). Government, the third actor of the innovation process (Etzkowitz & Leydesdorff 2000), supports collaborative researches as it should develop regional economy and social cohesion.

However, U-I collaborative research may experience some difficulties. For instance, actors involved in public-private partnerships recognized a certain discrepancy between academic and industrial languages. As shared language is a major factor of absorptive capacities (Cohen & Levinthal 1990), this should have some impacts on the way knowledge is transferred and used. They also conduct different “styles” of R&D. As expressed by Mowery and Ziedonis (1998), it is still difficult to bridge differences between research center, aiming at the quest for fundamental understanding, and the companies’ researchers who aim at the completion of milestones. Another problem is linked to the difficulties to effectively appropriate commercial benefits from consortiums (Teece 1986) and more precisely the conflicts over IP between university administration and companies (Bruneel et al. 2010). Other usual threats in alliances include: incompatible organizational routines and cultures (Das & Teng 1999), limited commitment of partners (Blomqvist et al. 2005), opportunistic actions (Deeds & Hill 1999) and learning race (Alvarez & Barney 2001).

These threats challenge the creation and sharing of knowledge at stake in collaborative research, especially between partners that promote different systems of knowledge production (Dasgupta & David 1994, Bruneel et al. 2010). If the U-I joint project is a privileged mean to access scientific knowledge and academic competences (from the point of view of the firm) or to confront scientific knowledge

to the field (from the point of view of the academic laboratory), then it is important to understand how norms from both systems are handled by partners while agreeing about a research object as well as during the actual conduct of the collaborative research.

2.2.3 KNOWLEDGE TRANSFER THROUGH JOINT R&D PROJECTS

As seen in the previous sections, the knowledge created in the academic sphere takes various paths before finally reaching a competitive recipient, from patents and licenses to research publication or consulting. Actually, knowledge is created throughout the three main functions of universities: the education of workers-to-be, the development and dissemination of research activities, and their active participation to social and economic development which has led to the concept of entrepreneurial universities (Etzkowitz & Leydesdorff 2000, Van Looy et al. 2006).

We can distinguish between two broad ways to approach U-I knowledge transfer as an empirical research object: untargeted and targeted knowledge transfer (see Table 6). In “untargeted knowledge transfer”, knowledge diffusion occurs from universities to the industry through a one-way flow of basic and mostly public knowledge (Blankenburg 1998, Etzkowitz et al. 1998); knowledge is created by the universities without any identified target and anyone – in other words any firm – can access it freely. Traditional instruments of open sciences (i.e. publication, conference proceedings) as well as patents through their mandatory publication are associated with this perspective which examines the transfer of codified knowledge originating from academic institutions. Nevertheless, researchers from this perspective³ (Jaffe & Trajtenberg 1998, Autant-Bernard 2001) do not assert the superiority of codified knowledge over tacit exchanges. On the contrary, the study of untargeted knowledge transfer usually assumes that technological transfer has a highly tacit component which is difficult to observe but which leaves marks in codified sources. Such marks include citations in a patent description (Sapsalis et al. 2006) or U-I co-authorship in academic journals (Calvert & Pattel 2003).

³ Please note that this affiliation is the result of my analysis and has not been endorsed by the authors involved.

TABLE 6 UNIVERSITY-INDUSTRY KNOWLEDGE TRANSFER (KT)

	Untargeted KT	Targeted KT
Direction of flows	$U \Rightarrow I$	$U \Leftrightarrow I$
Nature of observed knowledge	Public, codified knowledge	Private, both codified and tacit knowledge
Privileged instruments for knowledge transfer	Publication, conference proceedings, patent	Consulting, collaborative R&D projects, exclusive licenses
Foundational theoretical streams	Traditional economic analysis	Knowledge-Based View of the firm
Appropriate research methods	Quantitative methods	Qualitative methods

The second approach has regards with “targeted knowledge transfer” between a university and one (or more) specific partner(s), like in licensing, consulting, or joint R&D projects. This perspective suggests a specific meaning of the knowledge interactions: while the university is seen as the central source of knowledge in “untargeted knowledge transfer”, reaching recipients in a one-way relationship, “targeted knowledge transfer” acknowledges the existence of critical feedbacks from the recipient as the interactions eventually affect both partners in their research and transfer activities. Besides, it presents the knowledge interactions as instruments for knowledge creation and sharing than just transfer. Finally, it recognizes that the scientific production of academic laboratories is not always public as the collaboration gives partners the opportunity to secure knowledge appropriation. It is important to note that this appropriation is caused by contractual agreements as well as by the tacit nature of knowledge when transferred through direct interactions.

Untargeted and targeted knowledge transfers are supported by different but complementary theoretical streams, research tools and methodological approaches. On the one hand, the “untargeted” approach has been influenced by mainstream

economics (Nooteboom 2000) which consider innovation as a “linear sequential stage-model, a one-time transfer from science downstream to technology and the market” (Blankenburg 1998). A quantitative approach has been generally used to understand and measure knowledge flows under an explicit form such as patents and other formalized sources. On the other hand, targeted knowledge transfer builds on the Knowledge-Based View (KBV) of the firm and the literature on organizational knowledge creation. From a methodological point of view, a qualitative approach should be more suitable to fully explore knowledge flows (Lockett & Thompson 2001) occurring through targeted knowledge interactions: a qualitative approach would give the researcher deeper insights about the transfer processes as well as about the collaboration links and their consequences (Feller & Roessner 1995).

In the field of U-I knowledge transfer, the literature has focused on untargeted knowledge transfer, studying various channels of knowledge transfer but focusing on publications and patents citations as sophisticated spillovers indicators (Breznitz & Feldman 2010). By providing evidence of spatial effects, studies like Jaffe (1989) or Audretsch and Feldman (1996b) have been crucial for our understanding of the role of tacit exchange in U-I knowledge transfer but this literature fails to uncover the sharing processes at stake in specific relationships. In fact, the way by which tacit and codified knowledge is exchanged between partners through consulting, joint R&D projects or even sponsorship is still relatively unknown (Agrawal 2001). As suggested by Agrawal (2001), *“there is a need for further research that specifically examines the nature of those channels less studied”* by which *“firms may benefit significantly”*.

In this thesis, I propose to partly fill this gap by investigating one of those “channels less studied” – the joint R&D project – as an instrument for targeted knowledge transfer: the interactions that occur between partners for knowledge creation and sharing within a common covenant. This choice supports qualitative research as an adequate research strategy as it takes into account the significant tacit component of knowledge flows as well as people-related concerns proper to U-I collaborative research (Davenport et al. 1999). From a theoretical point of view, this choice implies three basic assumptions that guided my doctoral work and form the keystone of the advocated situated approach of U-I knowledge transfer.

(1) The recognition of U-I relationships as a two-way relationship rather than a linear arm's length transaction.

As a result, I adopt an interactive approach (Santoro & Saporito 2003), a perspective that has gain more attention since the work of Ring and Van de Ven (Ring & Van de Ven 1992,1994) on inter-firm cooperation. Empirical evidences (Harmon et al. 1997) as well as theoretical arguments (Meyer-Krahmer & Schmoch 1998) support the two-way relationship between universities and firms resulting from such an approach. As a matter of fact, the joint R&D project has attracted a lot of attention in the literature as a collaborative tool (see for instance Table 5). As illustrated in the first part of this chapter, generic motives for collaborations and barriers inhibiting partnership activities were investigated; other studies focus on the collaborative experience through the examination of success factors, using multiple research methodologies, from case studies to quantitative analysis of contextual and organizational factors (Barnes et al. 2002, Mora-Valentin et al. 2004). However, the success of knowledge transfer is not equal to the success of its dedicated activities (Davenport et al. 1999, Bozeman 2000): successful resources and deadlines management may support the success of the project even if knowledge transfer has been neglected. As a result, there is still a need to investigate the joint R&D project as a context for targeted knowledge transfer.

(2) The importance of knowledge creation and sharing rather than just transfer⁴.

This distinction has been recognized by researchers interested in inter-firm learning and knowledge transfer (see Jiang & Li 2009) who call for an exploration of both processes (Lubatkin et al. 2001, Faems et al. 2007) as their distinctive and combined

⁴ More precisely, I consider that, per definition, sharing entails creation. This idea is better expressed by Tywoniak (2007): "*Much like remembering for an individual involves the re-production of a memory, the process of sharing knowledge within a community of practice is only complete when it is recreated in action*". As a result, the distinction between "creation" and "sharing" is metaphorical but it facilitates the communication of findings towards practitioners as well as towards the research community dedicated to the study of inter-firm learning.

effects are still to be explored. As a result, knowledge transfer always refers to both processes in this thesis. As a matter of facts, preliminary researches (see Hermans and Castiaux 2007; Hermans and Heck 2009) highlight that knowledge creation does not automatically imply sharing in the project: the laboratory might share existing knowledge with its partners while it may also create new scientific knowledge and keep it from other participants in the project.

(3) The importance of actions (Nooteboom 2000, Anderson 2003), especially social interactions, for transferring knowledge rather than technology and formal appropriation (Pfeffer & Sutton 1999).

Behind this assumption lies a view of cognition as *a situated activity*, suggesting that “*thinking beings ought therefore be considered first and foremost as acting beings*” (Anderson 2003 p. 91). It also acknowledges the socially-embedded nature of knowledge production (von Krogh & Roos 1996, Bozeman 2000, Dietz & Bozeman 2005) and innovations (Alter 2000, Baba & Walsh 2010). In particular, there is a growing consensus that failing to incorporate social factors such as organizational politics undermines our ability to understand and predict learning processes (Lawrence et al. 2005).

These assumptions form the keystone of a situated approach of U-I knowledge transfer and imply a three-fold shift from existing studies in the literature:

- A shift from the knowledge flow to the knowledge interaction as the main research object;
- A shift from instrumental factors to social factors (Sargis-Roussel 2005) to understand targeted U-I knowledge transfer;
- A shift from the (inter)organizational level to the interpersonal level (Grabher & Ibert 2006) as the main level of analysis.

From this perspective, I take into consideration a twofold process of interest alignment: vertically when actors from various organizations and functions develop interdependencies and are supposed to contribute to a consensual goal in the project; horizontally as members of a given organization do not automatically align personal and (inter)organizational interests (see Chapter 8).

2.3 RESEARCH QUESTIONS

2.3.1 THE GENERATION PROCESS

For Yin (1994), the first component of a research design is the study's questions. Maxwell (2005) also recognizes the central role of this component in its interactive model of research design. However, designing a research question may be the most difficult task for the researcher who may identify interesting research questions by exploring potential "issues" (Stake 1995) faced by practitioners.

In this thesis, potential issues in U-I joint R&D projects were explored in a twofold way. First of all, the literature in the field of knowledge transfer, U-I interactions and organizational learning offered some insights about gaps in their knowledge base as well as about potential issues in the context of U-I alliances. For instance, Cyert and Goodman (1997) suggest that: *"the essential issue (in U-I alliances) is whether these relationships create learning for a few individuals or whether the learnings are diffused throughout the organization"*. Focusing on learning within inter-firm alliances, Inkpen and Pien (2006) show that *"learning opportunities could be unrealized due to inability to identify and understand the knowledge that underpins partner skill differences"*. University-Industry collaborations might suffer from the same problem due to the difficulties to bridge differences between research centres and companies' perspectives on R&D practices (Mowery & Ziedonis 1998). As a result, *"future research on group learning needs to be more explicit about why groups focus on certain objects in their environment but not others, and how groups develop a shared understanding about using their knowledge in the future"* (Wilson et al. 2007).

Secondly, potential issues emerged from the empirical field through the picture of the Belgian ISR drawn by the 2007 survey as well as through a preliminary interview-based study (see Hermans & Castiaux 2007) that was performed in order to gain a better understanding of the context and to identify potential research questions. This study was a first attempt to understand the knowledge flows underlying the research work performed through joint R&D projects. It highlights knowledge-based limits to the reconciliation process that lead to limited research diffusion and organizational learning, but it also confirms the importance of the third role of university, namely participation to economic development. In other words, it

confirms the feasibility of reconciliation when engaging in technology efforts (Van Looy et al. 2006) while it also shows that the knowledge processes may suffer from it. In fact, it remains true that: *“the impact of industrial partnerships on knowledge diffusion and circulation is one of the most controversial issues in economic and sociological literature on University-Industry collaborations”* (Cassier 2002).

One main issue emerged from both the literature and the empirical observations: given the difficulties of the firm to appropriate returns from U-I consortiums (Teece 1986), how can its employees influence the knowledge creation and sharing processes of the project to make sure that it contributes to organizational strategies? From the point of view of the academic partner, how do the researchers ensure a functional relationship with the firm while also contributing to the scientific excellence of the laboratory? As a result, a first research question emerged: Q1 – How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer?

Two case studies from the Competitiveness Cluster framework were initially selected to study this research question (see Chapter 5 – Methods) and led to two additional issues: the impact of a given innovation policy on the collaborative behaviors of the partners and the role of academics in projects that target different phases of the innovation process, from use-oriented basic research to pure applied R&D. Two additional research questions were therefore explored:

Q2 – How did the Competitiveness Cluster Policy influence collaborative behaviors in a joint R&D project?

Q3 – How does the nature of the R&D projects influence knowledge transfer between partners?

In the following sections, I explain in more details how those research questions emerged and became relevant for both the research community and practitioners. The relevance of each research question is questioned through theoretical reflections as well as through evidence from the empirical field. Theoretical and practical contributions of the thesis ensue.

2.3.2 Q1 – IMPACT OF POLITICS ON U-I KNOWLEDGE TRANSFER

Apart from rare exceptions like Easterby-Smith et al. (2008) or Lawrence (2005) and despite the growing recognition that researchers should focus on their intertwining for the understanding of learning processes (Ekbja & Kling 2003, Peci et al. 2009), knowledge and power are two concepts that are rarely combined in the field of knowledge management, organizational learning or even innovation studies. The same conclusion is reached by Blankenburg (1998) who highlights that both the neo-classical schools of thought and the Knowledge-Based approach on U-I collaboration over-emphasized the role of cognitive factors at the expense of the political dimension. For Sargis-Roussel (2005), two reasons might explain this phenomenon: from a theoretical perspective, knowledge management has its roots in modeling and system theory, with little interest for power issues; from an empirical perspective, power relationships and their effects are difficult to observe and therefore are somewhat neglected by the research community. A third explanation, which in fact encompasses the two reasons above, is of epistemological nature and may explain why power issues have been neglected in the scientific discourse about knowledge in organization (see Chapter 3 – Epistemology).

However, it is clear from our preliminary study that the political factor is an important driver of U-I knowledge transfer: the R&D collaboration is expected to advance the objectives and strategies of the parent organizations (Luukkonen 1998) but what happens when such objectives and strategies are per nature diverging (Dasgupta & David 1994) ? As one respondent noticed (IND9)⁵:

The company is not looking for publications; on the contrary, it will often hold back publications, at least up to the deposition of a patent, while universities use it as a tool to be seen.

But interest conflicts go beyond the well-known issue of secrecy versus publication. In the preliminary study, I noticed that another alignment process is affecting the conduct of the collaboration: the alignment between the project's goals, the parent

⁵ When I cite or refer to industrial respondents, I use (INDx), while I use (ACAx) for academic respondents. See appendix 5 for an exhaustive list of data sources.

organizations' objectives and the personal interests of the researchers hired on the project. Indeed, the people in charge of social interactions and subsequent knowledge transfer are not the head of the laboratory but rather the junior and senior researchers hired for the project. These researchers are usually hired on a fixed-term basis and subsequently dedicate a lot of attention to their role of "entrepreneur of their own human capital" (Grabher & Ibert 2006), sometimes at the expense of their roles of "laboratory member" or "project participant".

Subsequent tensions affect the search for academic excellence of the laboratory as well as collaborations with its industrial partners: the high turnover of researchers in academic laboratory is pinpointed as an impending factor for U-I collaborations. As a matter of fact, when asked if she had a last comment about U-I R&D collaborations, one respondent (head of an academic laboratory) claimed that:

I don't have a problem. I think the only problem, when managing a lab like mine, is the continuity of knowledge and the hiring of researchers (...) what I try to do is to keep people, because they acquired a Know-How, and it would be a pity to develop this Know-How all over again.

Industrial partners recognize that problem, as expressed by another respondent (IND4):

The durability of academic knowledge, or of the collaboration, is problematic (...) the piling up of knowledge, the accumulation, the learning curve, actually it could be really better.

As a result, the following research question was proposed to explore joint R&D project: Q1 – How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer? This research question poses that the R&D collaboration is expected to contribute to organizational objectives (Luukkonen 1998) but it also recognizes that the personal interests of operational researchers might interfere with their role of organizational members and research partners. Indeed, because partners must be convinced to cooperate, power and politics are critical issues in collaborations (Phillips et al. 2000).

By exploring this topic, I contribute to the KBV in two intertwined ways. First of all, I focus on social factors rather than instrumental factors to study U-I knowledge transfer: I explore how social interactions inside a joint R&D project shape the

processes of knowledge creation and sharing between partners. Secondly, I challenge the automatic alignment of interest between employees and their organization, a hypothesis which is nevertheless largely shared within Knowledge-Based streams (Felin & Foss 2005, Hermans & Lederer 2009).

As I focus on power relationships, I acknowledge that power is not endemic but rather a powerful driver of human cooperation (Giddens 1984, Friedberg 1997) and organizational learning (Lawrence et al. 2005) and that power can be exercised by all contributors, whatever his or her position in the project. This focus on social factors rather than instrumental factors (Sargis-Roussel 2005) should contribute to our understanding of localized interactive learning and knowledge appropriation by the parent organizations (Lawrence et al. 2005). This is important for the laboratory that wishes to contribute to its research community as well as for the firm that expects a positive return from the efforts put in the collaboration. This is especially relevant in the context of the Competitiveness Clusters policy as the Walloon Government formally favors interactions between academic laboratories and firms in the hope that it will stimulate regional economic development. From a practical point of view, the goal of this research is to make visible the leverages that collaborative practitioners can mobilize inside the joint R&D project in order to contribute to organizational goals while preserving inter-organizational and personal interests.

2.3.3 Q2 – IMPACT OF THE COMPETITIVENESS CLUSTER POLICY ON U-I COLLABORATIONS

After the preliminary study, I identified the longitudinal case study as the most interesting research strategy to explore Q1 (see Chapter 5 – Methods) and took opportunity of the Marshall Plan for Wallonia to select two U-I joint R&D projects. Those projects were financed by the Competitiveness Clusters of Wallonia, a new R&D policy that was launched by the Walloon Government as part of their “Priority actions for the future of Wallonia” (Gouvernement Wallon 2005).

While the political dynamics behind knowledge sharing were my first research target, I quickly realized that beyond the understanding of such processes, I should also understand the institutional context of the projects. In this case, it meant to understand and critically assess the policy that was designed by the Walloon

Government to influence the collaborative behaviors of collaborative practitioners from universities and firms. From a theoretical perspective, this issue – the difference in partners' behavior resulting from an intervention of public authorities – is conceptualized by Georghiou and his colleagues (Buisseret et al. 1995, Georghiou 2003) as behavioral additionality. It refers to changes in the processes that take place within the firm (Clarysse et al. 2009) or, in our cases, within the collaborative research.

The concept of behavioral additionality was developed by the research community to complement the assessment of innovation policy which was mainly performed through the study of input and output additionalities. On the one hand, input additionality studies focus on how many additional Euros are spent by the firm for every Euro received in subsidy (Falk 2007). On the other hand, output additionality *“deals with the question of how much additional output would not have been foregone without this same amount of public funding”* (Clarysse et al. 2009): additional outputs such as publications, new products or patents generated thanks to the initiative.

Behavioral additionality was proposed as a way to complement existing studies because public initiatives sometimes have a direct impact on the way companies conduct their R&D activities but this impact might lead to input or output additionalities only in the long term (Clarysse et al. 2009). For that reason, the study of behavioral additionality is especially relevant in the context of cluster initiatives, when the policy targets the systemic character of the innovation process (Bellandi & Caloffi 2009) and supports “soft” goals such as the development of human and intangible capital (Van Haepelen et al. 2009). As confirmed in Clarysse et al. (2009), learning objectives and short-term additionalities are different objectives for policy makers and the evaluation of the policy at hand should reflect this concern. Nevertheless, the concept of behavioral additionality is still in its infancy (Autio et al. 2008, Clarysse et al. 2009) and the literature would benefit from more empirical works about the mechanisms at hand.

While a given policy cannot be assessed on the basis of a single case, this case-study research nevertheless allows for an in-depth exploration of behavioral effects at the project level, namely the effects of the policy on the collaborators' behavior during

the project. The resulting research question is therefore: Q2 – How did the Competitiveness Cluster Policy influence collaborative behaviors in a joint R&D project? Through this research question, I present the rationale of the Competitiveness Clusters policy and I study its impact on the way local companies and knowledge institutions actually organized and conducted their collaborations. The outcomes are twofold: a deeper understanding of the effects of program configuration on collaborative processes and a highlight of potential pitfalls. These outcomes should help policy makers to learn from the Walloon case.

2.3.4 Q3 – IMPACT OF THE INNOVATION STAGE ON KNOWLEDGE TRANSFER

The third and last research question also emerged through the iterations between the empirical field and a knowledge gap in the literature. The research question “Q3 – How does the nature of the R&D project influence knowledge sharing between partners” has regards with the uncertain role of university as a research partner according to the more or less mature stage of the innovation process targeted by the project.

In the literature, the role of public science in the innovation process is a recurrent topic. Since Vannevar Bush (1945) and earlier works about the linear model of innovation, basic research has been presented as an important source of ideas for applied R&D and technology (Balconi et al. 2010). As claimed by Bush: “*Basic research leads to new knowledge. It provides scientific capital. It creates the fund of new knowledge from which the practical applications of knowledge must be drawn*” (Bush 1945). Following this principle, university is seen as an essential actor in the Knowledge Society (Klevatorick et al. 1995, Nerkar & Shane 2003) through two distinct means: the construction of the knowledge basis and the supply of applied knowledge (Etzkowitz & Leydesdorff 2000, Cooke & Leydesdorff 2005).

As a scientific construct, the linear model has been systematically questioned by the research community (Godin 2006, Balconi et al. 2010), appended with potential iterations (Kline & Rosenberg 1986) as well as temporal and cognitive lags (Balconi et al. 2010) such as the “death valley” (Ford et al. 2007) or the “Darwinian sea” of innovation (Auerswald & Branscomb 2003). In spite of those discussions, the metaphor behind the model is still influencing innovation policies which support the

rapprochement of universities and firms in order to “get the dynamics right” between exploration and exploitation (Blankenburg 2000).

Basic Research =>Applied Research =>Development =>(Production and) Diffusion

FIGURE 6 THE LINEAR MODEL OF INNOVATION, BASED ON GODIN (2006)

In the context of the Competitiveness Clusters, the Walloon Government explicitly proposes two kinds of joint R&D projects: “*those projects either target the **concrete realization** of industrial applications within three years, or the building of a **prospective** vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster*” (Gouvernement Wallon 2005). In both cases, universities are presented as mandatory research partners, without reflections about the specific roles of academic laboratories following the nature of the project. However, the literature on inter-firm R&D (Koza & Lewin 1998, Cesaroni et al. 2005) teaches us that exploratory and exploitative R&D alliances provide partners with different learning opportunities, urging for a dynamic view of knowledge transfer (Faems et al. 2007). As universities are usually associated with exploration (Rothaermel & Deeds 2004, Bercovitz & Feldman 2007) rather than exploitation, it should be useful to understand the role of academic laboratories as privileged research partners in the Competitiveness Clusters.

As a result, practitioners should benefit from a systematic analysis of the role of partners in projects that target a more or less mature stage of the innovation process. Findings should be of interest for the various strategic actors involved in innovation networks: public authorities in charge of the policy, industrial and academic partners directly involved in the projects as well as the administrators of the network as this study may provide clues to better manage its projects’ portfolio.

2.3.5 TOWARDS AN INTEGRATIVE THEORETICAL STREAM

The three research questions explored in this work foreground to different sub-fields of innovation study, a scientific discipline which is itself still emerging (Fagerberg & Verspagen 2009). In other words, they anchor their relevance in different research communities: Q1 and politics contribute to the study of organizational learning; Q2 is the most relevant for policy evaluators while Q3 is of interest mostly for the “management cluster” of innovation studies (Fagerberg & Verspagen 2009) as it contributes to the literature on exploratory and exploitative R&D (Jansen et al. 2006). Nevertheless, these three research questions focus on a common research object: targeted knowledge transfer or the knowledge interactions between individual partners in a joint R&D project. They are complementary and each highlights a different facet of the research object: the political dynamics behind collective knowledge creation and sharing, the impact of public initiatives on the way actors subsequently organize their collaboration, and finally the influence of the type of projects on knowledge exchanges. To be able to draw valid general conclusions, these different questions have to be explored through a common epistemological and theoretical prism (Nooteboom 2000).

The first option was to turn to the theoretical background of targeted knowledge transfer: the KBV of the firm, a perspective that arose in opposition with the transaction cost theory (Nahapiet & Ghoshal 1998) and which proposes *“that a firm be understood as a social community specializing in the speed and efficiency in the creation and transfer of knowledge”* (Kogut & Zander 1996 p. 503). Like the Resource-Based View (RBV), the KBV of the firm supposes that organizations should develop resources that are *“valuable, rare, imperfectly imitable, not substitutable”* (Barney 2001) in order to sustain competitive advantage. But KBV diverges from its parent RBV on two main points. The first one is about the type of resources under study. KBV considers knowledge-based resources as the most important assets for the firm (Grant 1996). Assets such as industrial secrets, talented employees and absorptive capacity (Cohen & Levinthal 1990) are therefore at the heart of competitive advantage. The second point is the role of managers which shifts from the actual management of resources to the management of the context of their use (Nahapiet & Ghoshal 1998). Managers are now in charge of creating an

environment that favors interactions between knowledge creators (Spender 1996, Nonaka et al. 2000, Reinhardt et al. 2001).

From this perspective, joint R&D projects are opportunities to access private knowledge, in particular tacit knowledge, that external organizations or individuals can hardly replicate. This production of knowledge is seen as socially embedded (von Krogh & Roos 1996, Nahapiet & Ghoshal 1998), the interactions amongst partners leading to the creation and sharing of knowledge from both sides (Nonaka et al. 2000). In other words, the joint R&D project is a source of competitive advantage for both the laboratory and the firm. Indeed, one important advantage of this perspective for the study of U-I collaborations lies in its common definition of academic laboratories, research institutions and companies as social communities “*specializing in the speed and efficiency in the creation and transfer of knowledge*” (Kogut & Zander 1996).

Nevertheless, KBV has two important weaknesses considering the work at hand. First of all, it focuses on the organization as the main unit of analysis, inter-organizational learning being either an higher level of learning (see for instance Nonaka & Takeuchi 1995) or a separate unit of analysis (Holmqvist 2003). Quoting Spender (1996), “*We need a different kind of knowledge based theory in which organizations are enduring alliances between independent knowledge-creating entities, be they individuals, teams, or other organizations*”. Yet, in this work, the alliances under study are not enduring as the project is per definition temporary (furthermore, most academic researchers are hired on fixed-term contracts linked to the project). Secondly, the KBV frames specific hypothesis about the nature of firm as well as about people: as argued by Spender, “*organizations learn and have knowledge only to the extent that their members are **malleable beings** whose sense of self is influenced by the organization’s evolving social identity’ and thus learning is **primarily** internalized from the social context*” (1996 p. 53, emphasis added by Felin and Foss (2005) p. 443). As a consequence, the KBV poses that employees will voluntarily mobilize their talent in a way that contributes to organizational goals, taking for granted the alignment of interests between people and the collectivity to which they belong. Again, this perspective is not coherent with the research questions explored in this work.

As a result, a theoretical framework that complements the KBV by compensating for the weaknesses presented above is needed. Especially, the chosen framework should be able to handle the twofold process of interest alignment at stake in joint R&D projects: on the one hand between actors from various organizations and on the other hand between employees' interests and organizational goals. As the KBV is defined by its seminal authors as a sociologically informed perspective on Management (Nahapiet & Ghoshal 1998), I then turned to the social theories that were used to build its foundations (see Hermans & Lederer 2009). I finally selected the Structuration Theory developed by Anthony Giddens (1984) as an integrative tool to explore the three research questions, an approach that has been used by researchers in strategy and organization (Pozzebon 2004) such as Child (1997), Lowe (1998) and Phillips and his colleagues (Phillips et al. 2000, Lawrence et al. 2002).

The Structuration Theory is an interesting framework to explore the alignment process between the individual and the collective entity. Indeed, one of Giddens' ambitions was to provide the research community with tools to explore the "micro-macro transition", also called the individual-collective articulation (Nizet 2007). In other words, Giddens addressed the "*apparent conflict between individualism and holism methodology*" (Udehn 2002) and combined them in order to offer more satisfactory explanations of social phenomena that would take into consideration the influence of social world as well as the competence of individuals (see Nizet 2007 p. 24). As the Structuration Theory is not the only sociological framework that focuses on the micro-macro transition (see for instance Crozier and Friedberg (1977), Boltanski and Thevenot (1987) as well as Coleman (1988)), I followed the approach of Pozzebon (2004) who considers that ontological affinities might guide the choice for the "*best approach for overcoming dichotomist logic*" (Pozzebon 2004). As a matter of fact, the Structuration Theory was selected in coherence with the epistemological stance of the thesis as well as ontological premises underlying targeted knowledge transfer (see Chapter 3 – Epistemology).

The Structuration Theory allows for the exploration of alignment processes (Phillips et al. 2000, Pozzebon 2004) both horizontally through the individual-collective articulation (Child 1997, Pozzebon 2004) and vertically between individuals from various organizations and functions through the notion of interpenetrating structures

(Orlikowski 2000). Indeed, the Structuration Theory helps explain how individuals from different regimes of production (Blankenburg 1998) nevertheless cooperate and contribute to consensual goals (See Chapter 4 – Elements of the Structuration Theory). By considering the project as a network for knowledge creation and exchange, it opens the literature on knowledge creation (Nonaka & Takeuchi 1995, Cook & Brown 1999) and more generally the KBV of the firm.

Finally, the Structuration Theory takes into consideration the multiple institutional contexts that influence joint R&D projects, an element of particular importance for the study of U-I interactions. This is coherent with the Triple Helix model (Etzkowitz & Leydesdorff 2000), the “mode II” of research production (Gibbons 1994), the National (Freeman 1992, Lundvall 1992, Nelson 1993) and Regional (Cooke et al. 1998, Asheim 2003) Innovation Systems approaches and other models of innovation which intend to explain “*the current research system in its social contexts*” (Etzkowitz & Leydesdorff 2000), in particular the role of public authorities. While recognizing the influence of the institutional sphere on U-I knowledge transfer, the Structuration Theory goes beyond “*the institutionalists’ self-confessed tendency to determinism*” (Whittington 1992) by considering the competences of individuals who draw upon institutional resources and thereby (re)produce them. This approach addresses the multi-level issue (Nooteboom 2000, Hollingsworth 2002) which occurs when exploring socio-economic phenomena. Besides, it should contribute to existing models such as the Triple Helix whose founding father recently advocated for “*a turn towards reflexivity in sociology in order to obtain a richer understanding of how the overlay of communications in university-industry-government relations reshapes the systems of innovations that are currently subjects of debate, policy-making, and scientific study*” (Leydesdorff 2005).

As a result, The Structuration Theory goes beyond the weaknesses of the KBV and provides a powerful paradigm to understand knowledge exchange in cooperative contexts (Orlikowski 1992,2002):

- It allows considering the R&D project as an emerging construct, a network of actors drawing upon plural and overlapping structures;

- It orients the researcher towards specific processes and aspects of social systems (Nizet 2007) like horizontal and vertical interest alignment especially in the context of plural social systems (Whittington 1992) and multilevel studies (Child 1997, Morgeson & Hofmann 1999).

Nevertheless, the complexity and abstract character of elements of this theory are sometimes considered as a threat for its operationalization (Pozzebon & Pinsonneault 2005, Nizet 2007, Jones & Karsten 2008). For this reason, the Structuration Theory provides a general paradigm to understand targeted knowledge transfer while complementary operationalizable frameworks allow for the study of specific research questions.

The contribution of this work is therefore twofold:

- To contribute to the literature on U-I knowledge transfer by exploring the three research questions presented in this section.
- To propose the Structuration Theory as an integrative tool to understand targeted knowledge transfer and to reveal the social processes behind U-I joint R&D projects.

Indeed, this theoretical stream allows combining the three sub-fields of innovation studies and dedicated phenomenon: the political dynamics behind collective knowledge production, the influence of collective constructs provided by the institutional context (in this case, the Walloon Government) on the way actors subsequently organize their collaboration, and finally the influence of the type of projects on the meaning assigned by the partners to their role and expected knowledge flows. In the next chapter, I therefore present the epistemological and ontological approach of this doctoral work and highlight the coherence of the Structuration Theory with the chosen stance.

3.1 INTRODUCTION

In their work, researchers are guided by basic assumptions (1) about the phenomenon they want to explore, (2) about what constitutes objective knowledge on this phenomenon and (3) about adequate methods to reach it: the inquiry paradigm (Denzin & Lincoln 2000). This set of assumptions is rarely discussed by Management scholars but rather kept implicit in their work. Nevertheless, the inquiry paradigm influences the design of the published research (Maxwell 2005): its goals, research questions and means used to answer them (Pfeffer 1993).

In this chapter, I built on de Nanteuil-Miribel (2008) and Chua (1986) in order to distinguish between three main paradigms in Management science: positivism, structuralism and interpretivism. I present the three approaches focusing specifically on their underlying epistemological assumptions. In other words, I present how scholars from each paradigm answer the following questions:

- What is scientific knowledge?
- What is the meaning of knowledge?
- What is the limit of knowledge?

The first question has regards with the definition of scientific knowledge and the criteria used to assess it. The second question discusses the relationship between the produced theory and the practical world, in other words the purpose of knowledge in the world of practice (Chua 1986). This question is particularly important in Management science which has an historical focus on instrumentality. The third question is related to the limit of knowledge: can everything be known scientifically?

⁶ An earlier version of this chapter was provided as the final paper in the framework of the doctoral course “Epistemology – DSM 3001” (2008-2009).

Two other sets of hypothesis (see Chua 1986) are also briefly presented and complement the epistemological discussion within each paradigm: ontological beliefs and methodological premises. Indeed, those sets are closely related and interact with each other. For instance, even if the research questions eventually determine the specific methods to be deployed (Decrop 1999, Maxwell 2005), the very set of methods “*deemed appropriate for the gathering of valid evidence*” (Chua 1986) from which the researcher can draw is shaped by his epistemological hypothesis. Likewise, ontological hypothesis – the assumptions on the nature of the empirical phenomena under study – will have a deep influence on the way the researcher defines scientific knowledge.

I adopt the distinction made by de Nanteuil-Miribel (2008) and Chua (1986) as the red line of this chapter because positivism, structuralism and interpretivism are three inquiry paradigm that distinguish themselves from each other according to their epistemological hypothesis, which are the object of this chapter. They are very useful not only to depict each position but also to assess their respective strengths and weaknesses. While focusing on positivism, structuralism and interpretivism, I recognize that this distinction does not aim to exhaustively represent potential inquiry paradigms in Management science⁷. Nevertheless, such distinction allows to achieve two goals:

(1) To map existing paradigms in order to help me clarify my position. Indeed, “*a paradigm is what the members of a scientific community share, and, conversely, a scientific community consists of men who share a paradigm*” (Kuhn 1970 p. 176).

(2) To provide insights about the meaning of scientific research and its limits. Indeed, the epistemological stance influences the role of the researcher, the meaning of scientific knowledge as well as the basic definition of the object under study, the “conditions that motive one type of conceptualization or another” (Foucault 1982). I therefore intend to make clear the interaction between the epistemological premises

⁷ As a matter of facts, other distinctions have been made in the literature; see for instance (Burrell & Morgan 1979, Denzin & Lincoln 2000, Hatch 2000, Johnson & Duberley 2000).

of positivism, structuralism and interpretivism and the definition of my research object. In other words, I want to show how each position (re)defines U-I knowledge transfer and to make clear the epistemological paradigm underlying this work.

This exercise is required for two main reasons. First, the main research object of the thesis is knowledge transfer, thereby urging for a deeper reflection about the nature of knowledge and how it comes about. Secondly, I study “science(s) in the making”. The academic world being involved in innovation studies, I focus on my own community of interests, which urges for a reflexive look at my role as producer of scientific knowledge. For instance, Balconi et al. (2010) claim that authors studying the linear model of innovation might be *“responsible for a rigid, unflexible presentation of the arguments on which the model is based, often in order to make their case when allocation of resources was at stake”*. In her essay about UIR and power interactions, Blankenburg (1998) also recognizes that *“any theorising on the rationale underlying UIRs runs the danger of becoming part of a “mode of rationality” justifying a particular “regime of production” rather than explaining it”*. For these reasons, it is important to clarify my epistemological stance: to make clear the specific hypothesis that guided my work as I unveiled or created knowledge (Hatch 2000) about the phenomenon of U-I knowledge transfer.

3.2 POSITIVISM

3.2.1 BASIC ASSUMPTIONS

Since the infancy of Management science with Taylor and Ford, Management scholars have been deeply influenced by a positivist epistemology. This posture poses the homology of natural and social science: Management had to be considered as a science; it had to satisfy the same conditions than natural sciences and therefore it should adopt the criteria of positivism when defining what scientific knowledge is and how it can be discovered. While the roots of positivism are attributed to Comte, considered as the founding father of positivism (Crotty 2003), I focus on positivism in its contemporary form as proposed by Popper (1979, 1998).

For the positivists, a world of objective reality exists independently of human beings and has a determinate nature that is knowable (Chua 1986), albeit always known through the prism of the observer who want to describe the reality. Truth lays in

facts and the essence of those facts does not depend on the observer. As such, the researcher in Management and the object under study are independent. Moreover, the objective knowledge that is subsequently discovered through the efforts of the researcher is seen as independent from the individual who affirms to know (Popper 1998) : the 3rd world, world of objective knowledge and production of human mind, is independent from the world of subjective consciousness.

In Popper's view, science is the will to access truth even if it is not possible to do it perfectly or definitively as the researchers will never grasp the facts as such (Popper 1979). As a result, scientific knowledge deals with incompleteness and multiplicity as multiple formulations exist. In this view, scientific knowledge should meet two important criteria:

- The intention to describe reality with scientific knowledge and thus the criteria of adequacy to facts;
- The ability to confront scientific knowledge about the methods used to produce it and thereby to access truth – the criteria of falsifiability.

Those criteria lie at the heart of the Popperian positivism: truth exists but researchers do not have the criteria to judge if they have reached it or not. Consequently, scientific controversy is not about the degree of certainty but rather about the degree of refutability between ways to access truth.

The meaning of knowledge is straightforward for the positivist researchers: knowledge growth is a sign of immanent progress. For them, the objective world and its universal regularities should be rendered explicit through mathematics. This assumption is still valid when the researchers study human beings and their interactions: a universal order exists in the social world and the goal of the researchers is to discover its knowable causal relationships. This goal can be seen as providing technical answers to pre-given goals (Chua 1986): to provide recipes that can be applied by practitioners to predict and control organizational phenomena, such as technology transfer, and therefore enhance the organization's competitiveness (Reisman 2005). Positivists recognize the difficulty of the task and even use it to justify the lack of "scientific maturity" that characterizes organizational science when compared to natural sciences (see Lee 1991).

As a result, the limit of knowledge is the following: reality is in facts and if you cannot observe a phenomenon, then it is outside scientific knowledge. The construct that cannot be captured in formal propositions, quantified and finally tested through experimental control – such as feelings of love or meanings – are therefore not objects of research for the positivists.

From a methodological perspective, knowledge is the result of calculation or regular determinism. Following the thesis of the unity of science (Hempel and Kolakowski 1968 in Lee 1991), there is a strict distinction between the researcher (subject) and the object of the research. Besides, the only deemed methods for studying social sciences are the methods used in natural science or in other words the “scientific method” (Chua 1986, Lee 1991): the use of the mathematical language following the rules of the hypothetico-deductive logic. The role of the researcher is to be ideologically, morally and scientifically neutral. His goal is to describe reality which is not a matter of interpretation.

The prevailing methods are thus quantitative but it would be hazardous not to acknowledge the use of qualitative methods by positivist researchers. In fact, the influence of positivism and post positivism is very strong in seminal works dealing with qualitative research methodologies such as Glaser and Strauss (1967) and Yin (1994). From those perspectives, traditional criteria of falsifiability are still prevalent and the role of the researcher is to unveil the objective facts grounded in the qualitative material. The qualitative researcher seeks to explain the phenomenon (its causes and effects) when causal links are too complex to be handled by a quantitative survey (Yin 1994). Relying on calculation or on the unveiling of causal relationships, the dominant frame of analysis is explanation, not interpretation or social critics.

3.2.2 POSITIVISM AND TARGETED U-I KNOWLEDGE TRANSFER

In Management, positivist researchers suppose that both human beings and collectivities are purposive (Chua 1986). Like in other social sciences (see Udehn 2002), an important debate has thus lived up the field about the more important level of analysis: the self-interested individual or the purposeful collective entity? At the individualistic end of the spectrum, the social world is seen as “*discontinuous series of mechanical equilibria*” (Bourdieu 1986 p. 46) between homogenous agents

that strive for utility maximization like in the transaction costs theory (Williamson 1985) and the agency theory (Fama & Jensen 1983). At the collective end of the spectrum, interactions are ruled by social norms, institutions and obligations and individuals are seen as malleable beings (Spender 1996) who voluntarily contribute to organizational goals. From those perspectives, conflicts either are dysfunctional as they threaten the objectives of the organization (Chua 1986) or are even inexistent as researchers take for granted the alignment of interests between people and the collectivity to which they belong (Felin & Foss 2005, Hermans & Lederer 2009).

Targeted U-I knowledge transfer can be approached through both ends of the spectrum. First of all, the agency theory provides a theoretical framework that can be applied to joint R&D projects as, even if those projects are not purely an arm's length contract, we should observe one "knowledge buyer" (the principal) and one "knowledge supplier" (the agent). They are collaborative individuals who have potentially conflicting goals because they strive to maximize their own utility and may threaten the interests of the project or of the organizations involved.

Secondly, targeted U-I knowledge transfer can be explored through the framework of the KBV of the firm. While conceptualizing both individual and social knowledge (see Table 7), the KBV supports the prevalence of social knowledge (Spender 1996, Nahapiet & Ghoshal 1998) like organizational routines (Brown & Duguid 1991) over the individual level for the sustainability of organizational competitiveness. From this perspective, the R&D project is an instrument for knowledge appropriation and its effective conduct is ensured through adequate collaborative routines shared by the partners such as knowledge sharing routines (Dyer & Singh 1998).

TABLE 7 LEVELS OF KNOWLEDGE, ADAPTED FROM (SPENDER 1996, COOK & BROWN 1999)

	Tacit Knowledge	Explicit Knowledge
Individual Knowledge	Skills / Automatic Knowledge	Concepts / Conscious Knowledge
Social (organizational) Knowledge	Genres / Collective Knowledge	Stories / Objectified Knowledge

While those perspectives disagree on the relevant level of analysis (the individuals and how they interact vs. the collaborative routines), they both consider “knowledge” as an important organizational resource and “Management research” as a way to enhance its efficiency. In these views, knowledge is an intangible resource that exists independently of its use. Knowledge as a resource can be stored, accessed, located; knowledge as an asset generates value and can be owned, valued, accumulated and managed (Andriessen 2006), if not directly then at least through managing the context of its use (Nahapiet & Ghoshal 1998). Knowledge is isolated from its context and constitutes an objective reality independent of the context of production.

As a result, both perspectives seek to explain how events and actions take place in joint R&D project and how they contribute to an effective transfer (creation and sharing) of the object of interest: knowledge. The goal of the researcher is to observe the sharing processes and to discover the causal relationships at stake and ways to control them (see Table 8). The researcher does not question organizational and project’s goals and usually addresses the manager as the main respondent.

As an example, Hansen (2002) examines the efficiency of knowledge networks in multi-units firm and tries to answer the research question: Why are some business units able to benefit from knowledge residing in other parts of the company while others are not? In answering this question, Hansen focuses on the causal relationship between the nature of a piece of knowledge and the efficiency of a team. The explaining variables are the level of relatedness of a given piece of knowledge, its level of codification and its access path within the organization. Data were gathered through two surveys: the first one was addressed to R&D managers; the second one was addressed to project managers. The dependent variables are the level of knowledge transfer under a quantifiable form (technical advices embodied in software and hardware) and completion time as a proxy of efficiency. As a result, an efficient team is defined as a team that obtains more knowledge from other teams and that completes its project in a shorter time. The causal relationships are assessed through a statistical approach that confirms the formal propositions. The study shows that the most efficient project teams are the teams that are connected through short paths to divisions with useful knowledge for the project.

As a conclusion, a positivist study of targeted knowledge transfer would take for granted the project as a knowledge transfer instrument. The goal of the researcher is to investigate causal relationships between the level of appropriable knowledge under a quantifiable form (for instance embodied in reports, new products and new processes, samples) and the nature of the project: level of sharing opportunities (for example number of meetings, number of exchanged e-mails, number of phone calls etc.), access path to useful information, nature of partners, etc. Such a study does not question the goal of the project and seeks to provide potential partners with recipes for the conduct of U-I knowledge transfer that strengthen corporate or institutional competitiveness (Reisman 2005).

TABLE 8 POSITIVISM AND TARGETED U-I KNOWLEDGE TRANSFER

What is scientific knowledge?	What is the sense of knowledge?	What is the limit of knowledge?
Science is the will to access Truth. As such, scientific knowledge seeks to describe the joint R&D project following scientific methods that are subject to scientific critics.	Knowledge is immanent to human progress. The meaning of scientific knowledge is to render explicit the causal relationships at stake in joint R&D project in order to enhance the efficiency of this knowledge appropriation instrument.	Limits are related to the difficulties to observe and capture knowledge as a research object. It leads researchers to look for codified, quantifiable traces in publications, deliverables, etc.

3.2.3 CRITICS

A first critic is addressed to positivism by the supporters of structuralism. In the structuralist paradigm, critic goes beyond the discussion about the adequacy of methods. On the contrary, the scientific knowledge should be discussed as part of the social reality, or “social totality”, through which it is conceived. From this point of view, the disconnection of facts from their social reality is not a sign of objectivity but of subjectivism: the scientific confrontation about the degree of falsifiability supposes a common view of the world shared by the scientific

community. By choosing to limit knowledge to observable and quantifiable facts, positivists make the decision to narrow their view. This reduction is carried out through a subjective view of the world: an organized, conservative world which is transparent to knowledge. This disconnection is a stance particularly difficult to hold when the phenomenon under study involved human beings: people are then considered as external objects with characteristics (like leadership, openness or competence), who are not as active makers of their social reality (Chua 1986). In particular, power relationships are kept outside the scientific discourse.

The focus on quantifiable facts is also disapproved by interpretative researchers who consider that there is more in reality than just facts and that positivists should recognize that the research object could be a function of their own a-priori assumptions. The positivist hypothesis that states the separation of facts and values is criticized by interpretive researchers who consider knowledge production as the product of values and rational thinking. As a result, studying “knowledge transfer” should include both the study of contextual factors and value judgment. The researcher interested in knowledge transfer should adhere to an epistemological stance that allows taking both elements into account.

As a result, researchers that adhere to structuralism or interpretivism also criticize the declared neutrality of positivism. For structuralists for instance, taking for granted organizational goals and seeking to enhance the “efficiency” of the firm are not neutral but participate to the reproduction of the existing forms of suppression (Chua 1986). In fact, the distinction made by positivists between facts and value is itself a value judgment (Weber 1949 in Chua 1986). Such a stance has led to a sterilization of the discourse about knowledge in organizations, in the field of information and knowledge management but also in innovations studies. Collaborative knowledge strategies are seen as win –win situations and symbiotic relationships through “*growing the knowledge pie for all*” (Goh 2005 p. 12). Apart from rare exceptions like Easterby-Smith et al. (2008), knowledge and power are irremediably separated even when the research study is about knowledge access and consequently about the underlying asymmetry of resource distribution (Giddens 1984). Maybe the more flagrant example of such sterilization can be found in the seminal work of Nahapiet and Ghoshal (1998) who contributed to the KBV by developing a framework to explore the link between social capital and the creation

of organizational knowledge. While building their definition of social capital as well as their theoretical arguments on sociological theories (see Hermans & Lederer 2009), they align with the KBV about the predominance of the organizational level on the individual level and about the automatic alignment of interests between employees and their organization. By doing so, they voluntarily kept in the dark the political processes behind knowledge exchange in organization, processes that are nevertheless highlighted by the underlying sociological references (Giddens 1984, Bourdieu 1986, Coleman 1990).

On the contrary, the structuralist quest is to deconstruct notions such as organizational goals and efficiency to provide dominated agents with the skills to emancipate themselves from the domination structure. The next section therefore focuses on this particular paradigm and presents its potential adequacy for researches on U-I knowledge transfer.

3.3 STRUCTURALISM

3.3.1 BASIC ASSUMPTIONS

« Les transformations réelles et profondes naissent des critiques radicales, des refus qui s'affirment et des voix qui ne se cassent pas. » (Foucault 1980b)

The basic premise of structuralism is that science and the positivist approach have captured freedom and led the world to violence and technical dependency. People are alienated from self-realization through material, economic and political relations by existing structures – prevailing systems of economic, political and cultural authority – that should be exposed and transformed (Chua 1986, Orlikowski & Baroudi 1991). As a result, the meaning of scientific knowledge in structuralism is twofold: (1) to expose dominant views that are unconsciously taken for granted within a given social system and (2) to provide the tools for emancipation or in Horkheimer's words "to liberate human beings from the circumstances that enslave them" (1982 p. 244). This urge for a critical theory was firstly advocated by the Frankfurt School represented by German philosophers such as Horkheimer and Adorno but this epistemological premise is also shared by scholars that are not part of the Frankfurt School such as Bourdieu and Foucault (Bohman 2005). In this

section, I thus refer to “structuralism” as the paradigm that supposes such an approach of knowledge and to “critical theory” as the scientific knowledge produced within it independently from the origin of the researcher.

From a structuralist perspective, facts are no longer the major source of scientific knowledge. Researchers have to go behind the facts and to examine their relationships to the social totality: once the domination structures are rendered visible, researchers should criticize them not only on the basis of the methods used to unveil them but also on the basis of their interactions with all parts of the social reality. A real critic is thus a disagreement about everything, from scientific methods, chosen facts and values up to the global project the researcher wants to fulfill (de Nanteuil-Miribel 2008). As a result, critical theories are always temporal and context-bound (Chua 1986).

Three main criteria are used to assess critical theories. Scientific knowledge must be (see Bohman 2005):

- Explanatory: it should improve our understanding of the society as a whole and explain what is wrong with it. Scientific knowledge connects idea and facts, provides interpretive scheme and types of explanation (Foucault 1980a)
- Practical instead of instrumental: it should support emancipation and identify potential actors of change for social transformation. As noted by Benson (1983 in Orlikowski and Baroudi 1991), the role of the critical researcher is always to go beyond mere studying and theorizing and to promote changes in the phenomena being studied.
- Normative: it should provide clear norms for criticism and achievable practical goals.

By respecting each criterion, the researcher discusses his research as part of the social totality; if not, his research results are outside scientific knowledge.

The goal of the structuralist researcher is to adopt a critical stance towards taken-for-granted assumptions about organizations and other management constructs (Orlikowski & Baroudi 1991). It favors methods that allow accessing rich contextual

data about the phenomenon under study such as ethnographic studies of organizational structure and processes (Chua 1986). Beyond ethnographic studies, structuralism supports the use of all kinds of methods that attempt to reveal the historical, ideological, and contradictory nature of existing social practices (Orlikowski & Baroudi 1991) such as the archaeological method proposed by Foucault (1966). In summary, it calls for data-driven, inductive inquiry that allows reaching the multiplicity of beliefs and interpretive schemes that influence actors and thereby explain their behaviors.

3.3.2 STRUCTURALISM AND TARGETED U-I KNOWLEDGE TRANSFER

Like in the KBV, structuralists see people as malleable beings influenced by organizational practices and conventions but their goal, their vision of Management research, is drastically different: instead of aiming to enhance organizational competitiveness, structuralists want to emancipate human beings and to provide them with the capacity to think by themselves all aspects of decisions. The researcher seeks to go beyond the apparent neutrality of organizational objects and deconstruct them. In this regard, an important contribution is made by Foucault as he urges to dispel taken-for-granted assumptions and to remember that “*although elements are part of a familiar landscape, they are not “natural”, or part of a naturally existing order*” (Townley 1993 p. 519). For Foucault, human perception is influenced by our interpretive frame, particularly language and the classification systems embodied in it. To finally see the “obviousness” as constructed and transform it (Foucault 1994), people have to deconstruct familiar concepts: to learn to see them differently. The fundamental questions become: “should what goes without saying effectively go without saying?” “Shouldn’t we go beyond the obvious, even the more profound one?” (Foucault 1984). His power/knowledge perspective contributes to this goal by investigating the relationship between those two important components (Foucault 1983), not only in extreme cases such as asylum or prison, but also in regular, familiar settings such as the organization or the R&D project.

In the study of U-I knowledge transfer, it implies that instead of beginning with evident concepts such as the role of the R&D manager, the researcher starts by looking for power relations (Townley 1993). In the U-I joint R&D project, it means

observing daily interactions and trying to unveil how partners exercise power: the taken-for-granted systems of differentiations, the types of goals pursued, the instrumental modalities, the form of institutionalization and finally the degree of rationalization (Foucault 1982). Plenary meetings are very interesting places to observe such phenomena but the way decision evolves between meetings is also important to understand how power is exercised in backstage by managers and academics but also by the front-line researchers who are responsible for the daily progress of the research. As a matter of fact, the structuralist researcher seeks to give these less-heard actors a voice: technicians and junior and senior researchers are now relevant respondents.

The relevance of those less-heard actors may be explained through two complementary venues: the structuralist goal to emancipate dominated actors as well as their definition of knowledge. Indeed, knowledge is no longer a resource independent of its production context; it is rather a social construction shaped by the structure that the Management scholar seeks to unveil. Especially in the context of “science in the making” (the R&D project), it means that the researcher in Management does not witness the construction of “Truth”, but rather the construction of “truthful discourses”. Those discourses are corrected, adjusted, with the aim “to tell the truth”. The scientific error is not delimited by a higher force of Truth that would progressively come to light but rather by the statement of a new way “to tell the truth” (Foucault 1985). From this perspective, the less-heard actors actively contribute to the construction of knowledge within the project even if this construction is influenced by the power relationships that bind the partners together.

In organization science, structuralism also implies that “*organizations cannot be studied in isolation of the industry, society, and nation within which they operate, and which they in part constitute*” (Orlikowski & Baroudi 1991). For the study of targeted U-I knowledge transfer, it implies that domination and legitimization structures at stake in the project should be considered as part of the social totality. In the specific case of the Competitiveness Clusters of Wallonia, it is particularly relevant: the researcher has to explore the impact of this policy on the way the project was organized and later conducted. For instance, the requirement of “balanced involvement of actors” (see Chapter 6) in the Competitiveness Clusters may help reducing the power asymmetry at hand within the associated projects: as

large companies are not able to propose a project on their own, it provides SMEs with negotiation power to secure the consortium agreements and with veto capacity during its conduct. As such, the structuralists should answer the following questions: what are the dominant groups that benefit from the Competitiveness Clusters? Who benefits from the money? If the State acts as an “animator” (Diez 2001) – a generator of norms between local agents – who will benefit from those new rules?

TABLE 9 STRUCTURALISM AND TARGETED U-I KNOWLEDGE TRANSFER

What is scientific knowledge?	What is the sense of knowledge?	What is the limit of knowledge?
Scientific knowledge is a construction, a discourse of truth rather than Truth itself. It seeks to explain social inequalities and provides practical insights and normative rules to transform them.	To make visible the domination structures at stake in joint R&D projects and to emancipate alienated actors.	Limits are related to the piece of knowledge which would not be discussed as part of the social totality.

The structuralist researcher should also recognize that the produced theory is not value-free and independent of the context. He should look for the stakeholders of the research that he is conducting: the Walloon Region which is a potential employer and a source of money for his supervisor; R&D coordinators who are the official representatives of the involved companies and have a “right of inspection” on his work; R&D managers who manage the openness of the project so that the researcher can access interesting information; junior researchers and technicians who may use the research as a way to be heard by their hierarchy; and finally the university which is his current employer, assesses his work and sees in the Competitiveness Clusters policy an important source of fund as well as a way to legitimize its existence. Indeed, from the structuralist perspective, scientists are not disinterested but are also an organized interest group and the researcher actually belongs to it.

3.3.3 CRITICS

From the point of view of positivism, structuralism is outside scientific knowledge: structuralists base their research activity on the existence of domination structures without being able to capture them in formal propositions, quantify them or test them through experimental control. As structuralists consider that such argument contributes to the reproduction of domination structures, we witness a discussion at cross purposes.

From the point of view of interpretivism, structuralism has three main shortcuts that may impede its usefulness as a paradigm for conducting Management research. First of all, structuralism considers that structures are beyond human beings while interpretive researchers believe that people are conscious of the social constructs that at the same time constrain and enable them. Interpretive researchers consequently criticize the structuralist view of people as malleable beings and will rather define them as competent. Secondly, while structuralism presents power relationships as a source of alienation, post-structuralism and interpretivism on the contrary consider power as an important driver of human interactions. For instance, instead of considering the plenary meetings of joint R&D projects as the venue for an endemic struggle, interpretive researchers rather see meetings as opportunities for compromise reaching. Thirdly, the role of researchers in the structuralist paradigm is questioned by interpretive researchers. On the one hand, structuralism seeks to explain social inequalities and to select the appropriate political action for social transformation (Orlikowski & Baroudi 1991). Interpretive researchers on the other hand may agree with Habermas (see Chua 1986) who considered that scientific knowledge should be used to initiate self-reflection among human actors who are able to undergo the adequate political actions. In fact, this view of actors as competent and capable of cooperation beyond alienation is much more compatible with the conventional role of Management science as a strengthener of corporate or institutional competitiveness (Reisman 2005). The Management scholar who decides to follow the premises of structuralism will have to go against this mainstream vision of Management.

In conclusion, interpretive researchers and structuralists share the constructivist view that knowledge arises from interpretive frames that people construct in interactions

with their physical and social environment (Nooteboom 2000); knowledge is a social construct, product and process of “*negotiations and conflicts between actors whose rationality is at times limited or contingent*” (De Vos et al. 2002). Nevertheless, the underlying roles of structuralists and interpretive researchers as researchers and their respective view of actors are radically different. The transition from structuralism to interpretivism is best illustrated by the double epistemological assumption that characterizes post-structuralism, especially the work of Anthony Giddens (de Nanteuil-Miribel 2008): social interactions are shaped by structures but structures do not alienate human beings; actors know that they are not free and are able to mobilize structures in their interactions.

The Structuration Theory developed by Anthony Giddens focuses on how social systems – for instance the R&D projects financed by the Competitiveness Clusters – are produced and reproduced through the interactions of individual actors who are “knowledgeable” and reflexive: they are conscious of the structures and their constraining aspect but they also recognize their enabling facet and apply adequate rules and resources to interact with each other (Giddens 1984). The set of rules and resources that actors draw upon, constraining and at the same time enabling their actions is what Giddens calls structures. As a result, while structures are defined by structuralists as the abstract rules that shape the behavior of human beings beyond their control and their consciousness (de Nanteuil-Miribel 2008), Giddens considers structures as abstract rules that the actors can mobilize adequately in a variety of contexts (see next Chapter – Elements of the Structuration Theory).

Building on Giddens, we can see three main evolutions from structuralism to interpretivism. First of all, structures do not alienate the individuals who are conscious of their constraining and enabling properties. Secondly, conflicts and power relationships are no longer endemic to social system (Orlikowski & Baroudi 1991) but can be considered as drivers (Chazel 1983, Giddens 1984, Friedberg 1997) of human interactions. As a consequence, the aim of scientific knowledge evolves from emancipation to instruction: to shed new light on the organizational situations so that actors are better equipped to act.

3.4 INTERPRETIVISM

3.4.1 BASIC ASSUMPTIONS

In the interpretive paradigm, a clear distinction is made between natural and social sciences. For interpretive researchers, social order is not a pre-existing reality waiting to be discovered but the reflection of the inter-subjective meanings given by human beings to their interactions. In this view, reality is made of those interactions: as expressed by Chua (1986), *“through this process of continuous social interaction, meanings and norms become objectively (intersubjectively) real. They form a comprehensive and given social reality which confronts the individual in a manner analogous to the natural world”*. As a result, the reality that the interpretive researcher seeks to make visible is neither a universal order nor a domination structure but the subjective and inter-subjective meanings that individuals bring to their interactions.

While the scientific knowledge produced within structuralism is part of a critical theory, the knowledge generated through interpretive studies is what Amblard et al. (1996) called a comprehensive theory: interpretive researchers seek to make sense of human actions by fitting them into a purposeful set of individual aims and a social structure of meanings (Chua 1986). Two important elements are included in this definition: a focus on understanding rather than explaining and a dialectical thinking of human beings whose rationality is essentially composed of self-interested calculation and shared norms and values.

This focus on understanding (Verstehen) rather than explaining is evident in the different schools of thoughts related to interpretivism such as the hermeneutic school led by Ricoeur and the phenomenological sociology of Weber (Lee 1991). In this context, understanding refers to the *“process by which the observing social researcher interprets the subjective meanings that give rise to the behavior of the people that he or she is studying”* (Lee 1991). More specifically, Weber considers that human beings have a twofold rationality: they make sense of their actions and of the actions of others based on self-interest as well as shared norms (de Nanteuil-Miribel 2008). As a result, justification (or legitimization) emerges as an important theme for the interpretive researcher (Giddens 1984, Boltanski & Thévenot 1987, Friedberg 1997). While legitimization was regarded as an alienation tool in the

structuralist paradigm (dominant structures generate the norms and interpretive schemes that contribute to their reproduction), it is now considered as a positive topic: cooperation is attained through mutual consent and interactions are regulated through (positive or negative, formal or informal, external or internalized) social sanction.

For Weber, scientific knowledge is reached as the researcher complies with three main conditions (de Nanteuil-Miribel 2008):

- To focus on intersubjectivity: objectivity is no longer a question of an existing universal order but a matter of intersubjectivity constructed by the confrontation of a diversity of meaning.
- To develop ideal-types: ideal-types are theoretical constructs that have the capacity to inform actors about a given situation. For instance, tacit knowledge and explicit knowledge are conceptually separated while a piece of knowledge in real life is always a hybrid, a combination of both types of knowledge. While ideal-types never exist as such, they help understand what reality is made of.
- To adopt an axiological neutrality: if the researcher explores intersubjective meanings, people are the only experts on what they are doing and the researcher should not judge the way they justify their actions.

As human actions cannot be understood without references to their meanings, the task of the interpretive researcher is to interpret it (Lee 1991). His goal is no longer to explain but to understand. As such, the meaning of knowledge is to provide actors with new insights to gain a deeper understanding of a phenomenon so that the produced knowledge may be used to inform other settings (Orlikowski & Baroudi 1991). Interpretive researchers will thus insist on the operational aims of Management studies (Weber 1992, Amblard et al. 1996): the role of the researcher is to instruct managers and other organizational actors so that they are better equipped to make sound decisions. From this perspective, human beings are seen as competent and able to make sense of their behaviors and of the behaviors of others with whom they interact. This competency is nevertheless limited by unintentional consequences and unknown conditions (Giddens 1984). A bounded or limited

rationality implies that the actor (Friedberg 1997) 1) does not have all information, 2) has a limited capacity to treat them; 3) does not know all his preferences and 4) builds his strategic choice on a satisfactory solution 5) through a sequential examination of alternatives rather than a synoptic one. This rationality is also called incremental or procedural as the beliefs and preferences are continuously redefined through the conduct of strategic actions (Alter 2000).

As a result, the appropriate research methods for the production of valid interpretive knowledge are field studies as they examine humans within their social settings (Orlikowski & Baroudi 1991) as well as interviews (Weber 1992, Amblard et al. 1996) as the actors can express their intentions and communicate about the underlying meanings. Other methods like the hermeneutics have been applied: for Ricoeur, reality is made of meaning which is integrated in narratives such as writings, interviews as well as observation: the observed behaviors are ultimately analyzed as “text analogue” (Lee 1991).

3.4.2 INTERPRETIVISM AND TARGETED U-I KNOWLEDGE TRANSFER

Like in the Structuration Theory, the interpretive researcher considers that actors involved in U-I joint R&D projects are competent and strategic. Their interactions are regulated through their self-interest as well as the shared norms that bind them together (Orlikowski & Baroudi 1991). The goal of the interpretive researcher is to generate a comprehensive theory of such interactions that informs involved actors and enhances their decision-making capabilities.

Like in structuralism, knowledge – the object under study in this research work – is conceptualized as dependent of the context/network/system that produced it. Knowledge construction depends on social interactions within the system and is the product of rational or reasonable thoughts, based on self-interest as well as value and social norms.

The starting point would be to question the meaning of the joint R&D project for each actor: R&D managers, academic professors as well as post-docs, junior researchers and technicians. The interpretive researcher is interested in the finality of the project as regarded by the respondents and do not take for granted the R&D project as a simple tool for knowledge transfer. The first questions that arise are:

beyond the common written goals, what are the motives behind each collective and individual actor? What is considered as “normal” in the project? What constitutes the web of obligations and loyalties at stake in the project?

In the case of U-I knowledge transfer, a first observation is the multiplicity of visions and norms, of semantic and normative rules (Chazel 1983) at stake in the project: actors come from different “worlds” in the sense of the theory of Worth (Boltanski & Thévenot 1987) as well as in the common sense. From the beginning, different regimes of justification are confronted and require the building of a compromise. The specific research questions thus become: in a context characterized by a multiplicity of structures (Sewell 1992) and temporary teams, what are the mutual arrangements that found legitimacy; which criteria are used to guide the research; how individuals legitimize them and which interests are served (and disserved) by such arrangements.

The role of the researcher is not to judge the regimes at hand nor the way the local agreements are reached; his role is to unveil the dynamics behind the building of compromises so that the observed actors gain a deeper understanding of the processes in which they are involved. The neutrality of the researcher is also required as he explores the underlying power relationships.

TABLE 10 INTERPRETIVISM AND TARGETED U-I KNOWLEDGE TRANSFER

What is scientific knowledge?	What is the sense of knowledge?	What is the limit of knowledge?
Knowledge that seeks to understand the joint R&D project as a social system which results from the confrontation of inter-subjective meanings: multiple structures and self-interested individuals.	To make explicit the meaning attributed to social interactions in joint R&D projects in order to enhance decision-making capabilities of the involved actors.	Limits are related to the limited discursive capabilities of the informants and the limited opportunities to access evidence about informal and tacit norms.

3.4.3 CRITICS

Beyond the potential critics coming from the positivist perspective such as the fact that meanings are not directly observable and quantifiable, a number of critics can be addressed to interpretivism from a structuralist perspective. First of all, structuralists will point the weakness of the “actor agreement” or credibility as a criterion for objective knowledge (Chua 1986): if domination structures constrain actors beyond their consciousness, the interpretive researcher might just reproduce such structures without questioning the taken-for-granted interpretive schemes. Secondly, while the constructive facet of power may be seen as an important contribution of interpretivism, it has been achieved at the expense of its negative facet. As a result, interpretive researchers sometimes neglect the fact that power can be endemic and that social inequalities are still prevalent in some social systems. The third critic is consequently related to the declared axiological neutrality of the researcher who does not judge the meaning of the observed actors but should make clear his own interpretive schemes and norms. From a critical perspective, this posture is disapproved as value judgments are part of the structures of domination that need to be deconstructed.

3.5 TOWARDS A CRITICAL INTERPRETIVISM

Knowledge transfer between universities and firms has been a research object for Management scholars for some time. Through my literature review, I noticed that a positivist approach of this phenomenon has favored the production of scientific knowledge about what I called “untargeted knowledge transfer”: knowledge transfer from university to industry in a one-way direction and under a codified (quantifiable) form. After my literature review, I decided to focus on targeted knowledge transfer and the actual sharing interactions undergone by academics and industrial partners. While the need for an inductive, qualitative approach was quite straightforward, I did not recognize immediately the need to clarify my epistemological assumptions and thus did not acknowledge the impact that it may have on the basic conceptualization of my research object, U-I knowledge transfer. As interesting topics emerged from my empirical investigations, my research questions were refined and I found myself struggling with the implicit assumptions

of positivism and looking for alternatives way of defining scientific knowledge as well as my role as a researcher.

In this section, I firstly present four (4) ontological assumptions about U-I knowledge transfer that emerged at the light of the distinction between positivism, structuralism and interpretivism. Those four assumptions about U-I knowledge transfer are mainly coherent with the interpretive paradigm as well as the post-structuralism posture which, in my opinion, provide the most adequate epistemological assumptions to explore sharing interactions in U-I joint R&D projects.

3.5.1 ONTOLOGICAL ASSUMPTIONS

While Management theories about knowledge (especially the KBV of the firm) are part of a positivist tradition and neglect the interaction between knowledge and power, structuralism highlights that knowledge is neither neutral nor independent from its context of production. In this paradigm, (1) *knowledge construction results from political processes* and serves the interest of dominating actors: the shaping of knowledge allows for the manipulation of individuals – sometimes beyond their consciousness – thereby reproducing existing domination structures. It stresses for instance that organizational routines are not part of a natural order even if employees usually take them for granted. They are symbolic operators (Wallemacq 1998) that define what is normal and what is not, what should be done and what should not be done in a given organizational setting. In my view, innovations – and more broadly knowledge – are not isolated from their context. They are produced inside the network (or system) formed by the involved actors and through their interactions (Latour 1987, Alter 2000). In the context of joint R&D projects, this view of knowledge has a clear influence on the definition of the research object: targeted knowledge transfer. The exchanged pieces of knowledge are no longer independent of the network formed by the partners who exercise power to shape, correct, and alter the knowledge produced within it (Foucault 1985).

While structuralists consider the political processes behind knowledge shaping as alienating and that individuals do not have control over the social borders that produce it, interpretive researchers believe that knowledge is produced through strategic and rational actions. In this view, (2) *power relationships are constructive*

and enable the actors to reach compromises and thus cooperation. In U-I joint projects for instance, actors from different worlds share resources to reach personal and aligned goals. Interpretive researchers recognize that the definition of those common goals and of the required tasks to reach them is both evolving and the result of power relationships but it is not considered as endemic. In my case studies, I was confronted with evidence that plenary meetings were not only a place where power relationships struggle but they also served as an integration tools: “partners” were defined by individuals as the people “around the table” (IND22; ACA7; IND7). As partners, they reach consensus about the criteria and rules that should be used to construct knowledge, to consider that things hold and thereby are becoming true (Latour 1987).

Indeed, interpretive researchers recognize the competence of actors and conceptualize actions as “*the resultant of individuals’ capacity not to submit themselves to structure*” (Friedberg in Amblard et al. 1996 p. 109). (3) *Partners are able to adequately apply the set of rules and resources constitutive of structure and to influence back those structures* through their interactions as the project evolves. The actors are able to choose to transform rules and habits of their network (Alter 2000). It implies that the interpretive researcher pays more attention to modest and ordinary actors (Alter 2000) such as the junior researchers or the technicians who are now considered as important contributors to knowledge construction. He is particularly attentive to their own interpretation of the phenomena and to their role in the daily construction of knowledge through instantiated structures.

Finally, another interesting contribution of interpretivism on the conceptualization of untargeted knowledge transfer is the recognition that (4) *knowledge transfer is a source of value* not only for the organization involved (firms and laboratories) and their stakeholders but also for the human beings involved in the project. Indeed, knowledge is per definition a creator of value (Liew 2007), not only in the context of business but also for the individuals who draw upon it. Knowledge enlarges the basis for action of the actors, it contributes to the set of rules and resources from which the actors can draw upon to interact in a variety of contexts, it opens the possibility “to do otherwise”(Giddens 1984).

With such a conceptualization, knowledge production becomes a central stake in the joint R&D project. Knowledge will be co-created as a source of value for actors who nevertheless have different structures of meaning and follow different regimes of behavior. As a result, value takes different meanings as the actors try to make sense of their actions and interactions within the project. In the project, I witnessed a strong focus on industrialization: value creation meant enhanced products and market opportunities for the industrial actors. In the cases, it was expressed by respondents in the following terms: “the goal is to have a product ready to go to the market”, “a product with better performance than the competitors, easier to make and cheaper to manufacture” (ACA6). For the research laboratory, the stake was not automatically aligned with the project’s goals. “To create academic and research value” (IND9) meant to produce knowledge that can reach highly-rated scientific journals and which can be applied in the field. The academic laboratory found value in the reproduction of the conditions for knowledge creation: money to hire people to do the research and an operational field to test the result and ensure the accountability of the research theme. Of course, this meaning of value was not limited to an organizational perspective and evolved as the actors made sense of their interactions within the project. One important goal was thus to understand the “value” at stake for the actors (see Chapter 8) but also the influence of power relationships on the way they defined it: how interactions within the project shaped the interpretive scheme of “value” and its expression by the actors.

As a result, the study of U-I knowledge transfer cannot be separated from the study of power relationships: in a system of power, the newly-created knowledge is both the reflection of power and a generator of power effects. Even if I recognize that knowledge is a source of value for the partners, I should be attentive to the ways they compete to impose their own scheme of perception as the legitimated discourse in the project.

3.5.2 EPISTEMOLOGICAL ASSUMPTIONS

The epistemological assumptions behind such a view of U-I knowledge transfer are mainly linked to post-structuralism and the interpretive paradigm: a vision of competent actors – even if this competence is limited – who are able to make sense of their (inter)actions based on their rationality and systems of value. It assumes a

clear distinction between natural and social sciences and the importance of inter-subjective meanings to make sense of the phenomenon. It appeals for a double hermeneutic (Schutz 1973, Giddens 1984) to take into account the interpretation of the observing researcher as well as the interpretation of the observed human beings about the phenomenon in which they are involved. It urges for an understanding of social process through going inside the world of those generating it (Rosen 1991) by way of inductive and naturalistic methods. As the researcher is physically involved in the natural setting of the case, ethics matter. While conducting the cases, I adhered to an ethic of caution, was reflective and always opened to other views (Stake 1995). I was attentive to respondents' feedbacks and interpretations of the phenomenon at hand.

It also means that the researcher should not try to stay out of the phenomenon, or to hide behind a one-way mirror. His interactions with the respondents are full of learning opportunities and participate to the interpretive processes at stake in the project. As an illustration, my access to the field of MEGAPROJECT informed me about at least two phenomena: (1) the openness of MEGAPROJECT whose respondents felt that they owed something to the Walloon Region and therefore should be opened to outsiders like me; (2) the legitimization role played by the heads of laboratory such as the Professor who introduced me in Axis-1. I had the opportunity to triangulate this insight while discussing with a respondent:

Julie: When I am doing a workshop and I see the reaction of (...) regarding it, this is interesting. Or even the way I am accepted – or not – in a project, it gives out information.

Respondent: You entered the project thanks to Prof. (...) didn't you?

Julie: Yes

Respondent: So you got credibility from him too.

During this interaction, the respondent explicitly made a connection between the way I was accepted in the project and the legitimization function of the Professor during the project when supporting mistrusted results of front-lines researchers (see Chapter 8). After the interview, as we were debriefing the discussion, he also recognized that another reason was the fact that I took an interest on them, the front-line researchers.

In this paradigm, the role of the Management researcher is to instruct organizational actors so that they make better decisions (Amblard et al. 1996). It reflected my own view on Management science. In my belief, the primary goal of a researcher is to bring new understandings about unexplored or confusing phenomena. Like physicists explore physical events or chemists try to unveil the mechanisms behind a given chemical phenomenon, researchers in Management aim to bring some light to confusing socio-economic phenomena. But, as an interpretive researcher, I contest the unity of science: when studying people, the goal is not to explain a phenomenon but rather to understand it and to provide substantive models that reflect the interpretive processes at stake in the joint R&D project. As expressed by Giddens (1984): *“the social scientist is a communicator, introducing frame of meanings associated with certain contexts of social life to those in others”*.

At the project level, it implies that my primary goal is to explore the ways partners bring meanings to their interactions and justify the shaping of the knowledge creation processes. I am attentive to organizational goals as interpreted by their stakeholders as well as to the way knowledge transfer is seen as a source of value for the individuals who contribute to the project, independently of the organization to which they belong. At the policy level, I want to contribute to the field of innovation studies and to the *“knowledge base necessary for designing innovation policy”* (Fagerberg & Verspagen 2009): I aim for a deeper understanding of the actual effects of the Competitiveness Clusters of Wallonia on local actors and I want to highlight potential pitfalls so that policy makers may learn from the Walloon case.

While the interpretive paradigm advocates an axiological neutrality, I think that this position is very difficult to hold, especially in the case of this thesis as I study my own organized group of interest – the academic world. The university employs me, assesses my work, will possibly deliver my PhD and depends on regional and industrial funds to survive. As a result, it is important that I combine the interpretive assumptions that guide my work with a critical perspective as the one suggested by Habermas (1974): theories should be used to initiate a process of self-reflection among human actors who are competent to carry out the adequate actions. I am attentive to make clear who are the stakeholders of my research and to which extent they may influence my work. I also recognize that power relationships are sometimes endemic and attach importance to the transformation of alienating

structures. Indeed, I conceptualize U-I knowledge transfer as intertwined with power relationship: knowledge is always constituted by power, included scientific knowledge generated through joint R&D project. I should therefore avoid a naïve and neutral view of knowledge as “source of value” for all actors and study how actors compete to shape knowledge creation processes. Once again, the premise that *“the study of power cannot be regarded as a second-order consideration”* (Giddens 1984 p. 283) is coherent with the Structuration Theory.

3.6 CONCLUSION

In this chapter, I identify the specific hypothesis that guided my work as I unveiled or created knowledge about the phenomenon (Hatch 2000) of U-I knowledge transfer. I review the three main epistemological stances adopted by Management scholars as distinguished by de Nanteuil-Miribel (2008) and Chua (1986): positivism, structuralism and interpretivism. Each paradigm and its underlying assumptions are discussed and their impacts on the study of U-I knowledge transfer are explored. Then, I propose my epistemological stance as a critical interpretivism. Through this paradigm, I find the adequate theoretical and methodological premises to go beyond the traditional factors that influence knowledge sharing and creation – such as the amount of transferable knowledge flows, the attribute of knowledge transfer or communication frequency (Jiang & Li 2009) – and explore the political processes that have been neglected in this field. I also recognize that knowledge transfer is a process which can be source of value for collective and individual actors who are able to make sense of their (inter)actions within the R&D project and compete to impose their regime of justification as the legitimated ones.

To conclude, I confirm the Structuration Theory as an interesting inquiry paradigm for the study of targeted knowledge transfer. This paradigm is coherent with the ontological and epistemological premises presented above, especially its vision of individual actors as “knowledgeable” and reflexive: they are conscious of the structures and their constraining aspect but they also recognize their enabling facet and apply adequate rules and resources to interact with each other. As an inquiry paradigm, it confirms the research questions as interesting venues and leads towards data-driven, naturalistic methods to explore them. In the next chapter, the Structuration Theory and its implications are presented in more depth.

4.1 INTRODUCTION

The Structuration Theory developed by Anthony Giddens (1984) focuses on the structuration process of social systems: “*the structuring of social relations across time and space, in virtue of the duality of structure*” (Giddens 1984). This process is also defined by organizational researchers as “*the process whereby patterns of social action produce and reproduce the institutions and relationships that constitute the field*” (Lawrence et al. 2002). In other words, this framework describes how social systems – for instance the R&D projects – are structured through the interactions of individual actors – academic researchers and companies’ employees – who are “knowledgeable”, reflexive and apply adequate rules and resources to interact. The set of rules and resources that actors draw upon, constraining and at the same time enabling their actions, is what Giddens called “structures”. Structures are organized as properties of the systems but are “out of space and time”, applied by actors in a variety of contexts and practices.

Structures are dual: constraints and enablers of interactions, medium and product of the practices they shape (Nizet 2007). Through the duality of structures, actors bring meanings to a given context, focus on the adequate resources and are able to act. But they are also constrained by the structures: the rules, habits, institutions that shape their actions. Through their interactions, actors develop social practices that structure the project and become the new conditions for further actions.

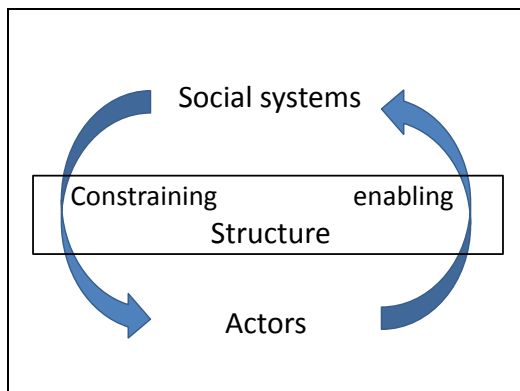


FIGURE 7 THE DUALITY OF STRUCTURE, ADAPTED FROM NIZET (2007)

While the Structuration Theory has been widely used to study information systems (Orlikowski 1992, Sahay 1997, Barrett & Walsham 1999), it has drawn less attention in other Management topics such as organizational learning and innovation studies. Some authors present the Structuration Theory as a powerful alternative to explore organizations and networks (Sydow & Windeler 1998, Hargadon & Fanelli 2002) but they can only observe that its “*application in empirical studies is still in an early stage*” (Pozzebon & Pinsonneault 2005), especially in the study of plural and overlapping social systems (Whittington 1992). In this work, I want to contribute to this field by empirically investigating such social systems, the joint R&D projects, and the way actors organize their actions to produce new knowledge that is valuable for their parent organizations. This framework allows considering academic and industrial partners as actors with different interests and motives and who have to coordinate their actions - share common and specific resources under common and specific rules - in order to contribute to the R&D project and brought back the gained knowledge to their organizations.

This theory shares common sociological bases with the KBV of the firm (Kogut & Zander 1992, Nonaka & Takeuchi 1995, Spender 1996, Brown & Duguid 1998, Nonaka et al. 2000). See for instance the concept of affordance proposed by Gibson (1977) and developed by both Giddens (1984) and Cook and Brown (1999). Like those authors, Giddens distinguishes between two types of knowledge: discursive knowledge and practical consciousness, “*all things which actors know tacitly about how to “go on” in the contexts of social life without being able to give them discursive expression*”. But, unlike them, Giddens links this knowledgeability to a missing concept in organizational learning (Easterby-Smith et al. 2000): power, the ability of one actor to accomplish things that depend on others based on his knowledge and the structural properties of the system (Chazel 1983, Giddens 1984).

In this chapter, I propose a general description of the Structuration Theory: its main theoretical elements, its use in Management study and some methodological implications. I also highlight the notion of power embedded in the Structuration Theory and explore its compatibility with the epistemological stance declared in the previous chapter.

4.2 THE JOINT R&D PROJECT AS A RELEVANT SOCIAL SYSTEM

Giddens defines the social system as a set of relationships that only exists in and through the continuity of social practices⁸ (Giddens 1984). Social systems are therefore the products of individual actors' interactions (Tywoniak 2007). They exist under the form of organizations, groups or even social movements (Nizet 2007) and differ on several dimensions such as the level of coordination of the constitutive interactions or their temporal and spatial extension.

In contrast with the sociology of organizations, Giddens' work does not focus on organizational contexts but it nevertheless inspires the study of various management situations and dedicated systems (see Autissier & Wacheux 2000) such as the management and evaluation of inter-firm networks (Sydow & Windeler 1998), knowledge management in distributed organizations (Orlikowski 2002) or knowledge creation through consulting relationships (Hargadon & Fanelli 2002). Like the KBV, the Structuration Theory considers the organization as a social community (Kogut & Zander 1996, Nahapiet & Ghoshal 1998) but it refocuses our attention on the fact that there are socio-political systems (Child 1997). In such view, interdependencies in joint R&D projects are not only a response to cognitive limitation in dealing with tacit knowledge and capability creation but also a strategic relation of power governed by a specific "regime of production" (Blankenburg 1998).

In this work, I deal with one particular kind of social system: the joint R&D projects. In those projects, individual actors have different values and diverging interests. Their actions are nevertheless intertwined as the Walloon policy of the Competitiveness Clusters requires their cooperation if they want to benefit from the

⁸ More generally, I define social practices as the "*coordinated activities of individuals or groups in their real work as informed by a particular organization or group context*" (Cook and brown, 1999) or, in other words, behaviors with meaning (action) in a group context (practices).

dedicated subsidies. In order to ensure the regulation of behaviors and the integration of strategies, a local order needs to be installed (Friedberg 1997): partners have to agree about a “problem” and ways to answer it within the joint R&D project. The definitions of the problem and its solution are an important stake for the partners (Friedberg 1997); they compete to shape it, enrolling allies to their cause even if those allies come from a different universe with “*distinct logic and horizon*” (Akrich et al. 1988). As a result, joint R&D projects are “*multilayered systems entwined through partially overlapping, partially competing logics as their members anchor in different linchpins of identity and loyalty*” (Grabher & Ibert 2006).

Another characteristic of joint R&D projects is their deadline-driven nature. They can be seen as temporary systems: “*set(s) of diversely skilled people working together on a complex task over a limited period of time*” (Goodman & Goodman 1976). This is especially true from the point of view of the laboratory which usually hires staff for the project on a fixed-term contract basis; in this case, the “episode” (Grabher & Ibert 2006) of the academic researcher within a given laboratory is equalled to the project deadline. But, in contrast with temporary groups studied in the literature (e. a. Meyerson et al. 2006), members of the project may expect to work together again in the future because of the institutional long-term relationship between the laboratories and the companies.

Through the prism of the Structuration Theory, we can argue that even if a local order stabilizes cooperative relationships by making opportunistic behaviors and defections more costly (Friedberg 1997), the negotiation about the R&D problem is continuously at stake in the conduct of the project. In fact, the Structuration Theory directs our attention to the social practices at hand in the project: the coordinated activities of partners as informed by the context of the project (Cook & Brown 1999) that (re)create the social system while building on it. As a consequence, the interdependencies at stake in the project are expressed in terms of actions rather than in terms of actors. Additionally, it defines the R&D project as an emerging construct: a locus of structuration instead of a formal structure (Autissier & Wacheux 2000). It is not a balance of forces as might have been argued by Mintzberg (1979) but it is, on the contrary, a network of relationships continuously

reproduced through social practices such as the negotiation about the R&D problem and ways to solve it.

4.3 STRUCTURES

The array of actions that are available for the actor is limited by his rationality as well as by the conditions of the context that, at the same time, enable him to choose one particular course of action (Friedberg 1997). The set of rules and resources engaged in interactions, constraining and at the same time enabling actors, is what Giddens calls “structures”. They are dual: constraints and enablers of interactions, but also medium and product of the practices they shape (Nizet 2007). Structures are collective constructs that emerge, are transmitted and persist through the actions of members of the social system. They are built from the “ground up” and form a reality that is partly independent of the interactions that gave rise to it (Morgeson & Hofmann 1999).

As expressed by Orlikowski (2000): *“Giddens (1979, 1984) proposed the notion of structure (or structural properties of social systems) as the set of enacted rules and resources that mediate social action through three dimensions or modalities: facilities, norms, and interpretive schemes. In social life, actors do not enact structures in a vacuum. In their recurrent social practices, they draw on their (tacit and explicit) knowledge of their prior action and the situation at hand, the facilities available to them (e.g., land, buildings, technology), and the norms that inform their ongoing practices, and in this way, apply such knowledge, facilities, and habits of the mind and body to “structure” their current action. In doing so, they recursively instantiate and thus reconstitute the rules and resources that structure their social action.”*

TABLE 11 THE THREE DIMENSIONS OF STRUCTURE, ADAPTED FROM GIDDENS (1984)

Structures	Signification	Domination	Legitimation
Modalities	Interpretive schemes	Facilities (and frustrations)	Norms
Interactions	Communication	Power	Sanction

In my opinion, the notion of social structures as instantiated rules and resources is the main conceptual contribution of Giddens to an important quest that still livens up social sciences (Udehn 2002, Felin & Foss 2005): the microtranslation of structural phenomena (Collins 1981, Giddens 1984). Concurrently to Giddens, James Coleman worked at a parallel task : the intrusion of social structure into the “rational action paradigm” (Coleman 1988). His explanation of social phenomena starts with the rational self-interested individual but, like Bourdieu (1986), Coleman acknowledges that an important part of one individual’s resources for action comes from his position in social structures that at the same time enable and constrain him.

As the notion of structure itself can be elusive and difficult to operationalize, Coleman defines the concept of social capital as “a resource for action” that consists of some aspects of social structure (Coleman 1988) and uses it as a tool to explore the way those structures influence our interactions. The conception of social capital developed by Coleman and later adopted by Nahapiet and Ghoshal (1998) accounted for the influence of “*the structure and functioning of the social world*” (Bourdieu 1986) on the individual and provides the basic theoretical blocks needed to overcome the operationalization difficulties attached to the micro-macro transition.

Since then, KBV researchers have used the concept of social capital to explain the creation and sharing of organizational knowledge (Nahapiet & Ghoshal 1998, Adler & Kwon 2002, McFadyen & Cannella 2004). This perspective poses the organization as a social collectivity (Kogut & Zander 1996) and a knowledge-creating entity (Nonaka & Takeuchi 1995) in which individuals voluntarily mobilize available resources in order to contribute to collective goals (Spender 1996). In Hermans and Lederer (2009), we argue that such an approach has led Management scholars to neglect important insights that are elaborated in the underlying sociological theories such as the political dimension of social capital, interest alignment between the actors and their social collectivity and therefore the use of social capital as a conceptual tool for the micro-macro articulation. In order to face those shortcuts, we compare the three dimensions of social capital as conceptualized by Nahapiet and Ghoshal (1998) with the three dimensions of social structures developed by Giddens (see Table 12).

TABLE 12 SOCIAL DIMENSIONS IN NAHAPIET AND GHOSAL (1998) AND GIDDENS (1984)

Dimensions of social structures	Dimensions of social capital	Modalities involved and function
Legitimation	Relational	Syntactic function: social norms giving direction for action
Domination	Structural	Political function: (asymmetrical) access to resources - facilities and frustrations
Signification	Cognitive	Semantic function: interpretive schemes to make sense of the context and to communicate this meaning

This confrontation brings four important insights. First, it clarifies the *distinction between the relational/legitimation dimension and the cognitive/signification dimension* by adopting a functional approach of those social constructs (Morgeson & Hofmann 1999):

- the relational dimension fulfills a syntactic function – norms inform about what action is socially approved or otherwise sanctioned, the collective behavioral expectations (Pozzebon 2004);
- the cognitive dimensions fulfills a semantic function – interpretive schemes help make sense of the context and communicate that meaning to others (Sydow & Windeler 1998).

Second, it presents the domination structures of Giddens as the reflection of an *asymmetrical access to resources* like information or access to relations with other agents, thereby highlighting the importance of position in a given network. Thirdly, it reminds us that social capital is a *tool for the micro-macro* transition, from social structures to agency and backward as “*social structures are both constituted by human agency, and yet at the same time are the very medium of this constitution*” (Giddens 1993). Finally, it allows the *reintroduction of power issues* in the KBV, a goal that has driven this work from the beginning.

4.4 STRUCTURES AND KNOWLEDGE

4.4.1 STRUCTURES AND ORGANIZATIONAL KNOWLEDGE

Following Giddens, structures are organized as properties of the systems but are “*out of space and time*”; they do not have a time-space presence apart from their instantiation through social interactions⁹. Structure is what gives form and shape to social life, but it is not itself that form and shape (Pozzebon 2004, Pozzebon & Pinsonneault 2005). In this view, a set of samples, new equipment or a plasma source only become resources when involved in social practices in the context of the project. While I understood the *virtual* nature of structures as memory traces instantiated in social practices (Giddens 1984 p. 25), I did not agree with its definition of structures as a set of rules and resources. Especially after the confrontation with the framework of Nahapiet and Ghoshal, it became clear to me that resources, be they allocative (command over non-human resources) or authoritative (command over human resources) (Sewell 1992), are not part of structures: only the rules that organize their access and distribution are. In that sense, I align with Sewell and define structures as the set of rules that empowers and constrains social actions, resources – or rather the access to those resources – being an effect of those rules (Sewell 1992).

Building on Wittgenstein, Giddens defines rules as generalizable procedures applied in the enactment of social practices. Those rules are generative in the sense that they are source of value for the involved actor because they facilitate desirable actions and generalizable in the sense that they can be applied (or transposed) in a variety of contexts (Sewell 1992). For Giddens, rules are therefore also memory traces that are inscribed in the discursive knowledge and practical consciousness of the actors and

⁹ As expressed by Giddens (1984, p. 33, emphasis added by Orlikowski 2000): “*some forms of allocative resources (e.g. land, raw materials etc.) might seem to have a real existence. In the sense of having a “time-space” presence this is obviously the case. But their “materiality” does not affect the fact that such phenomena become resources . . . only when incorporated within processes of structuration*”.

that they knowledgeably mobilize in their interactions (Nizet 2007). This conception of rules as memory traces that direct human actions leads me to question the nature of structures: if structures are collective generative rules, what distinguishes them from organizational routines and more generally organizational knowledge?

Since Davenport and Prusak (1998 p.5), knowledge has been approached as “*a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the mind of knowers*”. More specifically, Tywoniak defines knowledge as a behavioral rule that has been tried and successfully implemented, a structure validated (or sanctioned) through actions (Potts 2001, Tywoniak 2007). For this author, knowledge is a rule that produces heuristics guiding action and reduces environmental uncertainty through connections between ideas and facts (Tywoniak 2007).

While knowledge is held individually within the mind or in the brain of the knower (Davenport & Prusak 1998, Hargadon & Fanelli 2002, Liew 2007), it is not generated in a vacuum but through interactions with the environment (Anderson 2003, Tywoniak 2007) and other actors: knowledge must be shared for inter-subjective validation to occur. From a structurationist perspective, organizational knowledge will thus refer to the recursive alignment of individually held schemas, goals and identities that occurs because organizational actors tend to be surrounded by their own actions: “*knowing become social when the knowledge manifested in one individual’s action, by becoming a social artefact, shapes another individual’s schema*” (Hargadon & Fanelli 2002 p. 300). Organizational knowledge forms structures in the sense that it reflects the structural properties of a given organization, constraining and enabling actors whose interactions participate to its reproduction. It emerges out of social interactions, reduces uncertainties and stabilizes behaviors (Friedberg 1997, Becker 2004, Tywoniak 2007) thereby giving sense to practices and ensuring access to identity (Alter 2000, Hargadon & Fanelli 2002).

Those rules are sometimes called routines (Child 1997, Friedberg 1997), a concept that has been mainly developed through an evolutionary perspective after the seminal work of Nelson and Winter (1982). This perspective assumes that routines

are collective phenomena and direct human interactions through more or less flexible patterns of behavior (Becker 2004). While the debate remains on whether organizational routines actually refer to actions or cognitive rules (Becker 2004), the Structuration Theory might offer an interesting contribution: through the structurationist prism, routine can be seen as a dual phenomenon comprising action and cognition, the enactment of structures through organizational practices. This view has two main implications. First, one shall insist on the fact that *"an organizational routine is not a single pattern but, rather, a set of possible patterns – enabled and constrained by a variety of organizational, social, physical and cognitive structures – from which organizational members enact particular performances"* (Pentland and Rueter 1994 in Feldman 2000 p. 613). Second, routines are not a stable equilibrium but are constantly produced and reproduced through organizational practices. This is the main departure from the evolutionary perspective which poses that routines are followed repeatedly but are subject to change only if conditions change (Winter 1964); by contrast, the structurationist perspective on routines fits with an understanding of organization (or organizing) as an ongoing accomplishment (Feldman 2000) and with an epistemology of practices as proposed by Cook and Brown (1999).

4.4.2 STRUCTURATION AND KNOWLEDGE CREATION

Structures provide the conditions for actions, they define what members of a given network or system believe is possible and the panel of actions they can choose from to reach their goals such as knowledge creation through R&D activities. Sometimes, the network of relationships that is useful for reaching a given goal do not contain the entire organization (Hansen 2002). In other cases, the relevant networks include groups and other social collectivities outside the boundaries of the firm, blurring the distinction between the organization and the environment as the relevant social system (Child 1997). For instance, industrial researchers who work in collaboration with academic laboratories contribute to organizational knowledge creation while an important part of their useful relationships are outside the organization.

As a matter of fact, individuals belong to multiple social networks and draw resources from all those different systems. In order to take into consideration this phenomenon, the following axioms (Sewell 1992) may be helpful:

- The multiplicity of structure: structures emerge at different levels of analysis. The useful pattern of an employee may include some organizational divisions and not others as well as external knowledge communities and forums.
- The transposability of rules: syntactic and semantic rules that emerge in a given group may be applied in an innovative way in a variety of contexts and practices by actors. For instance, knowledge brokers take advantage of the structural holes that they bridge (Burt 1992, Burt 2004) to apply rules from a context to another one.
- The polysemy of resources: as a result of the transposability of rules, resources that are accessed in a given context may have different meanings when applied in another context. For instance, well-known concepts in a given research community can bring new lights and foster enthusiastic new developments in another discipline (Burt 2004).

In Hargadon and Fanelli (2002), the authors highlight the interest of overlapping networks for knowledge creation. They show how consulting firms specialized in New Product Development interact with their clients to produce new innovative products: the consulting firms provide the clients with new solutions that were not seen as “possible” by the clients while the clients provide the consulting firm with the empirical field to enact them in action. While the clients might be trapped in their own organizational routines, the relationship with a consulting firm brings an overlapping of networks and opens the set of possibilities for new knowledge creation. Orlikowski (2000 p. 412) explains that phenomenon in the following terms: *“by enacting various interpenetrating (and perhaps even contradictory) structures, actors experience a range of rules and resources that may generate knowledge of different structure and awareness of the possibilities for structural change (Sewell 1992, Tenkasi and Boland 1993)”*.

Such a recursive process between new possibilities and actions can be witnessed in the collaborative research projects financed by the Competitiveness Clusters of Wallonia. The joint R&D project is a privileged field for the observation of interpenetrating (and *often* contradictory) structures for new knowledge creation. Through the cross-fertilization of members, those projects should create value for the parent organizations: the social interactions at stake should enlarge the basis for action of the actors (Coleman 1988); they should allow the possibility “*to act otherwise*” (Giddens 1984) in which “*lies the potential for innovation, learning and change*” (Orlikowski 2000). At the same time, the R&D project is a complex system to handle: links between members are characterized by various intensity, frequency or nature. Besides, they might suffer from what Friedberg (1997) called a “deficit of legitimacy” as actors come from different worlds with specific principles (Boltanski & Thévenot 1987).

4.5 STRUCTURES, KNOWLEDGE AND POWER

Following the arguments presented in the previous section, knowledge creation in the Competitiveness Clusters and their joint R&D projects should be stimulated by the overlapping of networks. Academic laboratories as well as companies provide their partners with solutions that were not seen as “possible” before the collaboration. But the transposition of rules from one context to another, especially when the context is still emerging, is not neutral. The overlapping is constructed through interactions by individuals with diverging interests and asymmetrical access to resources: the facilities that partners have access to “contextually and individually” (Sydow & Windeler 1998) enable them to shape the project, its borders, its participants and its relevant rules. By doing so, partners exercise power: they reproduce resources as structures of domination and, at the same time, qualify themselves as knowledgeable actors (Sydow & Windeler 1998).

Through the structurationist prism, power is therefore seen as a transformative capacity: as “*the capacity of the actor to intervene in a series of events so as to alter their course*” (Giddens 1976). This view of power as a capacity to act diverges from the mainstream notion of power as an influence on others that emerges from the work of Dahl who describes power in the following terms: “*A has power over B to the extent that he can get B to do something that B would not otherwise do*” (Dahl

1957 p. 290). This latter view on power was adopted by Friedberg and Crozier (1977) who see power as the capacity for a given group or individual to influence other groups or individuals.

A narrower definition of power has been proposed by Giddens and combines the notion of influence on others and capacity to act (Chazel 1983). In Giddens (1976), **power is seen as a property of social interactions and more particularly as the ability of an actor to reach some results that depend on the action of others**. As a result, Giddens shares with authors like Friedberg and Crozier or Arendt (1972) a **relational** perspective on power, the fact that power is not a commodity that can be possessed or exchanged but instead becomes apparent when it is exercised between partners (Foucault 1984, Townley 1993). Unlike the early work of Foucault and the structuralist tradition, Giddens supports a **constructive** or collusive (Friedberg 1997) vision of power as an important driver of human cooperation: conflicts and power relationship are no longer endemic to social system (Orlikowski & Baroudi 1991) but can be considered as drivers (Chazel 1983, Giddens 1984, Friedberg 1997) of human interactions. Finally, power is **instrumental** as it is exercised by strategic actors who define their goals based on motives that they are able to express (Giddens 1984, Friedberg 1997).

This notion of power as a relational, collusive and instrumental process is coherent with the epistemological premises of this work. It recognizes that knowledge is produced inside a network formed by the involved actors and through their interactions. In this way, knowledge construction results from political processes but individuals are aware of it and have the capacity not to submit themselves to structures. This notion of power is subsequently also in line with the practical goal that initiated the research: to outline the leverages that actors can mobilize inside an R&D project to achieve organizational goals while preserving inter-organizational and individual interests.

4.6 CONCLUSION

In this chapter, I review elements of the Structuration Theory (Giddens 1984) as a general framework to understand the political processes of knowledge creation and sharing at stake in joint R&D projects. Through this prism, the collaboration is seen as a social system characterized by interpenetrating structures (Orlikowski 2000, Phillips et al. 2000): partners come from different kinds of organizations and are “*simultaneously embedded in the webs of obligation and loyalty to the project team, the firm, and to their role as entrepreneur of their own human capital*” (Grabher & Ibert 2006). In this view, knowledge creation in R&D projects is seen as a recursive process involving the enactment of interpenetrating structures: latent knowledge is made empirical through social interactions and made latent again through each individual interpretation of the mobilized modalities (Orlikowski 2000, Hargadon & Fanelli 2002). Social interactions between partners thus have an effect on the way partners perceive the goals and means of the project as well as their expected contribution. In other words, social interactions have an impact on the definition of the R&D problem as well as ways to solve it.

In the Structuration Theory, three dimensions are taken into consideration when exploring social interactions (see Table 11 p. 91):

- Communication that mobilizes interpretive schemes such as scripts, stories or identities and that “*restricts and enables agents to make sense of the context they act in and communicate this meaning (...) to others*” (Sydow & Windeler 1998);
- Sanction that mobilizes social norms and fulfills a syntactic function;
- Power exercise which mobilizes the means – facilities (Giddens 1984) and frustrations (Ortega 1961 in Cook & Brown 1999) – that are available for the actors in a given interaction.

In this work, I focus on the last dimension: I want to explore how power is exercised in joint R&D projects for the definition of the R&D problem and ways to solve it. I also acknowledge the semantic and syntactic functions of rules that are relevant within the project and used to legitimate its decisions.

This theoretical framework helps making sense of the political process at stake in joint R&D projects (Q1) but it is also coherent with the emerging research questions of this work: the influence of collective constructs provided by the institutional context (in this case, the Walloon Government) and appropriated by the collaborative practitioners (Q2), and the influence of the type of projects on the meaning assigned by the partners to their role and expected knowledge flows (Q3).

Concerning the impact of the Competitiveness Clusters policy on the way partners organize their collaboration, the Structuration Theory orients the researcher towards the role of the Walloon Government as an “animator” (Diez 2001). In other words, it focuses the attention of the researcher on the “*interplay of the institutional context when examining the dynamics of collaboration*” (Phillips et al. 2000, Lawrence et al. 2002): in this case, the way agents appropriate the set of rules provided by the institutional framework.

Concerning the link between the nature of the project and the specific knowledge exchanges, the Structuration Theory informs the researcher about the constant redefinition of the projects and the potential iterations that happen when “*old way of acting is challenged and claimed to be obsolete*” (Holmqvist 2003). In Chapter 7, I therefore look for potential hybridizations and iterations as the projects are constantly redefined. Then, I study the expected roles and contributions of actors in terms of knowledge transfer as the R&D activities vary between exploitation, exploration and prospect.

In Chapter 8, finally, I tackle the political processes at hand in Axis-1 and explore how the participants characterized their R&D projects as exploitative, explorative or prospective. As expressed by Phillips and his colleague (2000): “*the negotiation of collaborative relationships involves a wider and more fundamental range of issues, including the roles to be played by different participants, and the nature of the problem to be addressed*”. Chapter 8 therefore explores such negotiations, the emerging modalities and their subsequent mobilization by actors who want to contribute to organizational goals.

In conclusion, the Structuration Theory provides a powerful paradigm to understand knowledge exchange in cooperative contexts (Orlikowski 1992, 2002). It orients the researcher towards specific processes and aspects of social systems but it also gives methodological guidance to approach social phenomena (Nizet 2007). From a methodological point of view, actors are seen as knowledgeable and reflexive. The social scientist therefore considers that they can interpret their own behaviors as well as the power interactions that shape them. Even if this competence is limited by unintentional consequences and unknown conditions (Giddens 1984), actors understand the conditions of their actions, define goals based on motives that they are able to express and know that others will do the same.

This view of actors as competent and strategic is translated into a vision of scientific knowledge that aims to inform actors and to help them make better decisions. It also implies that respondents are able to give an account of their actions: the researcher has to be attentive to respondents' feedbacks and own interpretations of the phenomenon at hand – the double hermeneutic as expressed by Giddens. Besides, as all actors are involved in the structuration process, each partner in the R&D project is considered as a potentially valuable respondent. As a result, the researcher gives voices to the “ordinary” actors that nevertheless contribute to the innovation process (Alter 2000). The researcher also needs an observation phase in order to access the practical consciousness of actors as well as unintended consequences of their interactions. This is coherent with the naturalistic approach considered in this thesis that combines both *in situ* observation of interactions and semi-structured interviews. Another consequence is the urge for a longitudinal, diachronic study to explore the structuration process of the project and its impact on actors. The actual methods used in this work are presented thoroughly in the next chapter.

5.1 INTRODUCTION

In the previous chapters, I present the research object of this work as well as the theoretical and epistemological premises that are guiding its study. In the present chapter, I describe the methods: what I, as a researcher, actually did in order to answer the research questions (Maxwell 2005). In the sections below, I firstly introduce the research strategy – the qualitative longitudinal case study – and explain why it constitutes an adequate choice for this doctoral work (section 5.2). Secondly, I discuss alternative units of analysis and determine the sampling logic underlying the selection of the cases (section 5.3). Thirdly, I identify the data collection methods and the analysis strategies that were applied to generate findings (section 5.4). Finally, I discuss the validity of the research strategy as well as the coherence of the research designs that were selected to answer the three research questions (section 5.5).

Please note that this strategy has evolved since the beginning of the research. As expressed by Maxwell (2005): *“to design a study, particularly a qualitative study, you can’t just develop (or borrow) a logical strategy in advance and then implement it faithfully”*. For that reason, I try to put into context the choices that were made and the changes that occurred. Besides, the qualitative longitudinal case study was initially selected to answer the first research question of this thesis, Q1 – How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer. The research design was altered later on in order to allow the exploration of the emerging research questions:

- Q2 – How did the Competitiveness Cluster policy influence collaborative behaviors in a joint R&D project;
- Q3 – How does the nature of the R&D project influence knowledge sharing between partners.

As a result, I focus mainly on Q1 for the justification of the research strategy while highlighting evolutions linked to Q2 and Q3. Anyway, a summary of each specific design is presented in the dedicated chapters.

5.2 THE CASE STUDY AS AN ADEQUATE RESEARCH STRATEGY

As presented in the previous chapters, I chose to study U-I knowledge transfer as a social, contextualized process (von Krogh & Roos 1996, Faems et al. 2005) through a qualitative research informed by the Structuration Theory. More particularly, I chose the longitudinal case study as an appropriate research strategy (see Table 13). Guided by the research questions and the paradigmatic stance of this work, the justification builds on three main blocks: the necessity to develop naturalistic methods to approach targeted knowledge transfer, the coherence of the case study as a strategy to study a “How” question on contemporary events and the coherence of the strategy with the Structuration Theory.

First of all, the case study as the systematic examination of a case in real-life settings (Decrop 1999) is adequate to study U-I knowledge transfer as a social and political process. As proposed by Sargis-Roussel (2005), power relationships are difficult to grasp for an external researcher, requiring *in situ* observations and access to the field to witness the actual social interactions. Indeed, the case study research was identified as an interesting strategy through a preliminary study (see Hermans & Castiaux 2007) which confirms the interest of a qualitative approach while highlighting the methodological shortcuts of an interview survey: “(...) *discrete interviews are useful for gathering data about how the participant perceives the projects and their underlying knowledge flows. But it is a less powerful instrument when it comes to describe the actual knowledge process, as we did not actually observe it. Furthermore, respondents were mainly senior professors and R&D managers. As a result, front-line researchers are not sufficiently represented in our analysis that may suffer from this pitfall*” (Hermans & Castiaux 2007 p. 51).

By contrast, the case study was identified as a tool to witness actual events and to access all contributors of U-I collaborations. Besides, the phenomenon of interest – knowledge transfer – and its context – the joint R&D project – are difficult to distinguish from one another (Yin 1994, Salminen et al. 2006); especially, knowledge is considered as the product of social interactions (von Krogh & Roos 1996, Bozeman 2000), requiring to be studied through its context of production. Finally, long-term exposure to the case and its implicit multiplicity of data sources allow for an access to off-record issues as well as a better identification of taboos

and contradictions in the discourse of actors. It is an essential tool to draw an accurate picture of “competing and opposing loyalties” (Grabher & Ibert 2006) at stake in the collaboration.

Such a naturalistic approach – or at least its methodological aspects – is coherent with the study of *situated actions* as proposed by the promoters of ethnomethodology like Suchman (2007). According to her, the expression “situated action” underscores “*the view that every course of action depends in essential ways on its material and social circumstances. Rather than attempting to abstract action away from its circumstances and represent it as a rational plan, the approach is to study how people use their circumstances to achieve intelligent action*” (Suchman 2007 p. 70). And because people tend to overlook the fleeting circumstances of action, the *a posteriori* narration of actions is not enough.

Secondly, this work seeks to answer a “How” research question and focuses on longitudinal, contemporary events that the researcher does not control, pointing to the longitudinal case study as an adequate strategy (Yin 1994). Besides, it focuses on the understanding of processes, which are mostly explored through case studies (Merriam 1998) when the researcher can observe the sequence of events that describe how things change over time (Van de Ven 1992). Finally, the study of knowledge creation and sharing mechanisms involves intangible flows which can only be investigated through qualitative research (Lockett & Thompson 2001). Such a qualitative approach is particularly appropriate given the difficulty for measuring and interpreting organizational phenomena in the context of University-Industry interactions (Link et al. 1998).

Thirdly, the case study is coherent with the Structuration Theory that acts as a research paradigm for this work: combining semi-structured interviews with the observation of social interactions allows accessing both the discursive knowledge and practical consciousness of the knowledgeable actors (Giddens 1984). Besides, it takes into consideration the requirement for a longitudinal study to explore the structuration process at stake in the project. As expressed by Pozzebon and Pinsonneault (2005): “*Along with other scholars (Jones 1997; Rose 2000), we suggest that process approaches are more appropriate when structuration is adopted as the theoretical approach*”.

TABLE 13 MAIN FEATURES OF THE RESEARCH STRATEGY AND JUSTIFICATION

Features	Justification
Qualitative approach	Intangible flows mostly explored through a qualitative approach (Lockett & Thompson 2001); it allows to capture the significant tacit component of knowledge flows as well as people-related concerns proper to U-I collaboration (Davenport et al. 1999)
	Qualitative research appropriate given the difficulty for measuring and interpreting organizational phenomena in the context of U-I interactions (Link et al. 1998)
	Need of a rich data set: discourses of the actors as well as access to the field to witness social interactions (Sargis-Roussel 2005). Need to be close to the data and the informant (Decrop 1999)
Longitudinal approach	Exploration of a “How” research question that focuses on longitudinal, contemporary events that the researcher does not control (Yin 1994)
	Relevance of longitudinal, diachronic studies (Pozzebon & Pinsonneault 2005) to explore the structuration process (Giddens 1984) at stake in U-I collaborations
	Long time exposure to gain trust and to access off-record issues
Multiplicity of data sources	Combining semi-structured interviews with the observation of social interactions allows accessing both the discursive knowledge and practical consciousness of the knowledgeable actors (Giddens 1984)
	Better triangulation to identify taboos and contradictions in the discourses of actors, especially about the interests at stake in the joint R&D project
Naturalistic approach	The phenomenon of interest – knowledge transfer – and its context – the joint R&D project – are difficult to distinguish from one another (Yin 1994, Salminen et al. 2006)
	Knowledge is considered as the product of social interactions (von Krogh & Roos 1996, Bozeman 2000), requiring to be studied through its context of production
Explanatory case study	The study’s aim is to explain a situation we do not understand, when causal links are too complex to be handled by a quantitative survey (Yin 1994)
Instrumental case study	Conducted in order to gain more understanding about a phenomenon: the case is instrumental in reaching that goal (Stake 1995)

For these reasons, the case study was selected as the most appropriate strategy to answer the first research question of this thesis. As such, it is an instrumental case study: a study conducted in order to gain more understanding about a general phenomenon (Stake 1995). Instrumental case studies are usually contrasted with extreme or intrinsic case studies, when the cases are worthy being studied for themselves. Nevertheless, the distinction depends more on the research questions and general purposes of the study than on the intrinsic value of the cases. In this study, the goal is to learn about the phenomenon of targeted knowledge transfer and the cases are instrumental in the process of reaching it.

More precisely, it is an explanatory case study by opposition to exploratory and descriptive case studies. The explanatory case study seeks to understand how events and actions take place. It explains a situation we do not understand, especially when causal links are too complex to be handled by a quantitative survey (Yin 1994). Those insights allow for the construction of theory intimately connected with the empirical evidence (Glaser & Strauss 1967, Eisenhardt 1989). As a result, I draw on the cases to build insights about the link between power interactions and value creation in joint R&D projects. It is not an exploratory case study as research questions and adequate methods have been identified before its actual conduct (e.a. through the preliminary interview survey). Finally, it encompasses some depiction of the context but it goes beyond descriptive case study, looking for a general understanding of the phenomenon.

5.3 SAMPLING STRATEGY

In case-study research, the sampling strategy refers to three basic questions (Mills et al. 2009): what constitutes a “case”, how many cases should be studied and which criteria guide the selection of the case(s)? I answer those questions in the next sub-sections: I define the relevant unit of analysis as the collaborative research, “*the exchange relationships in formal research projects undertaken by university researchers and other research partners*” (Landry & Amara 1998) and explain the process of case selection.

5.3.1 A RELEVANT UNIT OF ANALYSIS

The choice of a unit of analysis, the definition of what the case is (Mills et al. 2009), is vital in a case study research. It can be an individual, a group, a program, a region, an organization (Patton 2002) as well as any other management situation (Eisenhardt 1989). For instance, units such as the new product development project (McDermott & O'Connor 2002) or the technological innovation (Leonard-Barton 1988) are used to analyze the innovation process.

In this work, I study targeted knowledge transfer through joint R&D projects. Such a research object can be explored from two main methodological points of view: within the organization or within the joint R&D project (see Figure 8, horizontal axis). As a unit of analysis, the organization allows focusing on how the whole portfolio of projects contributes to organizational strategies (Bruneel et al. 2010) but it fails short to explore learning *within* the joint R&D project. On the contrary, the analysis of joint R&D projects focuses on knowledge transfer *within* the project, thereby neglecting transfer *through* the project (Jiang & Li 2009). The choice between alternatives was made according to the goal of the study: to provide the collaborative practitioners with new insights about the conduct of joint R&D projects. As a result, I focus on the joint R&D project as the relevant level of analysis (right part of Figure 8). By doing so, I align with Sargis-Roussel (2005) and Helper and his colleagues (2000) who selected the project as a relevant unit for the study of knowledge creation and diffusion.

When defining the unit of analysis for the study of inter-organizational interactions, a second issue emerges: the choice between the organization or the individual as the relevant actor in the joint R&D project. In coherence with the epistemological premises that are guiding this work, I chose to focus on the joint R&D project as a network of individuals rather than organizations. This perspective acknowledges that individuals are self-interested actors whose personal interest sometimes aligns with organizational and inter-organizational goals. It also allows considering the multiplicity of network logics and loyalties that influence the behavior of individuals (Grabher & Ibert 2006).

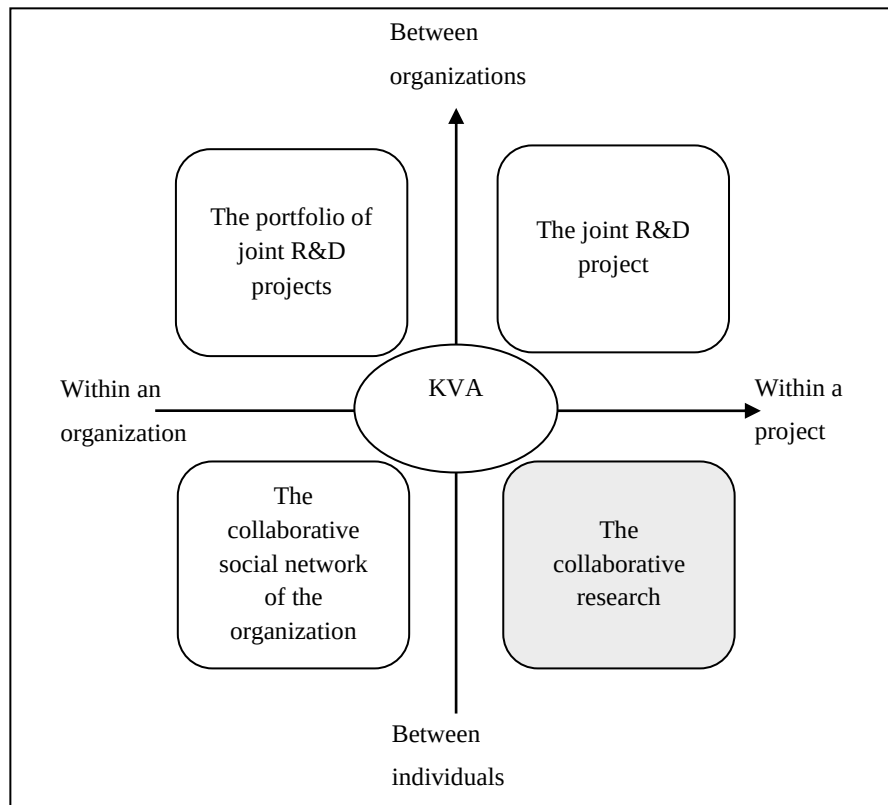


FIGURE 8 ALTERNATIVE UNITS OF ANALYSIS FOR THE STUDY OF TARGETED KNOWLEDGE TRANSFER IN JOINT R&D PROJECTS

Once those choices were made, a last issue remains: the definition of the boundaries of the case. On the one hand, the relevant unit of analysis can be defined as the formal project as decided in the consortium agreement. This option is usually considered for practical purposes. On the other hand, the collaboration can include a very large network of collaborators, if not the world research community (Katz & Martin 1997). In their search for a relevant unit of analysis for research project evaluation, Rogers and Bozeman (2001) propose the Knowledge Value Alliances (KVA), “an institutional framework binding together, in a knowledge covenant, a set of directly interacting individuals from multiple institutions, each contributing resources in pursuit of a transcendent knowledge goal”. The rationale behind such a unit is the concern that focusing narrowly on a project may lead to myopic results as its impact generally goes beyond the project framework. The same logic can be applied to the knowledge process at stake in U-I collaborations as open science

norms such as skepticism and communalism bear out knowledge diffusion in the academic community.

Opting for a unit of analysis such as the KVA would offer a broad perspective on knowledge transfer but it may also divert the study from its original purpose: helping the collaborative practitioners to manage inter-organizational knowledge processes. Once again, the goal of the research is decisive in defining the unit of analysis: its nature and boundaries. I define the unit of analysis, the case itself, as the collaborative research: the *“exchange relationships in formal research projects undertaken by university researchers and other research partners”* (Landry & Amara 1998). In the context of U-I links, engaging in a collaborative research thus involves *“defining and conducting R&D projects jointly by enterprises and science institutions, either on a bi-lateral basis or on a consortium basis”* (Debackere & Veugelers 2005).

As informed by the Structuration Theory (Giddens 1984), this unit of analysis is an emergent construct: it takes the joint covenant as a basis for the selection of the case(s) but it may take distance from its formal definition and boundaries. Indeed, it focuses on individual partners who actually engage in exchange relationships and thus continue to jointly conduct the R&D activities throughout the project. As a result, the collaborative research 1) may involve only a subset of the original partners and 2) allows considering partners who are not formally involved in the project and nevertheless contribute to the collaborative research. As expressed by Katz and Martin, *“exactly where that border (of the collaboration) is drawn is a matter of social convention and is open to negotiation”* (1997). As a result, I use a strategy of self-reported collaboration to draw the relevant borders. This strategy is proposed by Bozeman and Corley (2004) and permits the respondent to determine which exchange relationships are part of the collaborative research.

As an example, the relevant unit of analysis in Chapter 8 is a collaborative research named Axis-1. Axis-1 is a subpart of MEGAPROJECT, a mega project that was launched by the members of MecaTech during the first call for projects (see Figure 9).

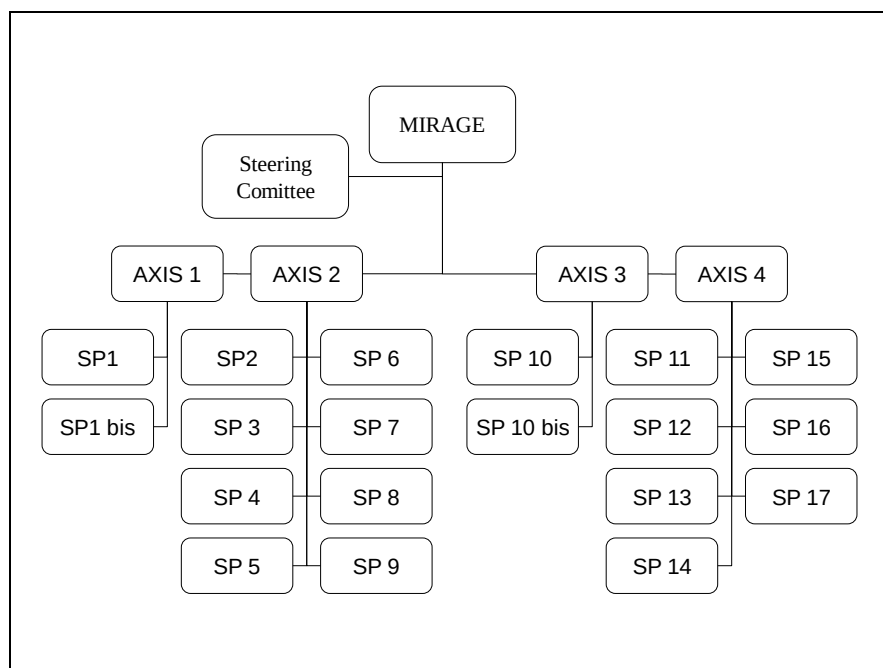


FIGURE 9 MEGAPROJECT AS A PORTFOLIO OF PROJECTS, ADAPTED FROM KUTY (2008)

Axis-1 is itself composed of two subprojects (SP): “antibacterial” (SP1) and “self-cleaning” (SP1bis) following the targeted properties of the research. Both subprojects have dedicated legal agreements, resources and deadlines but the majority of partners worked on both sides and considered Axis-1 as one project. As expressed by one respondent (IND6):

Axis-1 is composed of two projects that are considered as two dimensions of the same project (...) Axis-1 is quite specific; its two internal projects have a lot of similarities and are treated in common for more interactions.

The partners of “MEGAPROJECT” were the people “around the table” (IND22; IND7):

When I say “partners”, I mean Namur, Mons, all those people; the people who are really... the people we are working with (ACA7).

By contrast, members of MEGAPROJECT from other Axes and subprojects were not automatically included as partners; Axis-1 was conducted independently from MEGAPROJECT with only punctual interactions with those other partners (for instance during team building events). Another piece of evidence was the Excel

document prepared by the project managers with the name, affiliation and contact information for each “partner” (Notes_18.03.08): it comprised the individuals working on Axis-1, myself included even if I was not directly contributing to the R&D activities. The posters drawn by the partners at the end of the project¹⁰ (for more information about the context and the methodology, see Erpicum & Chalant 2010) also picture Axis-1 and all the partners as the relevant collaborative unit (see Figure 10).

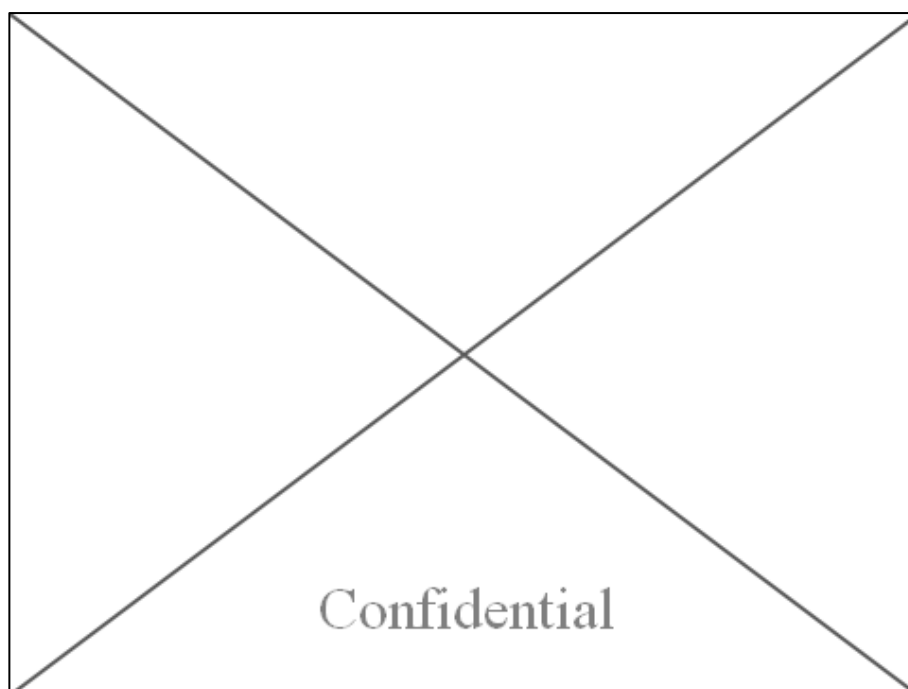


FIGURE 10 THE COLLABORATIVE RESEARCH AS SEEN BY A MEMBER OF AXIS-1

¹⁰ At the end of Axis-1, researchers from the Research Group Innovation Process proposed the “exchanger” method to capitalize on the collaborative experience of Axis-1 (see Erpicum and Chalant 2010). Partners were asked to draw the project as a journey and the resulting posters were presented to the group during the last plenary meeting of Axis-1.

Built as a relevant unit of analysis for Q1, the collaborative research is used to address the three research questions of this work, with one important subtlety concerning the exploration of Q2. In Chapter 6, I study the impact of policy configuration on the collaborative behavior of partners: on the way MEGAPROJECT was designed and conducted by individual actors. Departing from Axis-1, I could observe the influence of the public intervention on the conduct of the project but I failed to grasp its influence on the actual design of the project: focusing on Axis-1 alone would have failed to capture the influence of the Competitiveness Clusters policy on the construction of MEGAPROJECT as a portfolio of projects. As a result, I altered the research design and opted for an embedded case study (Mills et al. 2009) with two levels of analysis : the subproject level (Axis-1) and the project level (MEGAPROJECT). In both cases, the collaborative research was still the relevant unit of analysis: when building the mega project, R&D coordinators from various companies and heads of research laboratories were interacting “around the table” and each interlocutor was deemed partner of the collaboration.

5.3.2 SAMPLING LOGIC

In instrumental case studies, like in most qualitative researches, the foremost criterion for case (or respondent) selection is the learning potential: the best strategy is to identify cases with high learning opportunities rather than looking for the statistical representation of a population. For instance, MEGAPROJECT was considered by the actors as the main structuring tool of MecaTech. It was also one of the biggest projects in terms of budget and mobilized workforce (Kuty 2008). As a result, MEGAPROJECT seemed like a rich field to explore the research question at stake.

More precisely, I followed a purposeful selective sampling. It implies that the selection of cases is made prior to the beginning of the study based on a set of *a priori* criteria (Mills et al. 2009). Beyond learning potential, I established the following conditions: (1) I was looking for joint R&D projects (2) involving multiple partners (more than two partners) as bilateral projects might involve a different dynamic (3) with at least one company and one academic laboratory (4) primarily conducted in Wallonia to control for cultural influence as well as for

practical purposes. To ensure the access to the field, I also selected cases (5) with a personal gate keeper: an individual involved in the R&D project and who introduced me to his or her partners. Finally, I decided to include a final criterion: (6) projects launched in the first call for projects of the Competitiveness Clusters policy, which in fact encompasses all prior criteria (apart from criterion 5). From a methodological point of view, it allows for a better comparison of cases as projects are conducted under the same institutional framework. From the point of view of accountability, studying a public initiative enhances the relevancy of the research. From a practical point of view, it enhances the visibility of projects and facilitates the access to the field (see Chapter 6). Of course, cases had to meet the definition of collaborative research, which was not automatic. Indeed, some projects might involve multiple partners in the formal covenant while actual interactions are conducted in pairs or even alone. The framework of the Competitiveness Cluster policy accentuated this phenomenon as some subparts of the mega projects were performed as bilateral subprojects.

The choice between single and multiple case studies was not straightforward. At the beginning, a single case study seemed desirable because of the longitudinal approach selected for the exploration of Q1. Besides, the research question did not require contrasting observations from different projects. On the other side, multiple cases would have avoided problems associated with single case study such as the progressive loss of objectivity as the researcher is being committed to the case (Leonard-Barton 1990) as well as the lack of broader perspectives on the process as the researcher focuses solely on a micro study. From a practical point of view, a single case study is also a risky strategy as the researcher bets on one case which could be disappointing in terms of learning potential. However, being involved in multiple cases could have raised ethical as well as practical problems: the chance to unconsciously reveal information about a project to external persons rises dramatically with the number of cases under study. For that reasons, trust would be more difficult to create and maintain.

At first, this dilemma was solved by selecting two projects – TELECOM and MEGAPROJECT – in two different Competitiveness Clusters of Wallonia. TELECOM is part of Skywin, the Competitiveness Cluster of the aeronautic and

spatial industry, and MEGAPROJECT is part of MecaTech, the mechanical engineering Competitiveness Cluster. As the research evolved, each case was redefined as a subset of its original project (Axis-1 in the case of MEGAPROJECT and one “thematical axis” named CECES in TELECOM). This refinement was consistent with the formal definition of collaborative research as well as with the interpretation of the respondents who described their partners as “the people around the table”, the people who contribute to Axis-1 and CECES. In both cases, partners had identified a common field to be developed but while Axis-1 focused on the creation of new products and processes, CECES had adopted a more prospective approach, building a community of experts on the chosen theme. CECES and Axis-1 became interesting dual cases as they involved the same number of partners, the same kind of actors (two MNCs, one local SME and various research actors) and focused on issues involving nuclear technologies.

I finally decided to focus on Axis-1 for reasons linked to learning opportunities. First of all, Axis-1 became a richer case to clarify the problematic: the role of political interactions for value creation. In comparison, insights from CECES were not sufficient to draw valid conclusions. Secondly, Axis-1 and more generally MEGAPROJECT, reveals itself as a revelatory case (Mills et al. 2009) that enables to observe phenomena that were previously inaccessible in Wallonia. Indeed, actors from the case acknowledged that it was the first time that they worked together “as a real team” (ACA12; IND6). As a result, I focus on Axis-1 as the relevant unit of analysis to study Q1, using insights from CECES for triangulation purposes only.

If the research questions treated in Chapter 8 (Q1) and Chapter 6 (Q2) did not explicitly require a replication strategy, Q3 – “How does the nature of the R&D project influence knowledge transfer between partners” rests on cross-cases comparison. Four main replication strategies (see Table 14) are possible to contrast observations and draw conclusions. First of all, replication is ensured through the comparison of typical cases (comparative replication) or through temporal bracketing (Pozzebon & Pinsonneault 2005), when a longitudinal case is broke down in “learning” episodes that are subsequently treated as discrete analytical cases like in Knight and Pye (2005). Secondly, replicated cases target either similar results

(literal replication) or contrasting results (theoretical replication) for predictable reasons (Leonard-Barton 1990, Yin 1994).

In Chapter 7, I combine different strategies and propose a robust design for the study of exploitative, explorative and prospective R&D projects. First of all, I followed Axis-1 as a single longitudinal case due to its richness in terms of iteration and hybridization. Indeed, while some projects stay prospective, explorative or exploitative from the beginning to the end of the collaborative research, Axis-1 experienced a central iteration from exploitation to exploration, allowing for theoretical replication through time-bracketing (see Chapter 7). Besides, subparts of Axis-1 were identified as being of a different nature than the main part of the collaborative research, allowing for theoretical replication within the case through hybridization (see Table 14).

TABLE 14 REPLICATION STRATEGIES IN CHAPTER 7

Purpose of the replication	Theoretical replication	Literal replication
Method of replication		
Comparative replication	Comparison of subparts of Axis-1 as it experienced hybridization	Comparison of insights from Axis-1 with typical retrospective cases from MEGAPROJECT
Time-Bracketing	Comparison of “learning” episodes as Axis-1 experienced iterations	/

Secondly, I enhanced the research design with the dual methodology proposed by Leonard-Barton (1990). With this methodology, insights from a single longitudinal case (Axis-1) are compared to retrospective replicated cases (Leonard-Barton 1990, Yin 1994), in this case other subprojects from MEGAPROJECT. Indeed, MEGAPROJECT provided a field for quasi-experiment: subprojects were designed by the same persons, are financed based on the same rules, are conducted by the same (organizational and sometimes individual) actors who are subjected to the

same consortium agreements. As a result, I ensure literal replication – or confirmation – through the confrontation of insights from Axis-1 with additional cases from MEGAPROJECT. The selection of the retrospective cases followed a purposeful theoretical sampling (Mills et al. 2009): I selected typical cases on the basis of the emerging constructs – the explorative, exploitative and prospective R&D projects. SP7, SP9 and SP10 were finally selected on the basis of the description of MEGAPROJECT, interviews with the R&D coordinators and discussions with researchers from Innovation Process.

In complement with the replication strategy adopted in the thesis, I also studied this phenomenon through a traditional comparative study. In Hermans and Heck (2010), we compare three typical cases in order to highlight the link between the nature of the project and the specific knowledge flows. Cases were selected from Skywin and included CECES. Additional cases were studied by Michael Heck, a researcher who worked for nearly two years for the Research Group Innovation Process. Insights from this paper (Hermans & Heck 2010) are therefore used for triangulation purpose in Chapter 7.

5.4 DATA COLLECTION AND ANALYSIS METHODS

5.4.1 DATA COLLECTION METHODS

The case study research is a choice of objects to be studied (Stake 1995) that encompasses multiple data sources such as participant-observation, questionnaires, semi-structured or structured interviews, informal conversations, focus-groups, the examination of documents and artifacts, and many others. In this work, various sources and methods were therefore used to examine the cases in natural settings. In fact, the data collection methods were based on the three qualitative inquiry principles of Wolcott (1994): enquiring, experiencing and examining (see Table 15).

In order to face myopia threats (Leonard-Barton 1990, Rogers & Bozeman 2001), the methods include data collection through semi-structured interviews of front-line researchers working on a daily basis on the projects, senior researchers, academic professors and managers supervising the collaborative work. Punctual semi-structured interviews of organizational representatives such as the R&D coordinators of companies or the TTO from the universities involved were also

realized. Such panels permit respondent triangulation: respondents are from the industrial and the academic worlds, the latest being neglected in the literature (Gilbert & Cordey-Hayes 1996, Cockburn & Henderson 1998, Bozeman 2000).

An exhaustive list of sources is provided in Appendix 5. In Appendix 7, I also present the templates of guideline that were used to prepare the interview of the partners of Axis-1, of the R&D coordinators and of the partners of replicated cases.

TABLE 15 DATA COLLECTION METHODS, BASED ON WOLCOTT (1994)

Principles	Data collection methods	Data Sources
Enquiring	Semi-structured interviews	Front-line researchers
		Academic professors
		Managers
		Other (TTO, R&D coordinators, ...)
Experiencing	Observation of collaborative interactions	Observation and informal conversation during plenary meetings , joint presentations, team building and other events.
Examining	Examination of documents	Documents prepared to attest formal interactions: research contract, consortium agreement , minutes of plenary meetings (PV), presentations
		Organizational documents : internet website of the Competitiveness Cluster, publications toward stakeholders, etc.
		Unprepared documents : mails from the project's mailing list, mails from the cluster's mailing list, memo, field notes.
		Secondary data collected by researchers from the Research Group Innovation Process: interviews, observations and posters

Inside Axis-1, front-line researchers are the main respondents in coherence with the epistemological choices as well as with the goal of the research. As expressed by one respondent, head of an academic laboratory:

I cannot answer this question. **Only the researcher can describe a typical day on MEGAPROJECT.** Personally, my own typical day, it's the fifteen projects of the lab. For that reason I can't answer (...) In general, once the project is accepted, they (*front-line researchers*) are in charge of its

conduct. We are there to frame them but really, this is their job. The lab works this way. Personally, I am already thinking about the next projects (ACA3).

By contrast, R&D coordinators and academic professors were key informants at the level of MEGAPROJECT when studying the design phase of the project (see Chapter 6). Additional interviews were performed at this level but I also benefited from secondary data collected by researchers from the Research Group Innovation Process who realized numerous interviews at the level of MEGAPROJECT (see Appendix 5). When relying on this set of secondary data, insights were discussed with the researchers in charge of the original data collection.

Concerning observations, the main empirical field was the monthly plenary meetings of Axis-1. Notes were taken freely as well as guided by observation grids which drew attention to the conceptual frameworks. Other events include observation during conferences and workshops proposed by MecaTech as well as the “Helicopter Views” (HV), the annual team-building events that gathered every person involved in MEGAPROJECT.

Examined documents are posters and mails related to the Helicopter Views, the minutes of the plenary meetings (PV), the consortium agreement of MEGAPROJECT and its description of each subproject. I also accessed data collected by the researchers from the Research Group Innovation Process, in particular the interview reports and observation notes that were produced during their study of MEGAPROJECT. For triangulation and illustration purpose, I finally examined the posters that were drawn by the members of Axis-1 as a way to capture the experience of the project (see Erpicum and Chalant 2010).

5.4.2 ANALYSIS METHODS

The case study researcher should also determine the logical linkage between the collected data and propositions in its research design (Yin 1994). In this work, it refers to the identification of adequate analysis techniques that allow for the emergence of an explanation about the processes under study. The analysis process involves getting familiar with the data, organizing and reporting it to come to the identification of concepts and interrelationships. In interpretive research, this process includes one further step, namely interpretation (Wolcott 1994), which tries

to make sense of the key factors and related links identified through systematic analysis. In fact, the more the data has to be contextualized (in the case of memo for instance), the more this third step has to be stressed.

In order to analyze the data gathered through semi-structured interviews, I used the explanation building technique, an inductive and iterative analysis technique which is based on the following principles. First, the researcher observes a phenomenon, organizes the dataset and tries to infer an explanation about the actions and events that he witnessed. Data organization was processed as follows: semi-structured interviews were transcribed verbatim, sent to respondents to allow feedback and then stored with the qualitative data analysis software Weft QDA. In some exceptional cases, the respondent asked not to be recorded. As a result, I prepared a report based on written notes taken during the interview, sent them to the respondent and asked for feedback and validation. Written notes taken during plenary meetings were stored with the minutes prepared by one of the managers of the project as well as with documents related to the cases. As a matter of fact, some documents were only available on paper version, such as the adhesion contract and the consortium agreement. In order to complement the thematic analysis conducted with Weft QDA, results were synthesized in analysis table (see for instance Chapter 7 Table 23) in order to facilitate the organization of data and the comparison between cases. Those tables provided chains of evidence (Yin 1981,1994) as extracts of interviews, observation notes or documents are attached to each construct presented in the conceptual frameworks. Another analysis tool and chain of evidence is the construction of timelines with the main events of the project and associated pieces of evidence.

The second part of explanation building is the confrontation of initial theoretical statements with empirical evidence: the researcher goes back and forth from new empirical evidence to theoretical explanation in an iterative motion (Decrop 1999, Pettigrew & Fenton 2000). Such data-driven research is coherent with the organizational literature building on the Structuration Theory (Pozzebon & Pinsonneault 2005) and more generally with interpretive inquiries (see Chapter 3 – Epistemology). In this research, my aim is to access the multiplicity of logics that influence actors in order to make sense of their behavior. Explanation building allows for the construction of new substantive theoretical models about the

interpretive processes of actors. It is guided by the initial conceptual framework, the observer's experience and the informants' feedbacks. This is the main difference with another well-known inductive analysis technique for qualitative inquiries, namely the Grounded Theory (Glaser & Strauss 1967) which postulates the absence of prior theoretical framework, allowing for the construction of theory which is literally "grounded" in the empirical evidence.

Finally, I was able to share preliminary concepts, methods and results with the respondents during the plenary meetings – usually during informal conversations but also through formal presentations. They were also discussed with other researchers involved in the study of MEGAPROJECT from the Research Group Innovation Process. Those events allowed the confrontation of my own interpretations with the respondents' interpretation.

5.5 VALIDITY

When referring to the validity of a research, the researcher seeks to answer the question "how can I be wrong?" (Maxwell 2005). To deal with validity, positivist researchers ensure the quality of their qualitative work through the assessment of reliability, external and internal validity and objectivity (Denzin & Lincoln 2000). Constructivists, on the other hand, still seek to establish a consensus on their own criteria. In order to rethink the traditional criteria, Denzin and Lincoln (2000) propose the criteria of confirmability, credibility, dependability and transferability while Leeds-Hurwitz (1995) argues that the good constructivist research is coherent and intelligent toward informants, probable and plausible within the context and finally open-ended. Lee (1991) summarized this concern by suggesting that "a good interpretation is the one that resolves the apparent absurdities in the researcher's initial interpretation of the passage in a text or concrete behaviors in a social setting".

In this section, I use the four criteria of confirmability, credibility, dependability and transferability as a way to communicate about the strategies that were deployed in this work to produce valid scientific knowledge. In coherence with my epistemological stance, I particularly insist on the strategies that permit the

confrontation of inter-subjective meanings: with informants as well as with other researchers involved in the study of innovation networks.

Confirmability, which refers to the extent to which the conclusions can be confirmed by other researchers who read or review the research results (Bradley 1993), is challenged by two factors: a strong interest for the existing literature that may influence subsequent interpretations and the fact that this doctoral research is conducted by a single investigator. As a result, I acknowledge the influence of the conceptual framework on my work and completed the interpretation process in collaboration with informants, colleagues from various research centers and senior supervisors. I also provide evidence linkage: the construction of chains of evidence in order to support findings based on multiple data sources.

In order to reach *credibility* and capture an authentic representation of the phenomenon under study, I observed the following principles:

- Shared intelligence (Roussel & Wacheux 2005): the empirical work progressively integrates informants' knowledge toward a constructed explanation, during the project as well as by having chapter drafts reviewed by informants (Yin 1994). Such a principle allows for the confrontation of inter-subjective meanings as guided by the interpretive paradigm. To enable the confrontation, I followed a twofold strategy. First, I shared preliminary concepts, methods and results with the respondents during informal conversations but also through formal presentations. Second, I organized peer debriefing (Dyck et al. 2005): insights were discussed with other researchers, in particular researchers from the research center Innovation Process. Those researchers were involved in the coordination of the project, in the study of the collaborative dynamics at the level of MEGAPROJECT and in other cases from other Competitiveness Clusters.
- Systematic recording (Roussel & Wacheux 2005): qualitative data from interviews were systematically recorded: taped, transcribed and annotated.
- Respondent triangulation: verifying the qualitative material by looking from the perspective of all kinds of actors (academic and industrial actors; front-line researchers and senior researchers; etc.)

- Other methodological triangulation: use of multiple data sources, collection methods and analysis techniques (Deshpande 1983, Eisenhardt 1989).
- Extended engagement in the case (Dyck et al. 2005): observation during a 36 month- time period.

Dependability, the coherence of the internal process and the way the researcher accounts for changing conditions in the phenomena (Bradley 1993), is developed in this research by:

- Rectification (Roussel & Wacheux 2005): a gradual formalization of the problematic through fieldworks and interactions with the key informants, revising initial propositions.
- Saturation (Decrop 1999): the search for rich data and analytical saturation instead of fixed sampling determination.
- Analytical creativity (Roussel & Wacheux 2005): observation allows for data gathering and micro-analysis in an iterative process in order to enhance explanation capabilities.

Adopting these principles does not automatically ensure the quality of the work but it helps preventing potential shortcuts in the conduct of the research. It also helps in keeping a transparent research process so that *transferability* to other contexts may be feasible. Transferability is also supported when the researcher provides the research design attached to his work: the logical sequence that links the empirical data to the research questions and conclusions (Yin 1994). The research design is the roadmap of the study (Mills et al. 2009), even if it often implies detours, wonderings and loops. It is usually composed of five components (Maxwell 2005):

- The purpose of the case study: why do I intend to conduct such a research?
- The conceptual framework: which theories and previous findings will guide the data collection and analysis process?
- The research questions: what do I want to learn by conducting this case study?
- The methods: how do I intend to actually answer the research questions?
- The validity of the research: how can I be wrong?

In Appendices 2 to 4, I therefore provide the research designs dedicated to each research question of this work. They are presented following the interactive model of qualitative research developed by Maxwell (2005) which takes into consideration the interactions between each component and places the research questions as the keystone of the process.

5.6 CONCLUSION

In this chapter, I present the methodological tools that were chosen to explore the three research questions of this work. I justify the case study research as an adequate strategy, present Axis-1 as the main unit of analysis and detailed the data collection and analysis methods. I also take into consideration the potential weaknesses of this work and propose ways to face them.

It concludes the background of the thesis: the next chapters focus on the three research questions and present empirical results. In particular, Chapter 6 answers Q2: the influence of the Competitiveness Clusters policy on the collaborative behaviors of MEGAPROJECT partners.

Chapter 6 CONFIGURATION IN THE FLESH: CHALLENGES IN PUBLICLY PROMOTED CLUSTERS¹¹

6.1 INTRODUCTION

While the political dynamics at hand in R&D projects were my first research target, I quickly realized I should also understand the policy that was designed to affect the collaborative behaviors under study. In this chapter, I thus present the rationale of the Competitiveness Clusters policy introduced in 2005 by the Walloon Government and I study how its configuration influences the behaviors of R&D practitioners. The outcomes are twofold: firstly I aim for a deeper understanding of the effects of program configuration on collaborative processes and secondly I want to highlight potential pitfalls so that policy makers may learn from the Walloon case (Hermans et al. 2010).

In the second section, I present a literature review about the concept of cluster as proposed by today's innovation policies. In the third section, I depict the research strategy: informed by the Structuration Theory (Giddens 1984), I firstly identified the central features of the Competitiveness Clusters policy based on the examination of official documents and the observation of speeches given by public representatives; then I observed their appropriation by the collaborating actors through a two-level case study: the design phase at the project level (MEGAPROJECT) and the actual conduct of the collaboration at the subproject level (Axis-1). In section four, I describe the Competitiveness Clusters policy: its background and configuration. In section five, I explore the impact of this configuration on collaborative behaviors in MEGAPROJECT and Axis-1. I discuss results in section six and conclude in section seven.

¹¹ An earlier version of this chapter was written in collaboration with Stéphane Lucas (LAB2), Marcus Dejardin (ESL-CERPE) and Annick Castiaux (LSM) and published in the Journal of Technology Transfer. See Hermans et al. (2010).

6.2 THE EVALUATION OF CLUSTER INITIATIVES

While the label “pôle de compétitivité” is quite recent and comes from the French clustering experience (Blanc 2004), its relatives – the economic cluster (Porter 1998), industrial district (Pyke et al. 1992, Asheim 1996) or regional hub (Wong 1997) – have been considered for the last decade as key elements for regional economic growth. This insight comes from different school of thoughts, from the knowledge economy (Griliches 1979, Jaffe 1989) and economic clusters (Marshall 1890, Porter 1998) to the literature on Regional Innovation Systems (Cooke et al. 1998, Asheim 2003), but all sharing the basic assumptions that R&D is at the heart of economic growth and that local economic agents should take advantage of close proximity to develop complementarities and specialization (Porter 1998, Doloreux & Parto 2005).

Porter defines the clusters as “*geographically proximate groups of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities*” (Porter 1998). Beside their geographical concentration, members are also subject to institutional (Ponds et al. 2007) or cognitive; (Maskell 2001, Andersen 2006) proximity. This network configuration enables the trust and common understanding that eventually lead to spillovers from local universities (Jaffe 1989, Varga 2002), the transfer of tacit knowledge (Audretsch & Feldman 1996b) and the reduction of transaction costs (Lorenzen & Foss 2003), sometimes at the expense of external relationships (Maskell 2001). The role of knowledge diffusion for innovation and competitive advantage (Freeman 1992, Cooke 2002) even gave birth to the concept of (regional) knowledge clusters (Gelsing 1992, Maskell 2001, Lorenzen & Mahnke 2002).

In the field, the “cluster” has reached a quasi-paradigmatic status. More and more regional economic plans are shaped under its precepts (Ketels 2004), like the knowledge clusters in the Basque Country and the Japan’s Technology Advanced Metropolitan Area. This trend is supported by the strong theoretical arguments presented supra as well as by evidence of positive effects from success stories such as the Finnish Competence Clusters and their Centers of Expertise. This program channels public funding for joint R&D projects and requires the interaction of local actors such as universities, SMEs and big firms. Embedded in their national

innovation system, the Finnish clusters are seen as major contributors for the transformation of Finland's traditional economy into an innovation-driven economy (Boschma & Sotarauta 2007).

Such a policy combines the clustering approach with insights from the Triple Helix model (Etzkowitz & Leydesdorff 2000) which calls for dynamic interactions between the industry, universities and the government (Fallon & Delvenne 2009). Indeed, the Finnish initiative carefully intertwines industrial and academic innovation capabilities through the subsidization of R&D projects thanks to various sources of funding. Similarly, the French government promoted the creation of "*pôles de compétitivité*" that we translate as Competitiveness Clusters. Such clusters gather on a given territory companies, training centers and research units in order to develop synergies and cooperation. The creation of joint projects are encouraged within those "poles" but funds are mainly drawn from existing subvention sources (Weil & Fen Chong 2008).

Following in the steps of their neighboring government, the government of the Walloon Region borrowed the label and proposed the creation of Walloon Competitiveness Clusters in 2005. This cluster initiative is part of a larger economic development plan, the "Priority actions for the future of Wallonia", also called the Marshall Plan¹² for Wallonia. As predicted by its underlying rationale (see Figure 11), the Marshall Plan should contribute to the development of regional competitive advantage: Walloon firms should acquire specialization and learning processes facilitated by an enhanced access to local capabilities like infrastructure, skills, knowledge and institutional assistance (Doloreux & Parto 2005).

¹² As an anecdote, the nickname of the Priority actions for the Walloon future – the Marshall Plan for Wallonia – may have two origins: the common reference is the action plan for Europe after World War II, but a more subtle view from regional and spatial economists would reveal the allusion to Alfred Marshall (Marshall 1890), pioneer in the study of agglomeration economies and industrial districts (Bayenet and Capron 2007).

The network configuration promoted by its Competitiveness Clusters may also support the competitiveness of the participants: networks, viewed as a source of technological knowledge (Hitt et al. 2000), are especially interesting in the context of technology transfer (Gilbert & Cordey-Hayes 1996) as they allow for the reinforcement of formal contracts between members and for improving the selection of future partners in the network (Shane & Stuart 2002). Besides, *“backward, forward, horizontal, lateral relationships and linkage within, among, between firms and other organizations such as universities (...) have a significant impact on the productivity and profitability of R&D”* (Teece 1989). In fact, the enhanced access to the knowledge basis of Wallonia allows for a better analysis of what has to be developed and produced and of the underlying technical and organizational constraints. More particularly, horizontal links between competitors (Maskell 2001) should allow comparing alternative concepts and learning from failed variants.

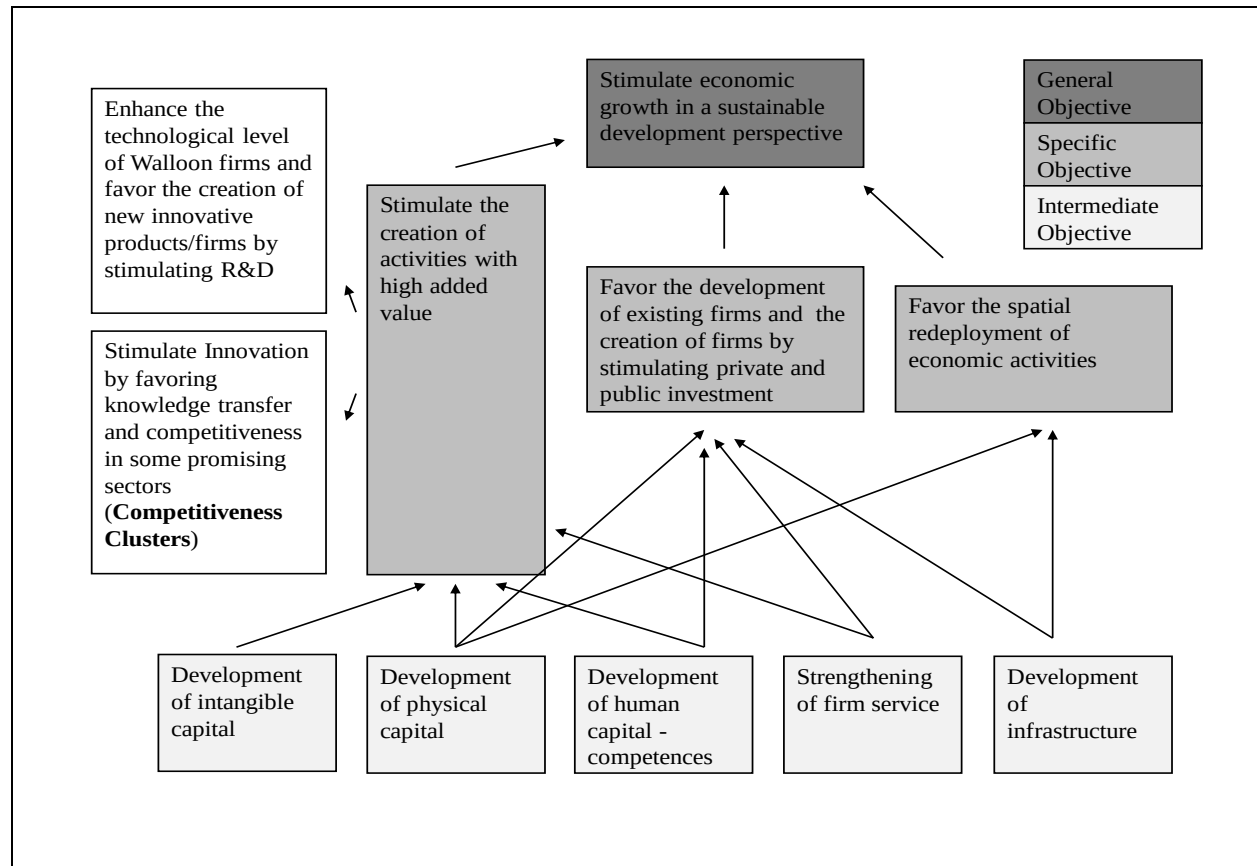


FIGURE 11 INTERVENTION LOGIC OF THE MARSHALL PLAN, ADAPTED FROM (VAN HAEPEREN ET AL. 2009)

Despite of the popularity of clusters, studies about the impact of clusters on the investing regions are still rare (Fromhold-Eisebith & Eisebith 2008). As a matter of fact, the evaluation of the underlying policies faces two strong technical obstacles: first, the difficulty of isolating its actual impact from other economic factors and, secondly, the difficulty to assess “soft” goals and other “second-order additionalities” (Autio et al. 2008) that nevertheless constitute the heart of most cluster initiatives, including the Walloon case (see figure 11 and Van Haeperen et al. 2009). Indeed, while first-order additionalities are concerned with the direct impact of the policy in terms of additional R&D activities (Autio et al. 2008, Clarysse et al. 2009), whether as extra R&D input or output, soft goals on the contrary focus on learning and knowledge exchanges inside the network. As confirmed in Clarysse et al. (2009), learning objectives and short term additionalities are different objectives for policy makers and the evaluation of the policy should reflect both levels.

As a result, the research community concludes that the study of direct and measurable additionalities is not enough to assess the impact of publicly promoted clusters. To meet this concern, two different paths are considered. On the one hand, researchers such as Autio et al. (2008) and Clarysse et al. (2009) are working on a quantitative analysis of second orders additionalities and more generally learning objectives inside the network. On the other hand, others advocate for a qualitative bottom-up approach (see Diez 2001) that emphasizes the social nature of innovation by gathering data from the different groups involved in the cluster: the operational cells, the firms, the research institutions, the authorities in charge, and so on. Through such a participatory approach, evaluators go beyond the acknowledgement of knowledge transfer and learning to “*take up the question of how this knowledge and learning can be used in the taking of decisions*” (Diez 2001). Combined with *ex-ante* evaluations that highlight the rationale of the policy under study (see Van Haeperen et al. 2009 for an *ex-ante* evaluation of the Competitiveness Clusters of Wallonia), such an approach should considerably enrich our understanding of its potential and realized impact on the investing region.

Through this chapter, I therefore want to contribute to the burgeoning field of clusters’ evaluation by conducting an analysis of the Walloon Competitiveness Clusters policy and its impact on local actors. To do so, I build on the concept of

behavioral additionality developed by Georghiou and his colleagues (Buisseret et al. 1995, Georghiou 2003): the differences in actors' behavior resulting from an intervention of public authorities (Georghiou 2003) also defined as the changes in the processes that take place within the organization (Clarysse et al. 2009) or in this case between organizations inside the joint R&D project. As the Competitiveness Clusters policy is structured through the conduct of U-I R&D project, the goal of this chapter is to inductively describe and explain the impact of the intervention on the collaborative behaviors inside a joint R&D project. My research question thus becomes: How did the Competitiveness Cluster policy introduced by the Walloon Government influence collaborative behaviors inside a joint R&D project? The outcomes are twofold: first I aim for a deeper understanding of the impact of such a policy on collaborative processes and, secondly, I want to highlight points of interest so that policy makers can learn from the Walloon case.

6.3 RESEARCH QUESTION AND METHODOLOGY

6.3.1 RESEARCH STRATEGY

To answer this research question, I developed the following research strategy. At first, I study the background of the Competitiveness Clusters policy in order to identify the most important features supported by the intervention. This first step was conducted through the gathering and analysis of data from official documents (i.e. Gouvernement Wallon 2005) as well as publications, conference speeches and workshops produced by policy makers, evaluators, and their academic collaborators (i.e. Bayenet & Capron 2007, Van Haeperen et al. 2009). The analysis resulted in the identification of six criteria that are used in section 6.4.2 to compare the Competitiveness Cluster policy with another Walloon clustering initiative.

Then, I study the transmission of these features in the design and conduct of MEGAPROJECT through a longitudinal qualitative case study. This strategy is informed by the Structuration Theory (Giddens 1984): through this prism, the features supported by the Walloon Government form a set of new rules that collaborating actors are able to draw upon (Phillips et al. 2000), constraining and at the same time enabling their actions. While the institutional framework provides those new features as heuristics to guide collaborations, knowledgeable actors have

to collectively appropriate those new rules (Alter 2000). By doing so, actors are in principle also able to challenge them through their reproduction (Phillips et al. 2000, Bachmann 2001). This structurationist perspective is consistent with the literature on the evaluation of innovation and clusters policy which considers that the role of public authorities is to *“create the conditions, the formal framework as well as the informal norms of trust and reciprocity, in short, the social capital that is required so that companies, intermediate organizations and public agencies be capable of self-organizing around the process of interactive learning”* (Diez 2001).

6.3.2 LEVELS OF ANALYSIS

The structuration process triggered by the Walloon intervention was studied through a multi-level longitudinal case study. First of all, the longitudinal case study is adequate to explore processes (Merriam 1998, Clarysse & Moray 2004) and to answer a “how” research question which involve longitudinal, contemporary events (Yin 1994). Beside, collaborative processes imply intangible flows (Davenport et al. 1999) which can only be investigate through a qualitative approach (Lockett & Thompson 2001). The longitudinal case study is also consistent with the nascent literature on cluster evaluation: a bottom-up and ex-post perspective (Diez 2001, Fromhold-Eisebith & Eisebith 2008) has been identified as a promising approach to reveal the actual impact and outcomes of regional clusters on firms. Besides, the concept of behavioral additionality is still in its infancy (Autio et al. 2008, Clarysse et al. 2009) and the literature would benefit from more in-depth empirical works about the mechanisms at hand.

The case, the MEGAPROJECT project, was followed from June 2007 to May 2010. Based on the hypothesis that behavioral additionalities are the largest with the first projects subsidized through a given policy (Clarysse et al. 2009), I selected a project that was part of the first call for projects. Besides, MEGAPROJECT is considered by the actors as the main structuring tool of MecaTech, the mechanical engineering Competitiveness Cluster of Wallonia. It is also one of the biggest projects in terms of budget and mobilized workforce (Kuty 2008). As a result, MEGAPROJECT is a rich case to answer the research question of this chapter.

The decision to conduct a multi-level study is guided by the particular nature of the selected case: MEGAPROJECT is composed of nineteen subprojects distributed

into four different “axes” (see Figure 12); as a result, MEGAPROJECT is not really considered as one project by the partners but rather as a portfolio of projects that are subsequently carried out more or less independently. Due to this complexity, the design phase has to be distinguished from its actual conduct: data collection and analysis are performed at two different levels: (1) the project level (MEGAPROJECT) to study the design phase and (2) the subproject level (Axis-1) to study the impact of the policy on an actual collaborative research. It also ensures that the transmission at the level of MEGAPROJECT is not a process of “windows dressing” to obtain subsidies.

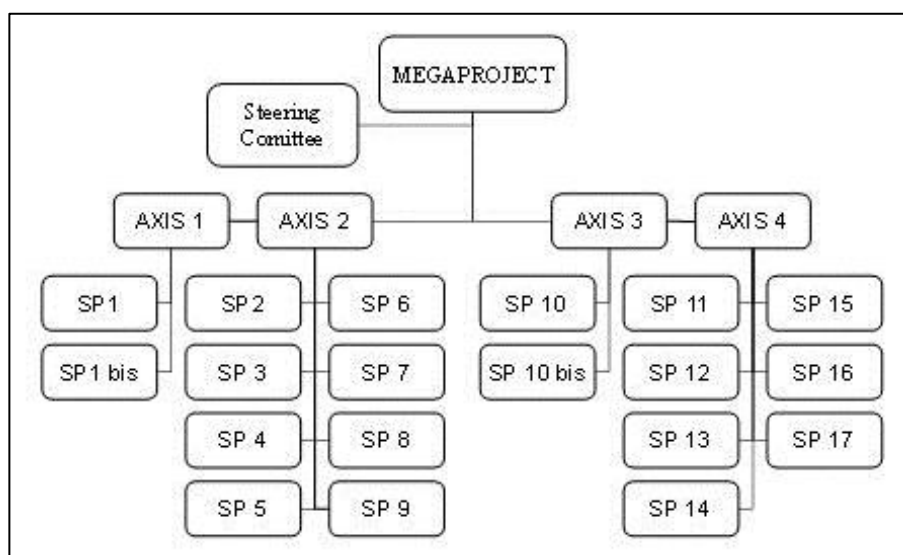


FIGURE 12 MEGAPROJECT AS A PORTFOLIO OF PROJECTS, ADAPTED FROM KUTY (2008)

6.3.3 DATA COLLECTION IN THE CASE STUDY

While the first component of this research – features identification – is based on observations and the examination of documents, the case study is explored using the three principles of Wolcott (1994, see p. 118) and thus also includes enquiring through semi-structured interviews. At the level of MEGAPROJECT, the panel of respondents is composed of individuals involved in the design process: directors of academic laboratories, spokesman of the academies, R&D managers from the companies that are part of MEGAPROJECT as well as some actors who participated to the creation of MEGAPROJECT but finally did not become part of it. Twenty-

one interviews were performed, fourteen from the industrial side and seven from the research world. This level of data collection allowed for the observation of the structuration process during the design of MEGAPROJECT but not the conduct of the collaboration per se. In addition with those interviews, I also refer to the work of Kutty (2008) and his team from the Research Group Innovation Process. At the subproject level (Axis-1), data were collected through observations during the monthly plenary meetings and other events as well as through semi-structured interviews of actors involved in Axis-1 (see Appendix 5 for more information).

6.4 THE COMPETITIVENESS CLUSTERS OF WALLONIA

6.4.1 BACKGROUND OF THE POLICY

The Competitiveness Clusters policy and the dynamics they are assumed to favor are a central component of the Marshall Plan which aims to establish in Wallonia *“the conditions for a shared prosperity through structural improvement and convergence towards European averages”* (Gouvernement Wallon 2005). This plan of four years (2005-2009), financed by one billion Euros, focuses on five priorities:

- The creation of Competitiveness Clusters;
- The support of professional initiatives and entrepreneurial activities;
- New fiscal measures at the benefit of the firm;
- The strengthening of research and innovation in connection with companies;
- The development of the Walloon workforce: skills and competences.

The five priorities are structured in “actions” (or instrument) with dedicated budgets, the biggest one being the funding of U-I R&D projects proposed within the framework of the Competitiveness Clusters. In fact, nearly 30 % of the whole envelope is dedicated to R&D activities throughout “actions” like the funding of U-I R&D projects, the support of academic spin-off creation or grants for doctoral researches with high innovation potential (see Figure 13).

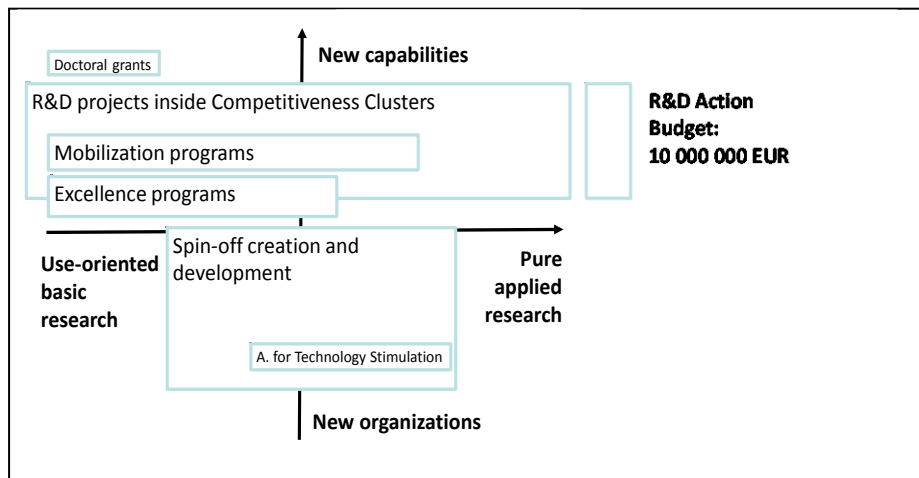


FIGURE 13 R&D ACTIONS FROM THE MARSHALL PLAN

Those instruments support the development of innovation capabilities either (see Figure 13, vertical axis):

- Through the creation of new organizations: new public agencies or new companies.
- Inside existing local organization, like companies and research units, by providing funds for additional research workers and research operating expenses.

Such R&D “actions” are driven by commercialization potential and support R&D activities that range from use-oriented basic research to pure applied research (see Figure 13, horizontal axis). Use-oriented basic research and pure applied research are both undertaken in the context of a given application but they differ on their objectives: while use-oriented basic research is dedicated to fundamental understanding, pure applied research is characterized by the quest for the right design. Pure applied research may produce new knowledge and practical experience but does not consider fundamental understanding as a primary objective (Stokes 1997). The position of a given project or doctoral work along this spectrum will depend on the vision actually adopted by the jury which selects it, the administration issuing the projects and the actors who will benefit from them.

Because these “actions” involve research centers and universities, the Walloon Region has to sustain efficient relationships between economic and research actors in order to benefit from systemic effects and to develop a competitive advantage (Lundvall 1992, Nelson 1993, Gibbons 1994, Etzkowitz & Leydesdorff 2000). The creation of Competitiveness Clusters and the financing of associated R&D projects tackle this concern. It urges Walloon actors to pool economic, technical, scientific and human competences in networks (Gouvernement Wallon 2005) and offers them a structure to materialize the potential partnerships.

The selection of the Competitiveness Clusters followed a mixed strategy (Bayenet & Capron 2007): a technocratic selection complemented by a bottom-up approach. First, five economic areas were initially selected by the Walloon Government on the basis of a preliminary study of the existing economic, technological and scientific bases of Wallonia (Bayenet & Capron 2007): (1) life science; (2) agro-industry; (3) mechanical engineering; (4) transport and logistics and (5) aeronautics and space industry. From those five would-be clusters, only two – life science and agro-industry – were identified by Prof. Henri Capron as having the potential to become an actual Competitiveness Cluster, namely (Bayenet & Capron 2007) the combination, on a given territory, of companies, training centers and research units which:

- Engage in a partnership approach in order to create synergies around innovative joint projects;
- Experience a critical mass that allows for international competitiveness and visibility.

This technocratic selection was combined with a bottom-up approach. After the identification of the five promising areas, relevant actors were asked to submit a cluster proposal that was reflecting a joint development strategy and the potential consortia that would result from the interconnection of participants. Economic and research actors took advantage of this opportunity and the five Competitiveness Clusters were finally labeled by an international jury in 2006: (1) Biowin; (2) Wagralim; (3) MecaTech; (4) Logistics in Wallonia and (5) Skywin. The clusters are now in their fourth call for projects and have launched more than forty joint projects

that include R&D collaboration as well as training opportunities. After the regional election of 2009 and the arrival of ECOLO (Green party) in the Walloon Government, the “Marshall Plan 2.Green” was negotiated and a sixth Competitiveness Cluster focusing on new environmental-friendly technologies was proposed.

6.4.2 PROGRAM CONFIGURATION

In order to identify the main features of the Competitiveness Clusters policy, I performed a thematic analysis on data collected through observation and documents examination. Observed events include the presentation of the policy by Mr. Benoit Bayenet during the 2008 CREAMAL (Creation in Wallonia) conference (henceforth CREAMAL) and the first University-Industry Meeting of MecaTech in 2007. Documents include the “Priority actions for the future of Wallonia” (Gouvernement Wallon 2005), the 18th January 2007 Governmental Decree about Regional Clusters (henceforth DECREE), the document produced by Prof. Henri Capron and that guided the selection of the Competitiveness Clusters (henceforth CAPRON) as well as the official websites of the Competitiveness Clusters policy and of the selected clusters (henceforth SITE).

The analysis resulted in the identification of six criteria: (1) the promoted pattern; (2) the promoted division of scope; (3) the allowed flexibility of membership; (4) the emergence process of the clusters; (5) the financial tools and (6) the promoted critical mass of the network (see Table 16). In the section, I present the six resulting features of the Competitiveness Clusters of Wallonia and compare this policy with another clustering initiative of the Walloon Government, the “companies’ networks or clusters” as defined by the Walloon Government in its 18th January 2007 Governmental Decree (for convenience, I refer to “Regional Clusters” when speaking about those “companies’ networks or clusters”).

Firstly, Competitiveness Clusters and Regional Clusters are both designed to favor an **organized network configuration** of Walloon agents: the pool of local competences and the interconnection of the knowledge basis. Indeed, the (geographic, cognitive or institutional) proximity that characterizes the members of a cluster is not always natural but can be organized so that they eventually form a

coherent interconnected network. For instance, actors of the Competitiveness Clusters are encouraged to adopt a governance system that favors the networking of members (CAPRON). Likewise, the 18th January 2007 Governmental Decree specifies that Regional Clusters should aim for the “*voluntarily development of complementary relationships between the members of the companies’ networks or clusters*” (DECREE). Finally, the Walloon Government recognizes the theoretical insights of Porter as a decisive influence for both policies (SITE).

TABLE 16 THE CLUSTERING APPROACH IN WALLONIA

Target	Competitiveness Clusters	Regional Clusters
Promoted pattern	Organized network configuration	Organized network configuration
Division of scope	Cross-fertilization	Cross-fertilization
Emergence process	Combination of technocratic selection & bottom-up approach	Bottom-up approach, spontaneous emergence
Membership	Require a balanced involvement of research actors (universities and research centers), training centers and (large and small) companies	Flexibility, mainly industrial actors
Financial tools	Dedicated R&D projects funding and temporary support of the operational cell	Partial and temporary financial support of the operational cell
Critical mass	International competitiveness and visibility	Regional competitiveness

Secondly, both Regional and Competitiveness Clusters share the ambition to go beyond a narrow definition of industrial sectors and to support **cross-fertilization**: it brings together organizations with complementary skills, from various economic sectors and scientific backgrounds. Indeed, extending network contacts outside a narrowly defined local milieu (Asheim & Isaksen 2002, Nishimura & Okamuro 2010) is emerging as an important feature of promoted innovation networks. Because “*the most threatening challenges are often those that come from outside the traditional definition of the industry and its products*” (Utterback & Suarez 1993), the promotion of cross-fertilization should facilitate the identification of such challenges.

The cross-fertilization should be particularly strong in Competitiveness Clusters through its focus on R&D alliances. For instance, it might bring together ICT specialists and hospitals for the treatment of complex medical pictures or the textile industry and pharmaceutical companies for the development of smart clothes. In fact, discourses presented cross-fertilization as an important feature for Competitiveness Clusters and as a secondary objective for Regional Clusters. During his speech at the 2008 CREAMAL conference, Mr. Bayenet even presented MEGAPROJECT as an extreme example of cross-fertilization and “hybridization” (CREAWAL) as it involves partners from organic chemistry and material specialists for the development of new surfaces.

The first real distinction appears at the third feature: the **emergence process** of Regional and Competitiveness Clusters. As explained supra, Competitiveness Clusters were identified by Prof. Henri Capron through a technocratic selection: the number of clusters and their area of focus were a priori defined by local authorities on the basis of the work of Capron. A bottom-up approach was used in a subsequent step for the actual creation of the Competitiveness Clusters. By contrast, the emergence process of Regional Clusters is much more flexible: they are “*spontaneously initiated by the industrial actors*” (CREAWAL) even if their labeling depends on conditions such as “*the mobilization of a critical mass in one or several domains of activities*” (DECREE).

The relative flexibility of Regional Clusters also transpires from its **membership** criterion: while the Competitiveness Clusters policy requires the balanced involvement of research actors, training centers, as well as large and small companies (Gouvernement Wallon 2005), Regional Clusters are “*established at the initiative, predominantly, of companies that have an activity in Wallonia, that can if necessary add the participation of academic institutions, research centers and training centers*” (DECREE). Indeed, Regional Clusters do not necessarily focus on R&D but rather on broad “business development” (CREAWAL). As a result, knowledge institutions are not mandatory partners.

Regional Clusters and Competitiveness Clusters also differ based on the available financial instruments (CREAWAL). Both kinds of clusters can count on local authorities for the **financial support** of their operational cell during the initial years of activity but only the Competitiveness Clusters have a specific funding tool for the conduct of concrete collaborative projects. Indeed, while Regional Clusters have a general focus on business development and innovation, the Competitiveness Clusters are the main framework for the definition and **conduct of joint R&D projects** financed by the Marshall Plan (see Table 17): in contrast to the French initiative, the Walloon Government allocated an earmarked budget for the “Marshall Plan projects”. The participation of universities are usually fully covered by public subsidies while its intervention covers 25% up to 70% of industrial expenses depending on the targeted activities (from basic industrial research to precompetitive development) and the nature of the firm (large firms or SMEs).

TABLE 17 FINANCIAL INVOLVEMENT OF THE WALLOON GOVERNMENT IN JOINT R&D PROJECTS, ADAPTED FROM KUTY (2008)

S: Subsidies RA: Reclaimable advances	Basic industrial research		Applied industrial research		Precompetitive development	
	S	RA	S	RA	S	RA
Large Firms	50%	-	35%	50%	25%	50%
SMEs	70%	-	45%	70%	35%	70%
Research Centers	50%	-	50%	-	50%	-
Universities	100%	-	100%	-	100%	-
Training centers	100%	-	100%	-	100%	-

In fact, Competitiveness Clusters distinguish themselves from other innovation networks through the materialization of its partnerships into concrete innovative projects (Bayenet & Capron 2007) involving both research actors and industrial partners with the goal of either targeting “*the concrete realization of industrial applications within three years, or the building of a prospective vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster*” (Gouvernement Wallon 2005). It should allow for spreading the risk and costs in the innovative phase (Mowery et al. 1996) and favor localized interactive learning through concrete collaborations.

Finally¹³, both kinds of clusters must demonstrate a reasonable **critical mass** in order to ensure its impact on Wallonia. The Competitiveness Clusters “*should aim for a critical mass at European scale, if not a global scale (...) a critical mass that allows for competitiveness and international visibility*” (Gouvernement Wallon 2005). The international visibility is also highlighted in the definition of the Competitiveness Cluster as the combination of organizations – firms and knowledge institutions – that experience a critical mass that allows for international visibility (Bayenet & Capron 2007).

For Regional Clusters, the Governmental Decree notifies that “*the critical mass shall be appreciated with regards with, among other things, the spatial dimension as well as the involved area of activity*”. More precisely, Capron proposes that activities that represent a regional stake but do not meet the definition of Competitiveness Clusters should rather develop a strategy of Regional Clustering

¹³ Note that in spite of those differences, Regional and Competitiveness Clusters are closely linked. In some cases, existing Regional Clusters became the engines of the corresponding Competitiveness Cluster (Kuty 2008; Van Haeperen et al. 2009), like in the creation of Logistics in Wallonia (SITE). In other cases, Regional Clusters appear as partners: confirming predictions made by Bayenet and Capron (2007), even if the ICT sector is not identified as a Competitiveness Cluster, its Walloon Regional Cluster has connections in each Competitiveness Cluster and actively participates in their R&D projects.

(CAPRON). In other words, Regional Clusters look for regional competitiveness while Competitiveness Clusters target global competitiveness and visibility.

While the characteristics of the policy (see Table 16) should support the learning processes of local organizations for the time horizon of the Marshall Plan, long-term impact remains uncertain and many fear that the underlying dynamics will turn out to be words writ on water. As the mechanisms behind long-term development of clusters and their impact on local capabilities are still unclear, a complementary analysis that considers the effects of the intervention on the behaviors of local collaborators is requested. In the next section, I build on the MEGAPROJECT-Axis-1 case study to understand the impact of the Competitiveness Clusters policy on collaborative practitioners involved in the project. First, I explore the transition of the characteristics proposed in Table 16 from the cluster level to the project (and subproject) level. Then, I interpret results and highlight central points of interests.

6.5 APPROPRIATION IN ACTION

6.5.1 STRUCTURATION AT THE PROJECT LEVEL: MEGAPROJECT

MEGAPROJECT was launched in May 2007 by members of MecaTech, the mechanical engineering Competitiveness Cluster. This sector was identified by the Walloon Government as one of the economic areas in which Walloon firms could develop synergies and competitive advantage through innovative partnerships (Bayenet & Capron 2007), pointing to a promising area of ferment in which the lagging region could compete. Indeed, even with moderate scores in Capron's study (Bayenet & Capron 2007), MecaTech brings together both well-established firms and more innovative industrial actors (Kuty 2008): hidden champions, high-tech academic startups and SMEs that represent the seeds of the future Walloon economy.

MecaTech defines its core feature, mechanical engineering, as *“the science of movement, equilibria, forces and the energies that they mobilize to provide customers with functional systems or machines”* (SITE). With this definition, MecaTech is characterized by a great heterogeneity of actors and should produce diffusing technologies (Bayenet & Capron 2007), in other words technologies that

are not specific to a single economic sector but can be applied in multiple areas. This heterogeneity is simultaneously the strength and the weakness of MecaTech: it favors cross-fertilization between actors from various economic sub-sectors, while it also underlies dispersed innovative efforts.

In order to tackle this issue, MecaTech members consensually defined five strategic foci that would constrain the upcoming calls for projects. Those orientations were coherent with the thematic deployed by existing Regional Clusters, smaller “grappes” and other organized networks that were active in Wallonia before the Marshall Plan. Yet, those five strategic orientations were deemed too diverse by the Walloon Government, which delayed the labeling of MecaTech and recommended that two out of the five strategic orientations be omitted. MecaTech was finally authorized and labeled in October 2006 with the original strategic orientations defended by both the soon-to-be members of MecaTech for the coherence of the Cluster and by a report by the French CETIM (Centre Technique des Industries Mécaniques), which supported the MecaTech foci choices (Kuty 2008).

The first strategic orientation, “Future materials and surfaces”, was sponsored by global leaders MNC1 and MNC2, two of the world’s leading surface producers. Both companies already had Walloon R&D centers and benefited from a solid network of subcontractors and research partners in Wallonia. Before the Marshall Plan, those networks were mainly organized as a sum of dyads: the sum of several bilateral relationships between one multinational corporation (MNC) and one regional research partner (see Figure 14). As negotiations for the creation of MecaTech and its first call for projects were still pending, MNC1 and MNC2 decided to mobilize the collective social capital (Kuty 2008) in a substantial joint R&D project: MEGAPROJECT. The approval of MEGAPROJECT and MecaTech by local authorities occurred concurrently in October 2006 and the project finally started in May 2007.

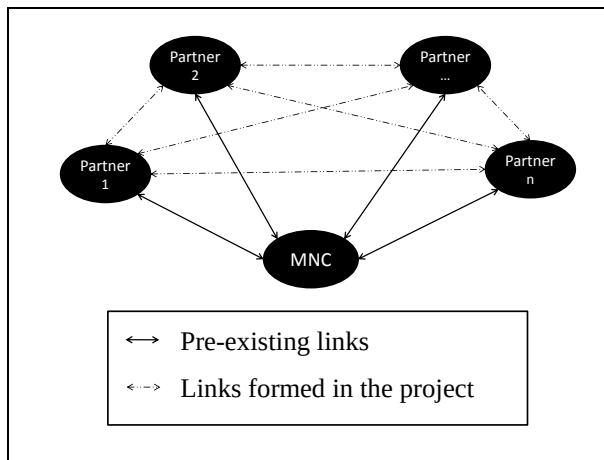


FIGURE 14 NETWORK FORMED BEFORE AND AFTER MEGAPROJECT

During the design phase of MEGAPROJECT, MNC1 and MNC2 acted as the crystallizers of the project:

Each bilateral is around the table (...) we took contact from the crystallizer towards everybody (IND1);

They need us to structure the approach (IND2).

Individuals from the partnering organizations (both academics and SMEs' representatives) also recognized the central role of large companies in the construction of the project (CR1, ACA1, SME1), especially the role of MNC2, "the initiator of the project" (ACA2).

MNC1 and MNC2 brought together a consortium of twenty-three organizational partners¹⁴ towards the strategic goal of "developing smart surfaces for a better management of the environment", focusing mainly on steel and glass surfaces following their core business. For the actors (ACA1, ACA2, IND3, IND22), the competence of each partner and its potential contribution to the strategic goal were the main criterion in order to be included in the project. Yet, the crystallizers also

¹⁴ Note that the university is presented as the relevant organizational level in the discourse of the industrial actors as well as in the documentation about the structure of MIRAGE. By contrast, the academic laboratory prevails as the relevant organizational unit in the discourse of academics and at the level of Axis-1.

took into consideration the requirement of the Marshall Plan (see Table 18 p. 149): additional partners were included in order to “set up a mega project that covers the whole value chain” (IND3). The consortium ultimately brought together seven universities, four public research centers, three large enterprises and nine Small and Medium-sized Enterprises from various sectors (surface producers, laser surface treatment, solar technologies, etc.) and various scientific disciplines (organic chemistry, plasma surface treatment, sensors development, spatial technologies, etc.).

The Marshall Plan and the financial incentives of the Competitiveness Clusters policy were seen as a catalyst for the formalization of the network “MEGAPROJECT”, as a “meeting place” where actors from diverse horizons gathered together for the first time. As explained by one respondent (IND2):

The positive aspect was to gather, very quickly, companies, universities, SMEs in order to share parts of our secrets, of our problems, of our challenges for the future, our roadmap, to exchange them, look for common elements and set up projects. I think it took three to six months, with great pain, but I think we got results. And without the Marshall Plan, we could never have had this cluster, this group of 16 people. It was impossible. For that reason I think this is an enormous positive aspect.

The Marshall Plan also provided a direction for the collaborative work under the motto “towards the economic redeployment of Wallonia”:

To go from the research phase to the economic valorization phase. This is the Marshall Plan, that’s the spirit of the Marshall Plan (IND4).

We want MEGAPROJECT to go somewhere, to achieve its initial objectives; (...) Marshall is there to create value in Wallonia, to create employment (IND5).

Through this direction, the leading role of industrial partners became clear for the crystallizers:

The idea comes from the industrials, with a clear vision of the equation market-offer (IND4).

Even in the most fundamental projects, academics have to ask the question about the interests for the industrial (IND2).

It also secured their legitimacy towards the academic partners:

Here, the originality was to give the takeover to industrials – because they have the leadership of the project – thus it was to say to them: here we are, we want to develop the economy in the Walloon Region, we want that – in ten years – you will be globally recognized industries. What do you have to do to in the framework of your R&D to be the best in ten years? (ACA2).

The nucleus is not the research into laboratories; it is the industrials and their problems (ACA4).

The Marshall Plan, it is an enormous nudge for the industrialization (ACA1).

As a result, industrial actors, and more particularly the large enterprises, were considered not only as crystallizers but also as ordering parties. The financing rules reinforced this arrangement, especially the financing of research centers at 50%, the other half of the expenses being in charge of MNC1 and MNC2. The role of industrial actors as ordering parties and the format of the projects proposed by the Walloon Government had a decisive influence on the selection of the four “axes” of MEGAPROJECT (see Figure 12) and the subsequent fifteen subprojects:

We cannot revolutionize in four years : they are either ends of projects that need a financing boost to reach the market or middle projects in order to complete them (ACA1).

Industrial partners therefore acted as they owed something to the Walloon Government, which among other things facilitated our access to the field, from the operational researchers to the R&D coordinators.

Nevertheless, the size of the project also created some tensions that delayed its launch. First of all, the negotiation of the consortium exhausted an enormous level of resources, undermining the motivation of the partners. Indeed, such collaboration is only viable if it is expected that each partner will respect its business scope: SMEs may be particularly worried if the large multinational partners decide to take over SMEs competences and becomes competitors. As expressed by one respondent:

It was difficult to establish trust in comparison with our usual bilateral relationships (IND1).

Such risks are inherent to technological alliances and were considered upfront by the partners of MEGAPROJECT, which took time and sweat. Nevertheless, the

requirement of “balanced involvement” of actors helped reducing the power asymmetry: the crystallizers needed to include more SMEs than initially designed (IND3; SME1); as large companies were not able to single handedly propose a project, it provided SMEs with negotiation power to secure the consortium agreements.

Additionally, the technological choices of MEGAPROJECT were made as a consensus. Indeed, the set of technologies chosen by the consortium builds on vacuum surface treatment, a scientific innovation that initially came from Space Research, disrupted the steel industry ten years ago and gradually replaced traditional technologies in mass markets as well as niches that are of interest for the research partners of MEGAPROJECT (Kuty 2008). As expressed by one respondent:

Every project is linked to the vacuum development, with 36 technologies behind in order to give a competitive advantage to each partner because it is a disrupting technology which will lead, during more or less a decade, to concrete results (IND5).

Vacuum surface treatment is a diffusing technology supported by an important set of Know-How developed in the steel industry and other sectors: it is already “trivialized, applying it not to a few pieces going into space but to millions of square meters” (IND4), with the potential to go global.

MEGAPROJECT was then structured on four Axes (see Figure 12): three “product” Axes (Axis-1, Axis-2, Axis-3) backed by one “process” Axis (Axis-4). Axis-1 for instance relates to a coating with self-cleaning and antibacterial properties through photocatalytic effects. The research activities actually developed in the subprojects varied from user-oriented basic research to pure development (Stokes 1997), stretching between two imperatives: on the one hand local economic development and quick concrete results – the interpretive scheme that put the industrials in their leading position – and on the other hand state-of-the-art exploration as hammered home by public discourses about the Competitiveness Clusters. This duality was expressed by one respondent (IND2) as the “great divide: undertaking fundamental, structuring research while creating employment”. The subsequent tension between exploration and exploitation was quite distressing for the partners as well as for the administration itself: how can we get quick results when an R&D project is about

future outcomes; how to finance industrialization project – the last step before commercialization – when the Competitiveness Clusters are about R&D? As expressed by one partners about the (re)negotiations:

Industrialization was a sacrilegious word. We had to take away two semesters dedicated to industrialization because the Walloon Region did not want to subsidize it; yet, the definition of the Competitiveness Clusters says the contrary! (SME1)

Finally, the partners of MEGAPROJECT chose to focus on bringing concrete results: *“a project really succeeds when it leads to the launch of a new product on the market or the integration of a new process on a line”* (HV_16.10.09). It nevertheless created tensions during the financing negotiation: basic research attracted better subsidies (see Table 17) but the Walloon Government omitted to provide a definition of basic research, industrial research and precompetitive development, allowing for freedom of interpretation and elasticity during the financing negotiations.

TABLE 18 TRANSMISSION AT THE LEVEL OF MEGAPROJECT

Competitiveness Clusters	MEGAPROJECT
Organized network configuration	Multi nodal network: 23 partners around 2 Large Enterprises as crystallizers Influence of pre-existing Regional Clusters, local “grappes” and other organized networks such as Agora
Cross-fertilization	Partners from various sectors and scientific disciplines: steel production, glass production, laser surface treatment, solar technologies, spatial technologies, organic chemistry, plasma surface treatment, etc.
Combination of technocratic selection & bottom-up approach	Struggle against dispersed innovative efforts: formalization of five strategic foci and inclusion of MEGAPROJECT in the first orientation
Require a balanced involvement of research actors (universities and research centers), training centers and (large and small) companies	7 universities, 4 research centers, 3 Large Enterprises, 9 Small and Medium-sized Enterprises Incentive to include more SMEs than initially planned
Dedicated R&D projects funding and temporary support of the operational cell	Incentive to “gather and talk”: the Competitiveness Clusters as a “meeting point” Selection of subprojects that address industrial problems and that meet the definition proposed by the Walloon Government: “those projects either target the concrete realization of industrial applications within three years, or the building of a prospective vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster” (Gouvernement Wallon 2005). Legitimate the leading role of industrial partners through the motto “local economic development” and the financial rules Tensions through the duality between explorative and exploitative R&D, resolved through a focus on “bringing quick outcomes”
International visibility and competitiveness	Incentive to include more partners than initially designed Technological choices influenced by the size of the partnership: a technology with application in global mass markets as well as niches of interest for the scientific and industrial partners

6.5.2 STRUCTURATION AT THE SUBPROJECT LEVEL: AXIS-1

MEGAPROJECT is composed of several independent axes that focus on dedicated properties like Axis-1 which is related to coatings having self-cleaning and antibacterial properties through photocatalytic effects. While Axis-1 was built as a set of two subprojects (SP1: antibacterial and SP1 bis: self-cleaning) with dedicated legal agreements, resources and deadlines, the majority of partners worked on both parts and considered Axis-1 as one unique project. As a result, Axis-1 was considered as the main unit of analysis to study the influence of the Competitiveness Clusters policy at the subproject level.

In line with the previous section, the research area of Axis-1 was initially identified by two partners – MNC2 and a Walloon academic laboratory – that previously assessed the feasibility of the underlying technological choice and took opportunity of the Marshall Plan to enlarge the collaboration to additional research partners:

As we were starting to talk about the Marshall Plan, our bosses said: wait, we are not going to do this project through the classical path, we are going to propose a project in the Marshall Plan, it will be a project for Wallonia, a multi-partnership project (IND8).

MNC1, one SME, one research center and three additional academic laboratories joined the original pair of partners, creating a “dream team” (ACA5) to address the research agenda of the project:

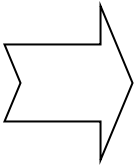
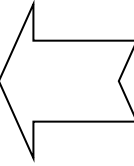
We might be the only ones in the world who are able to gather so many competences around the table to work on a project (IND22).

The project was rebuilt as an opportunity for cross-fertilization between the two crystallizers (see Table 19): on the one hand, MNC2 was already producing “easy-cleaning” steel but lacked a product with enhanced antibacterial properties; on the other hand, MNC1 already had an antibacterial product but was missing a competitive self-cleaning product produced through vacuum technologies. From the point of view of the industrials, Axis-1 was thus built as a learning strategic alliance (Doz & Hamel 1998) or rather a co-learning alliance because each partner was supposed to learn from the experience of the other.

By investing in Axis-1, both firms had the opportunity to develop new products and enhance their process portfolio following the technological choice made within

MEGAPROJECT. Indeed, Axis-1 primarily focused on vacuum surface treatment, with only peripheral exploration of technological alternatives (see Chapter 7). Other organizations were initially considered as Axis-1 partners to develop those alternatives but were finally dismissed in agreement with the Walloon Government in order to avoid dispersion.

TABLE 19 INITIAL INDUSTRIAL TARGETS OF AXIS-1

	MNC2	Cross-fertilization	MNC1
Self-cleaning	Enhancement of existing self-cleaning surface through plasma surface treatment		Development of a self-cleaning surface with photocatalytic effects induced by plasma surface treatment
Antibacterial	Development of an antibacterial product through plasma surface treatment		Enhancement of the existing antibacterial product through plasma surface treatment

By defining the specifications of the targets, the consortium explicitly defined a set of products that it believes in and wants the leadership for. In the case of Axis-1, the functionalities and performance to be met by the four targeted products were clearly specified: existing products of the crystallizers and competitive variants were characterized beforehand and specifications of Axis-1 were shaped with the intent to distinctly outperform them. Indeed, Axis-1 was supposed to quickly bring those new products to the markets, allowing for showing quick concrete results to the Walloon Government (HV, IND7). As the team eventually faced blocking points, the number of expected outcomes was lowered but the team kept an objective of realization in industrial settings (for more details, see Chapter 7).

The network configuration required by the Competitiveness Clusters policy and already applied at the level of MEGAPROJECT (see Figure 14) was displayed in Axis-1 both in its formal organization and in the actual interactions of partners. This specific configuration was acknowledged by the researchers and the managers who used to conduct joint bilateral R&D projects but had to develop new collaborative routines to take into account the multiplicity of actors in this new project. Indeed,

Axis-1 gathered five existing research partners of the crystallizers but it was the first time that those research partners ever worked together as a team¹⁵. As a matter of fact, it was the first time that the industrial partners worked in such a pattern:

It's not the first time we work with universities, but it is the first time we work with so many laboratories at the same time on the same project (IND6).

Along with the number of partners, the organization of the project strongly differs from previous collaborations. As expressed by a researcher (ACA13):

Q : Were those projects different than MEGAPROJECT ?

A : Yes, because there is more partners. When there is only one company, we have a direct contact with it. Here, it is a little bit different, first of all because there is two companies, two big companies, ordering parties I would say, which have their specifications, and different partners that interact. When we have a direct contact, tasks are not shared, therefore the organization is different.

Instead of providing a research service to the industrial company and thus be in charge of the research work from the beginning to the end, the research partners actually shared the tasks to be performed on the project. Two main technical roles were identified: the sample producers and the sample characterizers. Apart from one academic lab and the SME, all partners were able to perform both roles with different technologies. In fact, one of the goals of the project was to compare two different coatings technologies and access the knowledge of the two different labs in order to discuss the results (for more details see Chapter 7).

Indeed, results were shared with the industrial partners in punctual meetings as well as “around the table” during monthly plenary meetings: each partner was encouraged to come to those meetings even when they did not have results to show. In this way, coordinators conducted a collaborative project as defined by Debackere and Veugelers (2005): the project was jointly defined *and* conducted by the

¹⁵ The same phenomenon was witnessed in other subprojects. Members of MIRAGE in another subproject actually used a variant of Figure 14 to illustrate their organization during the Helicopter View (HV) of September 2008.

academic researchers and their industrial partners. Positive impacts were multiple: formalization of findings through the presentations, collegial discussion of results and the creation of a sense of community. As expressed by one respondent:

We try to be there for the others: people help each other, try to be available (...) as a matter of fact, also for you! (ACA6)

On the negative side, the frequency and length of plenary meetings put the heads of laboratory off. As a result, the actual experts were not always present to discuss future venues of the project, leaving the operational researchers – who were sometimes new to the subfield under study – represent the laboratory.

The network configuration was complemented by synergies between the scopes or skills of the partners. Complementarities were found:

- Between the competences of the large firms (see Table 19). In fact, the cross-fertilization between producers was the *raison d'être* of the project under the Marshall Plan banner. Axis-1 was seen as a “fair collaboration” as both partners brought their own experience and it eventually strengthened the link between the two companies (IND6).
- Between the large surface producers and the SME. The SME is specialized in eco-friendly detergents, has an extensive knowledge of the legislation that may affect the new surfaces and has developed stain characterization methods that are useful to assess the performance of the produced samples.
- In the scope of expertise of the research institutions. For instance, two alternative plasma techniques were used for the deposition of nano-layers. Each technique was applied in a different laboratory allowing the systematic comparison of results.

Beyond the formal complementarities that were designed into the project, I witnessed unintended examples of cross-fertilization, for instance between LAB2, specialized in nuclear physics, and the eco-friendly SME about a new procedure to assess stain (PV_03.12.08). Besides, synergies were not always based on the available equipment and techniques. As a matter of facts, the companies already had most of the equipment and skills to perform the characterization and deposition tasks of the projects. The overlapping of skills was then justified by a cross-fertilization

through the “different ways to work, different ways to tackle a problem” (IND6; ACA6), especially between the industrial partners and universities. Sometimes, differences were irreconcilable: while the first step of the project was supposed to define a common measure of the properties, the first collegial decision of the industrial partners was to keep their own measurement procedures, acknowledging that their absolute results could not be compared in a quantitative way. This subject stayed a source of misunderstanding until the end of the project.

6.6 DISCUSSION: BRIGHT AND DARK SIDES OF PUBLICLY PROMOTED CLUSTERS

In the previous section, I explored the impact of the Competitiveness Clusters policy on the collaborative behaviors in MEGAPROJECT and Axis-1 (for a synthesis of findings see Table 20 p. 156-157). In this section, I discuss the findings from an evolutionary perspective. More precisely, I build on the literature on technological life cycle and the KBV of the firm in order to highlight the main challenges of the Competitiveness Clusters policy that emerge from the case study.

6.6.1 COMPETITIVENESS THROUGH INTERCONNECTED COLLATERAL ASSETS

When designing MEGAPROJECT, the partners appropriated the set of rules and resources provided by the Competitiveness Cluster policy. A mega project was imagined, with three axes focusing on products and one axis developing the associated technological platform. Three main interpretive schemes guided the choice of vacuum surface treatment as the operational integrator of MEGAPROJECT: the struggle against dispersed innovative efforts, the involvement of actors from the whole value chain and the focus on quick, concrete results. This set of technologies was not new to the world, having disrupted the industry in the late 1990's. It builds on existing Know-How and promises results in mass markets targeted by the crystallizers as well as niches of interests for other partners.

In this way, MEGAPROJECT is seen as the final boost to reach global markets and to fully appropriate the economic valorization of past R&D efforts. The international dimension of the crystallizers, as well as the presence of hidden champions (Simon 1996) in the consortium, should help achieve these goals.

At the project level, the strategy followed by MEGAPROJECT triggers the competitive advantage of the whole consortium through the externalities generated by the nested technologies: interconnected – large and smaller – actors should be associated to the profit turned by the project. For instance, even if the SME from Axis-1 does not commercialize the deliverables of MEGAPROJECT, it is working on a complementary product designed to fit the new surfaces developed in MEGAPROJECT. The SME will benefit from the strong brand images of MNC1 and MNC2 in existing delivering channels as well as towards mass consumers when offering its complementary product. The established surface producers, in turn, will be able to use the collaboration with this small, innovative and eco-friendly firm to enhance credibility when communicating about efforts toward improving the environmental sustainability of their business. In other words, the Competitiveness Clusters and its R&D projects also allow established players to combine their own collateral assets – delivering channels, integration skills, brand image, existing processes – with organizations that have exclusive expertise or skills.

TABLE 20 TRANSMISSION, IMPACT AND EVOLUTIONARY INSIGHTS

Features	Transmission to MEGAPROJECT & Axis-1	Evolutionary insights
Organized network configuration	MEGAPROJECT as a multi nodal network: 23 partners around 2 Large Enterprises as crystallizers Influence of pre-existing Regional Clusters, local “grappes” and other organized networks such as Agora Axis-1 as a multi nodal network: 8 partners around 2 Large Enterprises as crystallizers	Better knowledge of failed variants (Maskell 2001; Thusman & Murmann 1998; Utterback 1996) Pool of existing collateral assets (Gouvernement Wallon 2005; Utterback 1996)
Cross-fertilization	MEGAPROJECT: steel production, glass production, laser surface treatment, solar technologies, spatial technologies, organic chemistry, plasma surface treatment, etc. Axis-1: Steel producer, Glass producer, Chemistry, Nuclear Physics, Eco-friendly detergent producer, ...	Better knowledge of threats and opportunities, especially if coming “from outside the traditional definition of the industry and its products” (Utterback 1996) New intertwined collateral assets (Doloreux 2005, Utterback 1996) and subsequent higher pleiotropy of the technological system formed by the partners
Technocratic selection & Bottom-up approach	Struggle against dispersed innovative efforts: formalization of five strategic foci and inclusion of MEGAPROJECT in the first orientation; selection of vacuum surface treatment as an integrator	Focus on one technological trajectory (vacuum surface treatment) at short and middle term
Balanced involvement	MEGAPROJECT: 7 universities, 4 research centers, X training centers, 3 Large Enterprises, 9 Small and Medium-sized Enterprises Incentive to include more SMEs than initially designed Axis-1: 2 MNCs, 1 SME, 4 academic labs, 1 research center	Fulfillment of gaps highlighted by the technological focus and enhancing/destroying impact (Gatignon et al. 2002) on Walloon organizations from the whole value chain, including knowledge institutions

R&D projects funding	Incentive to gather and “talk”: the Competitiveness Clusters as a “meeting point” Legitimate the leading role of industrial partners Selection of subprojects that address industrial problems and that meet the definition proposed by the Walloon Government Tension between exploration and exploitation: focus on getting quick concrete results “for the redeployment of the Walloon Region”	Additional resources from local authorities Higher rigidity of the network through credibility towards the public authorities Focus on one technological trajectory (vacuum surface treatment) at short and middle term: with both prospective and realization projects at the sub-system level (Murmann & Frenken 2006) Development of mutually-sustainable processes and products
Critical mass: International visibility and competitiveness	Incentive to include more partners than initially designed Technological choices influenced by the size of the partnership: a technology with application in mass markets as well as niches of interest for the research partners	Exploitation of the technological trajectory through the international dimension of the crystallizers and the presence of hidden champions

6.6.2 LOCK-IN THROUGH INTERCONNECTED COLLATERAL ASSETS

Partners share existing collateral assets but they also develop competences as needed by the project. The technological challenges that the partners of Axis-1 face are endogenously created within the Competitiveness Cluster: the eco-system formed by the participants is subjected to endogenous technological changes as the partners follow a given strategic focus (at the cluster level – MecaTech), select a common technological strategy (at the project level – MEGAPROJECT) and actually undertake the research activities towards a dedicated property (at the subproject level – Axis-1). This micro-level discontinuity affects the specific Know-How and skills of the partners by identifying gaps in competences that are nevertheless required in the cluster. It also affects existing capabilities, either by enhancing or threatening their relevance. This enhancing/destroying characteristic is rooted in the particular history of the participants: an innovation can be competence enhancing in one organization but competence destroying in another organization (Gatignon et al. 2002).

Or both: as a partner in MEGAPROJECT and more particularly in Axis-1, LAB2 engaged in the development of new competences needed by its industrial partners and linked to the production of smart surfaces through plasma surface treatment. At the same time, other competences like Wet-Chemistry surface treatment were made obsolete as alternative research areas were neglected and machines replaced in order to fit the technological choices technological choices: the focus on vacuum surface treatment favors within MEGAPROJECT. Such technological developments result from the political forces that were unleashed “around the table” for the creation of MEGAPROJECT and favors the development of specialized assets (Williamson 1985) as partners develop interconnected competences.

In MEGAPROJECT, Walloon organizations bet on vacuum surface treatment as the cash cow for the next ten years. Both prospective and realization subprojects are building on this set of technologies: the competences are supposed to be acquired through the project and remain state-of-the-art for a long time. As the subprojects progressively reach its commercial targets, partners should expect the slowing down of the collaborative dynamics as the exploitation of outcomes reduces incentives to further develop technological partnerships. As a result, the attractiveness of the

Competitiveness Clusters may drastically decrease. In particular, multinational corporations that were attracted to the knowledge cluster due to shortages of labor for exploitative R&D in their home base (Lorenzen & Mahnke 2002) may reconsider their spatial location. Coupled with the discrete nature of the Marshall Plan (2005-2009), the risk of its financial streams dry and the great mobility of R&D units in Europe (Sachwald 2008), this observation is particularly worrisome.

In their study of the link between the propensity for innovative activity to cluster and the industry life cycle, Audretsch and Feldman (1996a, with original emphasis) identify a *“tension between the propensity for innovative activity to cluster in order to exploit the value of such knowledge spillover, but at the same time to seek out new economic space because, **new ideas need new space**, at least during the mature and declining stages of the life cycle”*. The congestion of current clusters and the need to move away from them to develop new ideas refer to the concept of “lock-in” originally developed by Arthur (1989). In our case of interest, the lock-in would arise from the choices made at both the cluster and the project levels and channeled through the needs of the crystallizers: once investments are made according to those choices, a lock-in may prevent local firms from experiencing alternatives and opening new paths

6.6.3 SYNTHESIS: MAIN CHALLENGES

Two main observations emerge from the discussion. First, Competitiveness Clusters should evolve to favor the exploitation of the emerged interconnected competences and concrete project's outcomes. At the cluster level, commercial synergies with other participants should be explored. Second, Competitiveness Clusters should favor the exploration of future opportunities. This finding addresses the risk of lock-in, the potential freezing of a given cluster path (Lorenzen 2001) that the industrial actors of Wallonia face as the links and competences developed in the framework of Competitiveness Clusters become “rigid” (Leonard-Barton 1995), suffering from the “congestion effects” that replaced earlier positive agglomeration effects (Audretsch & Feldman 1996a). Indeed, even the most prospective subprojects of the Competitiveness Clusters are nested in the mega projects and channeled by the integrative technological choices. The following dilemma arises: how to ensure the

flexibility needed to break the path while knowledge transfer and competence building within R&D projects require strong ties between actors.

Yet, the only instrument from the Marshall Plan that explicitly deals with the rise of future Competitiveness Clusters is the “excellence programs” (see Figure 13) that support for five years selected academic teams working on common research stream. If this is the only way toward new technological paths, this choice may be questionable: as Varga figured out (2002), *“strengthening universities in order to advance local economies can be a good option for a relatively well developed metropolitan area but not necessarily for a lagging high technology region”*. In this context, the role of Regional Clusters as described in Table 16 is appreciated from a new perspective: while Competitiveness Clusters may suffer from the congestion effects (Audretsch & Feldman 1996a), Walloon Regional Clusters appear to provide a more spontaneous and flexible framework. Local authorities should therefore provide mechanisms that allow for the conversion from Regional Cluster(s) to Competitiveness Clusters as they gain enough potential as well as from Competitiveness Cluster back to Regional Cluster(s) as it loses attractiveness but still needs to focus on the exploitation of past projects.

6.7 CONCLUSION

In this chapter, I present the instruments developed by the Walloon Region of Belgium to support economic growth through innovation and technology development. The so-called Marshall Plan calls for the creation of Competitiveness Clusters centered on privileged sectors of potential interest for the region. I describe these Competitiveness Clusters and distinguish them from Regional Clusters. As a matter of fact, Competitiveness Clusters are dedicated to projects that partners agree to collaborate on. The project orientation helps partners focus on a common objective (a product or a technology): a future winner that they believe in and want to obtain the leadership for. They expect common realization and success and are supported in this ambition by the network configuration, generally crystallized around a well-established company that already dominates the industry. The configuration of MEGAPROJECT is not an exception: multinational corporations located in the Walloon Region are emerging as crystallizers in numerous R&D

projects while smaller firms – SMEs, hidden champions, startups – find a framework to develop their activities.

This chapter highlights two specific challenges arising from the Competitiveness Clusters policy: due to the risk of decreased attractiveness of the Competitiveness Clusters after the innovative phase and the lock-in phenomenon that may impede long-term development of the region, local authorities should (1) make sure that the exploitation of the R&D projects effectively benefits the investing region and (2) provide mechanisms that favor path-breaking thinking.

The first challenge calls for a debate about what constitutes a “benefit to the investing region” for the industrial partners as well as public authorities. As some R&D centers refer to headquarters and production centers outside the region in question, this debate is worthy of exploration. The second challenge refers to a good balance between exploitation and exploration: adequate networking and clustering instruments to support both objectives appear necessary to ensure sustainability and growth of the involved actors. Within MEGAPROJECT, prospective R&D projects contributed to the identification of promising economic areas, but these may be subject to congestion effects as activities are constrained by the Competitiveness Cluster strategy. In this case, Regional Clusters emerge as more flexible and spontaneous networks.

Beyond the specificities of the Walloon case, this chapter sheds some light on an important theoretical issue: the way program configuration effects community identification and learning objectives (Autio et al. 2008). This chapter firstly contributes to the literature by providing six criteria to qualify clustering initiatives. Then, it explores how collaborative practitioners appropriated the identified configuration. In this context, the interpretive schemes provided by the Competitiveness Clusters policy and appropriated by MEGAPROJECT partners were particularly powerful, such as the network configuration, the struggle against dispersed innovative efforts, the involvement of actors from the whole value chain and the focus on quick, concrete results.

In particular, I argue that the role of the authorities as “animator” (Diez 2001), in other words as a generator of norms for local agents, was favored by the financing of

R&D projects: the Competitiveness Clusters policy provided collaborative practitioners with a structure to materialize potential partnerships into concrete projects. Public authorities can influence the appropriation of rules inside the R&D project through two main leverages: (1) through the definition of a field of action; and (2) through the situated reinforcement of the ideal of the policy in the field. One important challenge therefore consists in a careful alignment between the original ideal of the policy and its interpretation by the administrative agents in charge with the concrete implementation of the policy: organization of calls for projects, allocation of resources, audit of allocated subsidies and so on.

Nevertheless, this analysis of the Walloon case builds on the same theoretical blocks that initiated the clustering policy itself. Indeed, based on an evolutionary and Knowledge-Based approach of the innovation process (Blankenburg 1998), clustering policies conceptualize innovation as a collective process in which embedded knowledge is transformed in a complex environment. This prism focuses on positive network externalities (coordination of existing knowledge and technology resources) and capability creation (implementation of collective process generating new capabilities) but obscures the problems of market failure and negative spillovers. Yet, those questions are crucial for practitioners: conflicts over IP are one of the most important barriers to U-I collaboration. Besides, Bruneel et al. (2010) show that such conflicts might persist *“even in the face of repeated and multiple collaborations”*. This theoretical choice therefore shapes one important limitation of this work that would benefit from complementary insights from the neo-classical economy and other school of thoughts.

Another limit is related to the unit of analysis of this work. By focusing on the R&D project, I did not address the place of entrepreneurship inside the Competitiveness Clusters. As spinoff creation and development is the second biggest R&D instruments of the Marshall Plan (see Figure 13), it could be interesting to explore the Competitiveness Cluster as a boost for new venture's creation.

Further research should also assess Competitiveness Clusters and other clustering initiatives by tracking key performance parameters over time. In that context, the systematic comparison of clustering initiatives on the basis of the six identified

criteria might be interesting. It would allow for the exploration of specific and combined effects of the policy features as promoted by their configuration. In particular, the exploration of promoted cross-fertilization might shed some light on the role of public policies in overcoming the “cost of openness” in a given network: the reduction of transaction costs within a cluster (Lorenzen and Foss 2003) at the expense of external relationships (Maskell 2001).

Beyond such comparative assessments, regional policy makers may also benefit from micro field studies focusing on the actual building of organizational competences: in-depth studies of the innovation process at stake may contribute to our understanding of localized interactive learning, knowledge appropriation by the parent organization and the role of distinct actors in the process. In particular, the role of universities and other research institutions involved in the Competitiveness Clusters when it comes to the different phases of the innovation process is still unclear.

For instance, Freeman (1992) points to a greater need for users-firms linkage rather than Science and Technology networks in the case of incremental innovation while Monjon and Waelbroeck (2003) find that knowledge spillovers from local universities provide the bigger benefit to firms pursuing imitative and incremental innovation. Building on Kline and Rosenberg, Boerner and his colleagues (Boerner et al. 2003) argue that pure, long range scientific learning is associated to the early stages of the innovation process while development activities emphasizes more applied learning.

In this work, I show that rather than being involved at the upper end of the innovation process, “*creating systematic openings for radical innovations*” (Blankenburg 1998), universities were working on the strengthening of an existing technological trajectory. As universities are usually associated to exploration (Rothaermel & Deeds 2004, Bercovitz & Feldman 2007) rather than exploitation, further studies should help understand the role of university as a knowledge supplier in Competitiveness Clusters and as an active participant in regional economic development (Breznitz & Feldman 2010). The next chapter helps tackle this particular issue.

Chapter 7 THE BOOMERANG COMPLEX: ITERATION AND KNOWLEDGE TRANSFER IN JOINT R&D PROJECTS¹⁶

7.1 INTRODUCTION

Since 2006, the Walloon Government is financing joint R&D projects within the framework of the Competitiveness Clusters of Wallonia. This policy complements the set of R&D instruments already deployed by the Walloon Region to sustain innovation on its territory by explicitly supporting the rapprochement of companies and research institutions. The promotion of UIR is a central feature of this framework as well as a stable component of innovation policies not only in Wallonia but worldwide (Behrens & Gray 2001). Nevertheless, bridging the academic and the industrial worlds is opened to discussion. In particular, the previous chapter concludes that the role of universities at the different phases of the innovation process is still unclear.

R&D projects that focus on the exploration of a new technological trajectory rather than its exploitation have specific stakes, objectives, deliverables and resources (Utterback 1996, Chesbrough & Kusunoki 2001). Likewise, the specific role of partners (multinational corporations, SMEs or academic laboratories) should depend on the nature of the alliance (Faems et al. 2005), allowing a large spectrum of learning opportunities. And yet, this phenomenon remains largely unknown (Faems et al. 2005, Faems et al. 2007), specifically when universities and other research actors are involved. As a matter of fact, the case study that I followed from June 2007 to May 2010 provides evidence that the dynamics of knowledge transfer between partners vary with the nature of the undertaken research: as the members of the collaborative research revise its objectives and ambition, its nature evolves along with what is learned, how and by whom.

¹⁶ An earlier version of this chapter was written in collaboration with Annick Castiaux and Ingrid Chalant and presented during the Triple Helix conference on University, Industry and Government Linkages (Madrid, October 2010).

This concern leads to the following research question: How does the nature of the joint R&D project influence knowledge transfer between partners? In this chapter, I therefore explore knowledge exchanges between academic laboratories and their industrial partners when the R&D activities in the collaborative research vary between **prospect**, **exploration** and **exploitation**.

I propose a qualitative, longitudinal approach to investigate how the nature of an R&D project influences knowledge transfer between partners. This approach has several advantages. First, it takes into consideration the bilateral nature of knowledge flows between partners (Meyer-Krahmer & Schmoch 1998). Second, it distinguishes between four forms of knowledge: Know-Who, Know-What, Know-How and Know-Why (Lundvall & Johnson 1994, Johnson et al. 2002), therefore acknowledging that collaborators share more than only scientific knowledge (Davenport et al. 1999, Autio et al. 2008). Third, it allows following potential iterations between prospect, exploration and exploitation as the projects meet blocking points, go back to fundamental understanding and sometimes even give up commercial ambitions.

This study aims to contribute to the empirical micro studies of what is learnt, how, and by whom (Johnson et al. 2002) in U-I collaborative research. By considering that R&D projects can take various forms and even evolve along time – for instance from prospect to exploitation and backwards – I also contribute to the development of a dynamic view of inter-organizational knowledge transfer (Faems et al. 2005) as part of the burgeoning field of exploratory and exploitative innovations (Jansen et al. 2006). Findings should be of interest for various strategic actors involved in innovation networks: public authorities in charge of the policy, both industrial and academic partners involved in the projects and the administrators of the network as this study may provide clues to better manage its projects' portfolio.

In the first section, I briefly present the role of joint R&D projects in the context of the Competitiveness Clusters policy. In section 2, I focus on technological maturity as a contingency factor of U-I collaborations. In section 3, I develop the conceptual framework used to study the impact of the nature of the project on knowledge transfer between partners. Section 4 presents the methodological approach to answer

the research question : the multiple case studies guided by the dual approach of Leonard-Barton (1990). Specifically, I combine insights from an in-depth longitudinal case study – Axis-1 – with replicated cases from MEGAPROJECT. Section 5 presents the findings of this work and I conclude in section 6.

7.2 JOINT R&D PROJECTS IN THE COMPETITIVENESS CLUSTERS

7.2.1 A SPECIFIC BRIDGE BETWEEN UNIVERSITIES AND FIRMS

As showed in the previous chapter, knowledge institutions have a central place in innovation clusters. Various instruments are used to connect them with their industrial partners: collaborative research, licensing, conferences, scientific publication, consulting and so forth (D'Este & Patel 2007). But the Competitiveness Clusters policy proposes a privileged path: the joint R&D project. In fact, Competitiveness Clusters distinguish themselves from other innovation networks through the following characteristic: the structuration of partnerships under the forms of innovative projects (Bayenet & Capron 2007) that mandatorily involve research actors and industrial partners (Gouvernement Wallon 2005).

As the backbone for collaborative research, joint R&D projects are characterized by specific transaction costs: *ex ante* costs due to the search and selection of relevant partners and to the negotiation of the consortium agreement as well as *ex post* costs linked to coordination, control and reporting (Landry & Amara 1998). When different kinds of partners are involved, such as academic laboratories and companies, partners should also take into account additional costs brought by differences between partners (Katz & Martin 1997, Mowery & Ziedonis 1998), not the least being differences between appropriability regimes (Hall 2004, Link & Scott 2005).

Academic and industrial research are overlapping and interacting systems (Pavitt 1998) that have goals informed by different “logics” (see Chapter 8). The rapprochement between industrial actors and academic laboratories therefore requires the alignment of motivational axes (Bodas Freitas & Verspagen 2009) and strong expected benefits (see Table 21): economic outcomes such as access to public funding (Hall 2004, Debackere & Veugelers 2005, Link & Scott 2005, Link &

Siegel 2005), social outcomes like intellectual companionship and networking visibility (Katz & Martin 1997, Melin 2000, Bozeman & Corley 2004, Debackere & Veugelers 2005) and scientific outcomes like cross-fertilisation (Katz & Martin 1997) and access to specialized equipments (Bozeman & Corley 2004). Those expected benefits should allow for the creation of added value for the partners who subsequently participate to regional economic development.

TABLE 21 ECONOMIC, SOCIAL AND SCIENTIFIC OUTCOMES OF COLLABORATIVE RESEARCH

Economic outcomes	Social outcomes	Scientific outcomes
Decreasing technical risks (Mowery et al. 1996, Audretsch et al. 2002)	Creating and consolidating links (Feller & Roessner 1995, Debackere & Veugelers 2005) ; ensuring network visibility (Katz & Martin 1997, Melin 2000)	Access to specialized members (Audretsch et al. 2002) and resources (Whitley 2003) in a context of growing importance of interdisciplinary fields (Katz & Martin 1997)
Costs sharing (Katz & Martin 1997, Melin 2000, Whitley 2003)	Prestige (Bozeman & Corley 2004) and reputation (Santoro & Saparito 2003)	Cross-fertilization (Katz & Martin 1997), building of absorptive capabilities (Debackere & Veugelers 2005, Rothaermel & Thursby 2005)
Access to (public) funding (Hall 2004, Debackere & Veugelers 2005, Link & Scott 2005, Link & Siegel 2005)	Real and apparent power (Whitley 2003)	Knowledge (Debackere & Veugelers 2005, Link & Scott 2005), competences, techniques and equipment (Bozeman & Corley 2004) sharing.

7.2.2 TECHNOLOGICAL MATURITY AS A RELEVANT CONTINGENCY FACTOR

The joint R&D projects launched through the Competitiveness Clusters policy vary in nature and form (Kuty 2008) : each project is built on scientific, technical and organizational contingencies that open the possibility of exchange between partners. As knowledge flows might constitute a better predictor of technology development performance than total R&D spending and project organizational forms (West & Jansiti 2003), it seems relevant to question the factors that have an influence on knowledge circulation.

In the previous chapter, I identify a factor of particular interest in the context of the Competitiveness Clusters policy: the technological maturity of a project or, from an evolutionary perspective, the position of this project along a given technological trajectory. Indeed, since the work of Rogers on the diffusion of agricultural innovations (Rogers 1962), the research community has dedicated important resources to understand the innovation process and the evolution of innovative efforts that the firm has to undertake for its survival. For instance, taking the dominant design model for granted (Abernathy & Utterback 1978, Anderson & Tushman 1990, Tushman & Murmann 1998), the R&D collaborations will target specific objectives and deliverables according to the evolution of a given dominant design: before its emergence, the collaboration focuses on the exploration of the underlying technological trajectory in the search for variety while a stabilized design allows focusing on peripheral innovations, elaborating around the core component that has emerged as the dominant design (Murmann & Frenken 2006).

In the same way, authors such as Jansen and his colleagues (2006), Koza and Lewin (1998), Rothaermel and Deeds (2004) and Cesaroni et al. (2005) build on March (1991) to distinguish between R&D activities of exploration and exploitation depending on the targeted stage of the innovation process. In the context of strategic alliances (Koza & Lewin 1998, Rothaermel & Deeds 2004) and R&D activities (Cesaroni et al. 2005, Chanal & Mothe 2005), the exploration is associated with the prospect of new horizons with the desire to discover new opportunities (Koza & Lewin 1998) ; it involves basic research, risk taking, the creation of new competences, entry to new commercial activities and investments in the absorptive capacity of the firm (Koza & Lewin 1998). The explorative nature of a joint R&D

project is thus defined through its deliverables (Rothaermel & Deeds 2004): radical innovations designed for emerging markets (Jansen et al. 2006) and the materialization of the newly-created knowledge into patents and prototypes. On the contrary, exploitative R&D will focus on the “D” of the process (Koza & Lewin 1998, Rothaermel & Deeds 2004, Chanal & Mothe 2005). It has regards with the further development of prototypes through testing, standardization, up-scaling and finally commercialization (Rothaermel & Deeds 2004) by building on the existing competences of the firm (Chanal & Mothe 2005, Jansen et al. 2006) or by pooling assets from complementary partners (Koza & Lewin 1998, Cesaroni et al. 2005).

In 2003, Carayol studied the various forms of science-industry collaborations and found the “novelty, nature and risk of the research” to be the most significant variable to typify U-I collaborations. As a result, the joint R&D projects that focus on more or less upstream stages of the innovation process will have specific stakes, objectives and deliverables (Utterback 1996). As the nature of the collaboration evolves, the role of partners should also vary, allowing for a wide-ranging spectrum of knowledge transfers (Faems et al. 2005). However, the way R&D alliances of different nature impacts knowledge transfers is still a puzzled and under-studied phenomenon (Faems et al. 2005, Faems et al. 2007), especially when an academic partner is involved. For instance, in contrast with the argument that academic partners are more usually concerned with radical innovations and the exploration of new trajectories (Shenhar et al. 1995, Blankenburg 1998), research partners of MEGAPROJECT contribute to the stabilization of vacuum surface treatment, a technology that disrupted the industry a decade ago and now contributes to reach mass markets as well as niches.

In fact, academic laboratories are presented as privileged knowledge suppliers all along the technological journey: through the conduct of exploratory and fundamental research, the design of prototypes, the testing of instrumentation or even the conduct of research on existing product lines (Lee 2000). As university is usually associated with exploration (Rothaermel & Deeds 2004, Bercovitz & Feldman 2007) rather than exploitation R&D activities, it should be useful to understand the role of academic laboratories as privileged research partners in the Competitiveness Clusters. In the next section, I therefore propose a conceptual

framework that allows for the exploration of this phenomenon. First of all, I focus on the nature of the joint R&D projects. Then, I present my conceptualization of U-I knowledge transfer: involved processes, direction of knowledge flows and finally forms taken by the newly-created knowledge.

7.3 CONCEPTUAL FRAMEWORK

7.3.1 TYPOLOGY OF JOINT R&D PROJECTS

In line with recent European clusters policies (Nishimura and Okamuro 2010), the Competitiveness Clusters support both the early and development stages of R&D projects. Two kinds of projects are explicitly proposed by the Walloon Government: *“those projects either target the **concrete realization** of industrial applications within three years, or the building of a **prospective** vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster”* (Gouvernement Wallon 2005).¹⁷

Prospective projects are aligned with the definition of exploration as originally proposed by March (1991): the experimentation of new alternatives with less certain outcomes and more diffused effects but nevertheless participating to long-term competitiveness and survival. Some **realization** projects also belong to the exploration category: despite a strong market orientation and existing industrial capabilities to support it, the main goal of these projects is to create new scientific knowledge which is necessary for the development of industrial prototypes or pilot lines. While both kinds of projects undertake **exploratory R&D**, they have radically different objectives: the building of a shared vision on the one side, realization in industrial environment in the other side.

¹⁷ Even if this distinction can be found in the portfolio of projects that has since flourished, the Walloon Government does not build on this definition to discriminate between projects.

Other **realization** projects will rather focus on **exploitative R&D**. The partnership will thus shift from industrial research to pure development, ramping-up, standardization and cost reduction. But even in this case, the distinction between exploration and exploitation R&D might get loose due to the iterative nature of R&D: blocking points sometimes blow a previously accepted design, forcing the team to come back to more basic research to understand the underlying phenomenon and eventually overcome the obstacles.

To sum up, prospective projects focus on exploration R&D without immediate realization into the industrial environment. On the contrary, realization projects are mainly concerned with the industrial crystallization of scientific knowledge. Nevertheless, the latter involve both exploitative and exploratory R&D.

If we compare the literature on dynamic R&D activities to the projects launched within the Competitiveness Clusters, we can see that it falls short to depict the nature of joint U-I R&D projects. In fact, its distinction between exploration and exploitation R&D is mainly relevant in the context of industrial R&D, whether inside the firm (Cesaroni et al. 2005, Chanal & Mothe 2005) or through inter-firm alliances (Koza & Lewin 1998, Rothaermel & Deeds 2004, Faems et al. 2007). For that reason, it fails short to capture the involvement of knowledge institutions in prospective projects.

An alternative typology is proposed by Stokes (1997) who studies research activities undertaken at the university and who distinguishes between pure applied research and basic research – even if undertaken with a concrete use in mind – based on whether the research activity is pursuing a quest for fundamental understanding or a quest for the right design (see Figure 15). His goal is to face the shortcut of the so-called “linear model” of the innovation process (see Godin 2006) which sees basic research as research “*performed without thought of practical ends*” and resulting “*in general knowledge and an understanding of nature and its laws*” (Bush 1945). The goal of Stokes is to acknowledge the possibility of performing basic research while being inspired by practical immediate realizations such as Pasteur and his discovery of a first vaccine against rabies. This time, the typology is very useful to depict

research activities inside universities but is less interesting to assess the nature of the projects in the Competitiveness Clusters which are led by the industry.

		Consideration of use	
		Yes	No
Quest for fundamental understanding	Yes	Use-inspired basic research	Pure basic research
	No	Pure applied research	

FIGURE 15 TYPOLOGY OF RESEARCH ACTIVITIES ACCORDING TO STOKES (1997)

In order to combine the literature on dynamic R&D and the empirical reality of the Competitiveness Clusters, I propose a conceptual framework which takes into account two main criteria: on the one hand the pursuit of a concrete realization in industrial environment and on the other hand the need for fundamental understanding (see Figure 16).

In line with the literature on dynamic industrial R&D, both exploration and exploitation R&D projects lead to a realization within the firm (March 1991, Koza & Lewin 1998, Rothaermel & Deeds 2004) but are distinguished on the basis of their quest for a fundamental understanding on the one hand, and for the right design in the other hand. R&D activities that lead to tangible deliverables realized outside the firm, in other words in the academic laboratory or the research center, are called prospective R&D as proposed by the Walloon Government. In fact, this typology combines the motives that traditionally guide the scientific work in universities and industries (see Godin 2006): the quest for fundamental understanding in the former, practical profitable results in the latter.

		Realization in industrial environment	
		Yes	No
Quest for fundamental understanding	Yes	Exploration	Prospect
	No	Exploitation	

FIGURE 16 TYPOLOGY OF JOINT R&D PROJECTS

In this typology, projects that neglect the quest for fundamental understanding are exploitation R&D projects: as the technology mature, scientific and technological uncertainties diminish and the central quest of R&D switches from fundamental understanding to the search for the right design. Those projects can generate new knowledge but are not considering fundamental understanding as a central objective (Stokes 1997). On the contrary, the main goal is to develop a new product or process with the right design and that will quickly enter the market or the production process of the factory. Deliverables of exploitation R&D projects will include new products and processes, sometimes still as an industrial prototype, sometimes as an enhanced version of existing products, and the members of the projects will not encourage publication activities. This case is quite frequent in industrial R&D: *“most innovation is done with the available knowledge already in the heads of the people in the organization doing the work, and, to a lesser extent, with other information readily accessible to them. It is only when those sources of information fall short of solving the problem that there is a need for research in order to complete a given innovation”* (Kline & Rosenberg 1986 p. 288).

When the search for additional information meets blocking points or, more broadly, when more scientific knowledge is required to develop the product or process targeted by the industrial partner(s), the quest for fundamental understanding takes the lead and defines the project as an exploration R&D project. Like exploitation R&D projects, exploration projects are directed towards the development of

practical application of knowledge but exploration projects specifically acknowledge the need for more understanding of the underlying phenomenon. This distinction is particularly important in the framework of U-I links (Stokes 1997) as it should shape the role of the academic partners: from recipients of existing knowledge to producers of new understanding. As a result, deliverables are the crystallization of the newly-created knowledge: its incorporation into prototypes that are integrated in the industrial environment, as well as into potential scientific publications.

To distinguish between exploratory and prospective projects, I use the criterion of “realization in industrial environment” (see Figure 16). Behind this criterion lays the capacity and/or will of the partners to integrate the newly-created knowledge into existing industrial activities. Indeed, each project led by a quest for fundamental understanding generates new scientific knowledge which is crystallized into a prototype, a proof-of-concept or a scientific article. But it is important to distinguish on the one side the deliverables that will be integrated into industrial environment and on the other side deliverables that stay in the laboratory (Auerswald & Branscomb 2003). While this concern mainly comes from sectors such as aeronautics and the Defense¹⁸, it is of particular importance in U-I joint R&D projects – whatever the targeted sector – as both kinds of environment co-exist: the laboratory and the industrial factory. As a result, prospective R&D projects lead to the development of new competences according to the shared vision of the partners who actively encourage scientific publication. Those competences are developed within the academic laboratory and will need further development before being integrated into industrial environment.

¹⁸ As a matter of facts, this concern was materialized through the development of scales such as the Technology Readiness Level (TRL) scale. Such a tool could have been interesting in this work but we finally decided not to use it in order to favor transferability (see Hermans and Hecq 2010). Indeed, the TRL scale is highly sector-related and would have lost its relevance in other economic and scientific areas such as MecaTech.

One could argue that prospect, exploration and exploitation could be respectively labeled basic industrial research, applied industrial research and precompetitive development in the context of the Competitiveness Clusters policy. Indeed, this distinction was used by the Walloon Government to decide about the intensity and nature of its financial intervention towards each partner involved in the joint R&D projects (see Chapter 6 Table 17). I decided not to switch to such labels for three main reasons. First, I favor the distinction between exploitation, exploration and prospect because this typology builds on the literature on industrial R&D than has already demonstrated the interest of dynamic transfers. Secondly, I take distance from the labels proposed by the Walloon Government because they are used to assess individual actors and their own activities and not the project as a whole, which is the point of view chosen in this thesis. Finally, the Walloon Government does not provide a definition of basic research, industrial research and precompetitive development, allowing for freedom of interpretation and elasticity during the financing negotiations but emptying the labels of rigorous meaning. Nevertheless, the financing decisions linked to the collaborative activities were used as clues to characterize the projects during the analysis of documents, in particular the consortium agreement and the official description of MEGAPROJECT.

7.3.2 KNOWLEDGE TRANSFER

According to the literature on U-I knowledge transfer, diffusion usually occurs from universities to the industry in a one-way flow of mainly public and codified knowledge. In this work, I complement this literature by a qualitative approach of knowledge flows that has three main theoretical advantages:

- It considers the processes of creation and sharing rather than just transfer (involved processes);
- It takes into account bidirectional flows rather than the one-way relationship described in the literature on U-I knowledge transfer (direction of flows)
- It allows for the exploration of different kinds of knowledge rather than only scientific knowledge (nature of flows).

From a methodological point of view, a qualitative in-depth approach allows for the *in situ* observation of knowledge flows, collecting data that are not based on rigid theoretical constructions but rather on the interpretation of the observed actors. The longitudinal study also allows for the observation of iterations between exploration, exploitation and prospect as projects meet blocking points, go back to fundamental understanding and sometimes even give up commercial ambitions to come back to the academic laboratory.

Finally, this analysis mainly focuses on knowledge transfer *within* the project (Jiang & Li 2009), thereby neglecting transfer *through* the project and its impact on the practices, procedures and routines of the parent organizations. In other words, I focus on the cognitive component of organizational learning, thereby neglecting its behavioral component (Miller 1996). The conceptualization of knowledge transfer also includes but is not limited to technology transfer as defined by Burgelman and his colleagues: “*the theoretical and practical knowledge, skills, artefacts that can be used to develop products and services as well as their production and delivery systems*” (Burgelman et al. 2004).

INVOLVED PROCESSES

The distinction between creation and sharing was identified in the literature on inter-organizational learning and knowledge transfer (Lubatkin et al. 2001, Faems et al. 2007, Jiang & Li 2009). Considering that knowledge transfer is composed of both components, those authors call for an exploration of their specific and combined effects. In fact, the nature of the joint R&D project (i.e. exploration, exploitation and prospect) should have an impact on both creation and sharing in different ways. As proposed in the previous section, prospect and exploration projects should provide the university with a role of scientific knowledge creator. On the contrary, exploitation projects should present the academic laboratory as a recipient of existing knowledge which is easily accessed by the industrial partners.

DIRECTION OF FLOWS

While the literature on technology transfer (e.a. Jaffe 1989, Autant-Bernard 2001) focuses on unidirectional transfers from the university to the industry, some authors explored the bilateral nature of flows between the laboratory and its industrial

partners (Meyer-Krahmer & Schmoch 1998, Hermans & Castiaux 2007). Others even acknowledge the possibility of unidirectional flow from the industry to the university when the knowledge basis of the sector is synthetic (Asheim & Coenen 2005, Moodysson et al. 2008), namely when innovations relevant for the industrial settings are rooted in the capacity to apply new combinations of existing knowledge rather than scientific progress (Baba et al. 2009). In this case, research partnerships imply the transfer of technologies (for instance under the form of equipment and prototypes) from the firm to the laboratory (Bodas Freitas & Verspagen 2009). In this thesis, I pose the hypothesis that beyond the sector, the nature of the projects will also have an impact on the direction of flows. For instance, a prospective project could favor bilateral flows in order to create the targeted “shared vision”. On the contrary, exploration and exploitation R&D projects might lead to unidirectional flows from the university to their industrial partners who might be afraid of potential leaks.

NATURE OF FLOWS

The nature of knowledge is usually explored through dichotomies (Jensen et al. 2007): tacit and explicit knowledge (Polanyi 1967, Nonaka & Takeuchi 1995), individual and social (or organizational) knowledge (Kogut & Zander 1996, Spender 1996, Nahapiet & Ghoshal 1998), public and private knowledge (Maskus & Reichman 2004). To explore the nature of knowledge flows within the joint R&D projects, I distanced myself from those dichotomies and used the four forms of knowledge developed by Lundvall and Johnson (1994, Johnson et al. 2002) for the study of innovation networks (De la Mothe & Foray 2001, Doloreux 2002) : Know-What, Know-Why, Know-How, Know-Who (see Table 22).

Following Jensen and his colleagues (Jensen et al. 2007), those four forms of knowledge require specific learning paths: the Know-What and Know-Why are usually associated to codified and public instruments such as patents, scientific journals, conference proceedings, data bases; on the contrary, Know-How and Know-Who are shared through practice and interactive learning. The joint R&D projects within the Competitiveness Clusters are thus a privileged instrument for the development of that kind of knowledge, which becomes more and more important in a context of increasing cross-disciplinarity in the academic world (Katz & Martin

1997) and of increasing complexity in industrial sectors (Johnson et al. 2002). Following the nature of the projects, one can expect that some forms of knowledge will be more desirable than others. For instance, prospective projects should favor the sharing of Know-Why and Know-What (state of the art, research agenda, market trends). Exploration projects might create iterations between Know-Why from the laboratory and private Know-How from the industrial partner in order to incorporate scientific knowledge into an industrial prototype. Finally, exploitation projects might focus on the exchange of Know-How in order to reach standardization and cost reduction.

TABLE 22 THE FOUR FORMS OF KNOWLEDGE, BASED ON JOHNSON ET AL. (2002), NAHAPIET & GHOSHAL (1998) AND GIDDENS (1984)

	Know-What	Know-Why	Know-How	Know-Who
Individual level	Fact, ingredients, state of the art	Causality principles, scientific explanation	Practical competences, intuition, based on experience	Information about who to reach and how to reach them
Systemic level	Shared data	Cognitive dimension : shared interpretive schemes (script and role)	Relational dimension : routines, shared norms of behavior	Structural dimension : links and configuration of the relevant network

By focusing on those four forms, this study acknowledges that learning in joint R&D projects is not confined to the scientific domain (Davenport et al. 1999, Autio et al. 2008). Informed by the Structuration Theory, even Know-Why is not always about scientific results as it participates to sense-making: socially derived scripts, goals and identities inside the project (Hargadon & Fanelli 2002). Created and shared knowledge between partners become modalities mobilized in their interactions. From this perspective, Know-Why plays a semantic function, it provides the interpretive scheme that are used to make sense of the context and to communicate its meaning (Sydow & Windeler 1998); Know-How has a syntactic function and refers to the “right way” of conducting research within the project; Know-Who impacts the structural dimension and informs about the power

relationships at stake in the project – who has access to (material as well as intellectual) resources and how to reach these people. The fourth form, Know-What, is concerned with data: basic set of discrete, objective facts about events (Davenport & Prusak 1998) such as databases.

When collecting and analyzing data, I refer to the respondents' interpretation to discriminate between Know-What, Know-Why, Know-How and Know-Who. For instance, the sharing of a scientific bibliography on the internet platform of MEGAPROJECT was considered as Know-What and not Know-Why as long as the bibliography stayed unexploited. Some forms of Know-Why exchanges were acknowledged only if the scientific publication was actually read and applied by a member of the project. Likewise, operational details about a given characterization technique that were exchanged during a plenary meeting were not considered as Know-How exchanges. The transfer of Know-How was acknowledged when the members of the project actually had the opportunity to try the machinery used to perform the characterization. Such an operationalization of the constructs is coherent with the qualitative and interpretive approach that was adopted in this doctoral work.

7.4 METHODOLOGY

7.4.1 RESEARCH STRATEGY

To explore the research question “How does the nature of the joint R&D project influence knowledge transfer between partners?”, I studied multiple case studies inspired by the dual approach of Leonard-Barton (1990). Specifically, I combine insights from an in-depth longitudinal case study with three replicated cases from MEGAPROJECT (see Chapter 5 – Methods). This methodological choice is guided by two main concerns: the research questions that I wanted to explore and the conceptual framework, more particularly the conceptualization of the four forms of knowledge as informed by the Structuration Theory.

The case study strategy was selected for four main reasons. First, the case study is a privileged research tool when the researcher explores a “How” question and focuses on longitudinal, contemporary events that he or she does not control (Yin 1994). A longitudinal approach was particularly interesting to capture iterations. Indeed,

blocking points or accelerations can impact both dimensions of the project's typology, thereby changing the nature of the project: on the one hand the quest for fundamental understanding can arise in order to overcome blocking points, and on the other hand the realization in industrial environment can become attractive when new discoveries lead to unexpected practical applications. Second, this study focuses on processes, which are mostly explored through case studies (Merriam 1998). Third, knowledge creation and sharing involve intangible flows which can only be investigated through a qualitative approach (Lockett & Thompson 2001). Finally, the phenomenon of interest – knowledge transfer – and its context – interactions in joint R&D projects – are difficult to distinguish from one another (Salminen et al. 2006). Especially, the four forms of knowledge as informed by the Structuration Theory are considered as products of social interactions (von Krogh & Roos 1996, Bozeman 2000), requiring to be studied through their context of production.

7.4.2 CASES SELECTION

As explained in Chapter 5, the choice between single and multiple case studies was not straightforward. At the beginning, multiple cases seemed desirable because of the research question: insights would come from the comparison of R&D projects of different nature. However, being involved in multiple cases could raise ethical, practical and analytical problems. Indeed, technological maturity is not the only factor impacting the conduct of joint R&D projects: differences in sectors (Tidd & Trewhella 1997, Tidd et al. 2005, Baba et al. 2009), size of the projects in terms of budget (Bizan 2003) or number of participants (Carayol 2003, Levy et al. 2009), type of members (Branstetter & Sakakibara 2002) or appropriation rules (just to name a few) might dilute the effect of technological maturity and decrease the analytical interest of this work.

The dilemma was originally solved by studying Axis-1 as a single case due to its richness in terms of iterations and hybridizations: while some typical cases stay prospective, exploratory or exploitative from the beginning to the end, Axis-1 experienced an important iteration from exploitation to exploration; moreover, subparts of Axis-1 were identified as being of a different nature than the main part of the collaborative research, providing prospective sub-cases. The systematic

comparison of the learning episodes and subparts of Axis-1 generated insights used to answer the research question.

I eventually enhanced the research design with the dual methodology proposed by Leonard-Barton (1990). With this methodology, insights from a single longitudinal case are compared to retrospective replicated cases (Leonard-Barton 1990, Yin 1994), in this case other subprojects from MEGAPROJECT. Indeed, MEGAPROJECT provides a field for quasi-experiment: subprojects were designed by the same persons, are financed through the same rules, and are conducted by the same (organizational and sometimes individual) actors who are subjected to the same consortium agreements. Three cases were selected for their typicality based on the description of MEGAPROJECT, interviews with the R&D coordinators and discussions with researchers from Innovation Process.

7.4.3 DATA COLLECTION AND ANALYSIS

In Axis-1, data were collected through three main paths: semi-structured interviews, observations and the examination of documents. The panel of respondents was composed of individuals actively involved in Axis-1: directors of academic laboratories, R&D coordinators of the project, senior researchers as well as doctoral candidates and technicians. Observations were realized from June 2007 to May 2010 during events such as plenary meetings (Notes_ dd.mm.yy) and team-building events (HV_ dd.mm.yy). Documents included the consortium agreement (CA), the detailed description of MEGAPROJECT (PROJET_MEGAPROJECT), Minutes of Axis-1 meetings (PV_dd.mm.yy) and e-mails from the mailing list. For illustration and triangulation purpose, I also used the posters (POSTERX) drawn by the respondents at the initiative of researchers from Innovation Process (Epicum & Chalant 2010).

Data from the replicated (SP7, SP9 and SP10) were collected through interviews (two additional interviews per case). For triangulation purpose, I also used secondary data produced by the researchers from Innovation Process who interviewed informants from SP7, SP9 and SP10 and also observed multiple plenary meetings (for an exhaustive list of data sources and collection methods, see Appendix 5).

In order to complement the thematic analysis conducted with the qualitative data analysis software “Weft QDA”, results were synthesized in Words table (see Table 23) to facilitate cross-case analysis and iterations from empirical evidence to theoretical statements. Those tables provide chains of evidence (Yin 1981,1994): extracts of interviews, observation notes or documents are attached to each construct presented in the conceptual framework (nature of the project, the four forms of knowledge, the direction of flows and involved processes). Other cells have regards with miscellaneous comments as well as considerations about the level of knowledge creation or sharing (in a subgroup, in the project, between projects, within a Competitiveness Cluster, etc).

TABLE 23 ANALYSIS TABLE – CHAIN OF EVIDENCE

SP X					
	Evidence (<i>Extract + sources</i>)				Comments
Quest criterion					
Realization criterion					
	Evidence	Direction	Process	Level	Comments
Know-What					
Know-Why					
Know-How					
Know-Who					

Data were analyzed in chronological order in order to highlight the evolution of transfer and potential iterations. Another analysis tool (and chain of evidence) related to the longitudinal nature of the case was the construction of timelines with the main events of the project and associated extracts. Finally, extracts from and references to the various data sources (in capital letters in the text) are included in the findings sections.

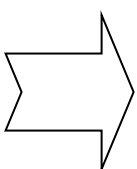
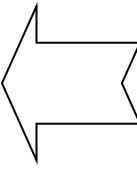
7.5 THE LONGITUDINAL CASE: AXIS-1

7.5.1 NATURE

AXIS-1 AS AN EXPLOITATIVE R&D PROJECT

As explained in the previous chapter, MEGAPROJECT is best described as a portfolio of subprojects (SP). These SP were characterized by various levels of technological maturity: some SP explored technologies and products that were new for the partners or even for the whole industry while other SP, like Axis-1, focused their efforts on the enhancement of existing products or production processes. In Axis-1 (SP1), MNC2 wanted to improve its easy-cleaning steel and to develop a new product with antibacterial properties while MNC1 already had an antibacterial product but was missing a self-cleaning product produced through vacuum surface treatment (see Table 17).

TABLE 17 INITIAL INDUSTRIAL TARGETS OF AXIS-1

	MNC2	Cross-fertilization	MNC1
Self-cleaning	Enhancement of existing self-cleaning surface through plasma surface treatment		Development of a self-cleaning surface with photocatalytic effects induced by plasma surface treatment
Antibacterial	Development of an antibacterial product through plasma surface treatment		Enhancement of the existing antibacterial product through plasma surface treatment

To summarize, the goal was “either to sell something at a higher price (*with added value*) or to produce at lower costs” (Notes_11.09.07). On the basis of the crystallizers’ experiences and the existing scientific knowledge about photocatalytic coatings, Axis-1 was designed as an **exploitative R&D project**. In other words, it was built with a focus on realizations in industrial settings and on a quest for the right design.

First of all, Axis-1 was targeting realizations in industrial environment. To achieve such a goal, the collaborative work was focused on the following steps:

- A preliminary step for sharing characterization methods and the state-of-the-art about the products;
- A first step consisting in reproducing the results achieved during the preliminary manipulations;
- An optimization phase to be done in the laboratories;
- The up-scaling of samples into the industrial environment.

Building on preliminary manipulations that were performed before the beginning of MEGAPROJECT, the project included an up-scaling phase from the academic laboratories to the industrial research centres (PROJET_MEGAPROJECT) as soon as optimal samples would be achieved by the academic partners. As claimed in the description of MEGAPROJECT (PROJET_MEGAPROJECT):

The industrial up-scaling of this system should be rather easy. Some films have already been prepared for MNC1 and MNC2: the tests realized on the films prepared for MNC1 gave positive results.

This goal was clear for Axis-1 partners. For instance, an industrial partner described the project in the following terms (IND8):

A project on two years with a finality where one puts the pressure: “wait, you are no longer in the research process, what we want after two years it’s something ready to be industrialized” (...) the finality is not to reach an academic lab’s product but to reach a product... the second generation of our product on the lines.

In the academic labs, the goal was seen as the development of products on steel and glass that are better than what exist today (ACA10). As expressed by another researcher (ACA8), the up-scaling phase was definitely a part of the project:

Once the characterization step is over, we identify the samples that seem interesting, and once it’s defined – I mean, we are not there yet – we move to the upper scale, in the research center of MNC1 and MNC2, or at least we transmit the information and say “here we are, you have to try that material during up-scaling” and then we will see that there is some other problems and there will be a feedback between the research centers and the laboratory (...).

Secondly, the quest for fundamental understanding was neglected at the benefit of the quest for the right design. Indeed, the project was focused on getting quick concrete outcomes in order to “quickly show something” (HV_10.09.08). To reach this goal, partners were planning to “copy-paste” (IND8) the plasma surface treatment recipe for getting easy-cleaning properties from steel to glass, and to transfer the experience of the glass manufacturer about antibacterial properties to create antibacterial steel products (IND2). The targets were ambitious but seemed realistic given:

- The combined capabilities of the industrial partners who already understood the photocatalytic phenomena (IND5) and were building on existing methods and processes (PROJET_MEGAPROJECT);
- The level of the academic partners (IND5) who were already active in the targeted fields, thereby providing an important source of information for the project (PROJET_MEGAPROJECT).

Anyway, it was felt by the members of the project that the duration of two years and its dedicated budget did not allow for exploration (Note_11.09.07).

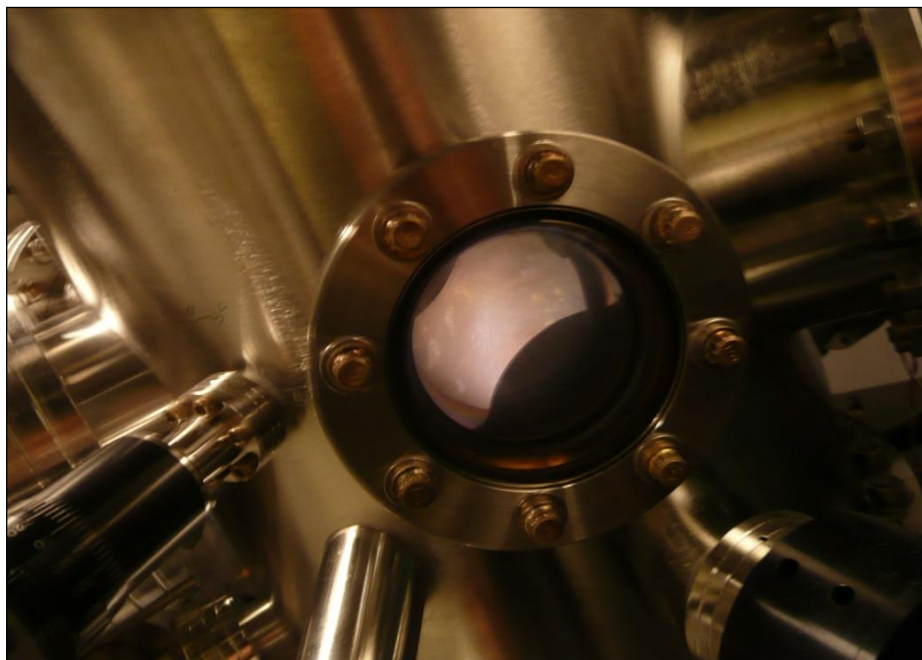


FIGURE 17 PLASMA DEPOSITION AT LAB2

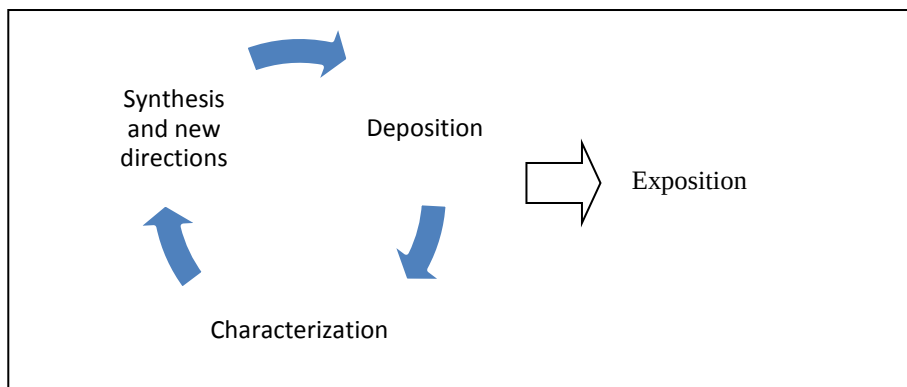


FIGURE 18 CHAIN OF SAMPLES

In order to reach the exploitative goal of Axis-1, the collaborative research was organized as a chain of samples (see Figure 18) that undergoes four main steps:

- Deposition: the cycle would start with the deposition of a specific nano-layer on a batch of samples in the laboratories in charge of the plasma deposition.
- Characterization: the analysis of the samples properties with various analytical methods.
- Synthesis: results were discussed in order to give direction for the next batches of samples.
- Exposition: promising samples were then exposed on an outdoor rack (see Figure 19).

The chain involved the partners at various levels. The deposition was mainly performed by LAB2 and LAB1. LAB2 and LAB1 were producing samples with self-cleaning properties (respectively with PVD and LAB1_PVD techniques), but only LAB1 produced anti-bacterial samples (through co-sputtering techniques).



FIGURE 19 OUTDOOR EXPOSITION OF PROMISING SAMPLES

The characterization was performed by partners as well as by external subcontractors: a first screening of the sample's photocatalytic performance was realized by LAB3 while the industrial partners performed complementary photocatalytic analysis; the wettability of samples was assessed by the industrial partners with a static method while LAB5 was in charge of a deeper examination on promising samples; external subcontractors assessed the antibacterial properties of samples and even LAB2 and LAB4 occasionally performed some characterizations.

The results and direction for the next batches were discussed through bilateral interactions between partners as well as during the plenary meetings. Finally, the exposition was realized on the rooftop of SME1 who was in charge of monitoring the "dirtying" of samples.

AXIS-1 THROUGH HYBRIDIZATIONS AND ITERATIONS

Two phenomena challenged the exploitative nature of Axis-1:

- The identification of subparts and peripheral research (hybridization).
- Changes in the exploitative nature of Axis-1 (iteration).

First, I identified multiple subparts in Axis-1. Two subparts were well acknowledged by the partners (i.e. POSTER1, POSTER2): the Self-Cleaning subproject (henceforth SC) and the Anti-Bacterial subproject (henceforth AB). Originally, each subpart focused on the dedicated properties (SC or AB) on both steel and glass products. However, the scientific results and the restructuration of the project progressively created a drift in terms of properties and substrates (ACA11; IND22; PV_23.06.10): on the one hand, SC properties on glasses and thus mainly driven by MNC1; on the other hand, AB properties on steel products and thus mainly driven by MNC2 (see Figure 20).

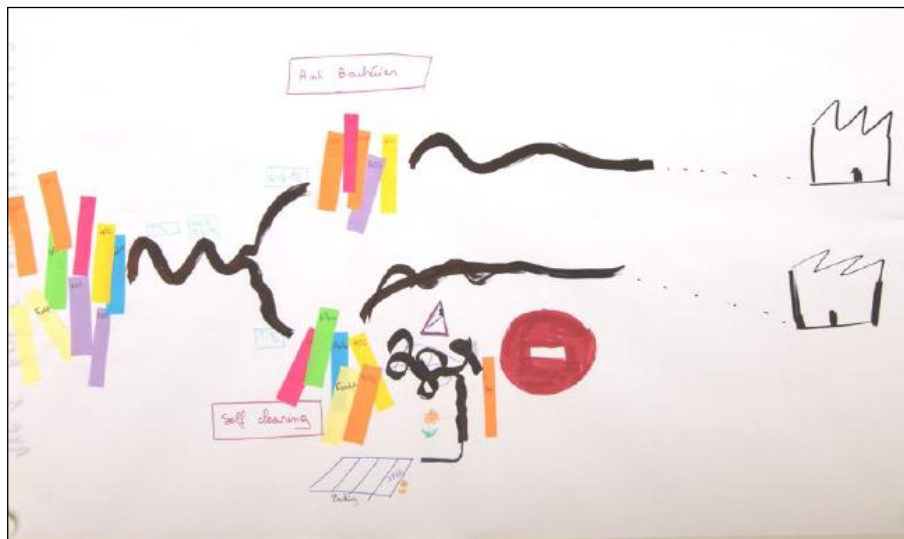


FIGURE 20 POSTER1

The drift was palpable during plenary meetings: AB discussion involved only a few actors while others were “getting bored” (Note_070708; ACA11) or even left the meeting (Note_21.04.08). Nevertheless, project managers kept organizing the meetings for Axis-1 as a whole, which contributed to the identity of Axis-1 as the relevant “project” even if divided into two subparts.

In fact, our observations revealed that SC acted as the glue or cement for Axis-1: each partner was contributing to SC either directly through specific R&D tasks, or indirectly through discussion during plenary meetings. On the contrary, some key actors of AB were not part of the collaborative research (ACA8; Notes_05.07.07; Notes_03.12.08): the characterization of the AB properties was performed by subcontractors outside Axis-1. As a result, the analysis of knowledge transfer in Axis-1 focuses mainly on the exchanges at stake for SC.

While SC and AB were considered as two legitimate parts of Axis-1 (CoPil_25.03.09) and built in parallel as exploitative projects, other subparts emerged in a more discrete way. More precisely, I identified three additional subparts that were characterized by an understanding orientation (see Figure 21):

- Peri_thesis: the doctoral work of the junior researcher who was hired to perform the DRX test at LAB3 and to study the effects of microstructure on the antibacterial properties of silver and titanium dioxide (TiO₂) coatings.
- Peri_LAB4: the work of LAB4.
- Peri_LAB5: the research work undertaken by a research team from LAB5.

Even if those partners were involved in the main collaborative work of Axis-1 (and more precisely SC), either as characterizers or as contributors during discussions (PV_21.04.08), they were in charge with the development of peripheral competences deemed “more exploratory” (PROJET_MEGAPROJECT; IND6; ACA8) such as the exploration of the mechanisms at the origin of the self-cleaning properties.

Peri_thesis was identified as an exploratory R&D project: the analyses performed in the framework of the thesis were supposed to contribute directly to the main project, thereby having the realization in industrial settings as a target (ACA7). On the contrary, LAB4 and LAB5 were in charge with the development of composite surfaces (TiO₂/WO_x and TiO₂/SiO_x) with self-cleaning properties through plasma deposition but also through alternative technologies such as the sol-gel processing methods. Because the resulting composite surfaces were not supposed to be up-scaled during the project (PROJET_MEGAPROJECT), Peri_LAB4 and Peri_UHM were characterized as prospective projects. Note that Peri_LAB5 is a little more

complex: like in Peri_thesis, the team from LAB5 was performing characterizations that contributed both to Axis-1 and Peri_LAB5 (Notes_05.07.07). But like Peri_LAB4, it was developing composites with an alternative technology. Because of their direct contribution to Axis-1 (and more precisely SC), Peri_thesis and Peri_LAB5 are drawn with an overlay with Axis-1. On the contrary, Peri_LAB4 is drawn apart from Axis-1.

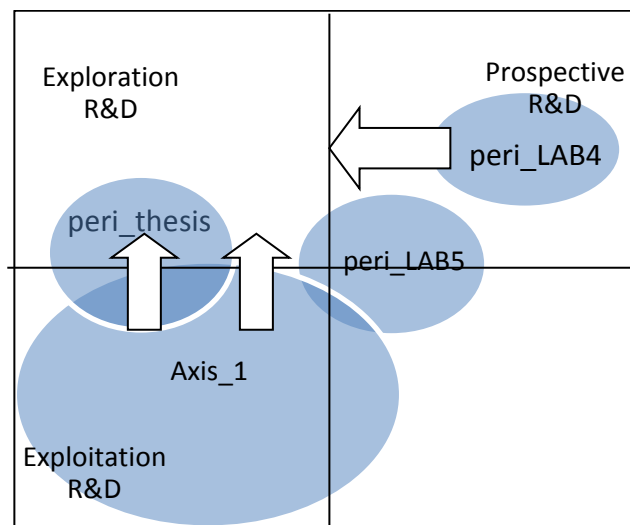


FIGURE 21 AXIS-1 AND ITS PERIPHERAL RESEARCH

The second challenge has regards with iterations: researchers in Axis-1 faced blocking points and dead-ends, forcing them to search for more explanations and to dig deeper than expected (IND6, Notes_01.02.08, PV_21.05.08). At one point, the quest for understanding gained some importance, pushing Axis-1 towards the exploration zone (see the arrows Figure 21). This iteration was triggered by a twofold crisis: the inability of the group to reproduce the preliminary outcomes in the academic laboratories (Notes_18.03.08; IND6; ACA8) and the realization that the “copy-paste” metaphor was not appropriate for the development of the targeted products (PV_01.02.08; PV_21.04.08; IND8), urging for a deeper understanding of the interactions between the substrates (steel or glass) and the nano-layer depositions (CoPil_25.03.09).

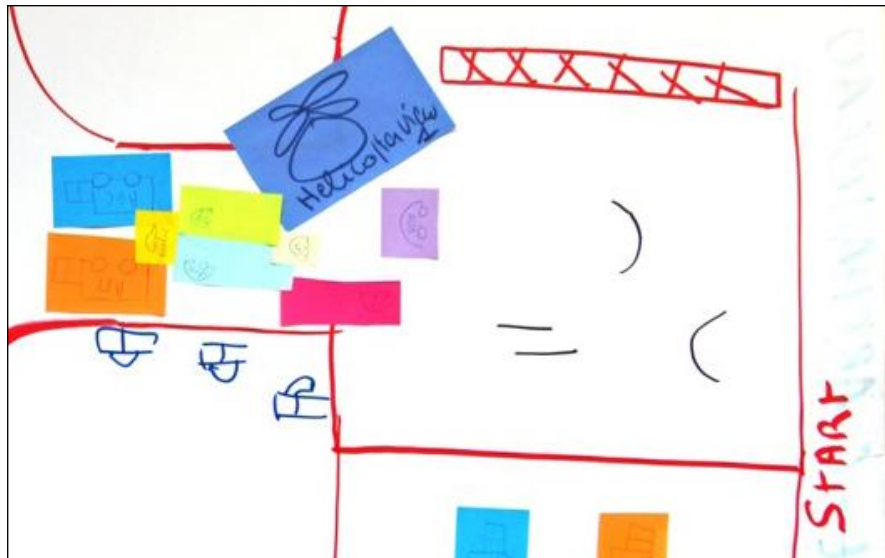


FIGURE 22 EXTRACT OF POSTER3

The iteration process took more than one year:

- The crisis was explicitly acknowledged in March 2008 (Notes_18.03.08);
- The redefinition of the project was discussed in depth six months later during the Helicopter View of September 2008;
- The redefinition of the project, in particular the need for more understanding, was formally submitted to the Steering Committee of March 2009 (CoPil_25.03.09; Notes_01.04.09);
- The negotiated changes in Axis-1 were formally written down in an amendment of the consortium agreement in October 2009.

Yet, the “pivot point” from exploitation to exploration was crystallized by the Helicopter View (HV) of September 2008 (see Figure 22). The project managers took opportunity of this team-building event to propose a new action plan with narrower targets but with a deeper exploration, thereby qualifying the project as an explorative research. The objective of realization in industrial environment was more vivid than ever: the iteration from exploitation to exploration came along with an “acceleration of transfer” between the academic laboratories and their industrial partners (Notes_11.09.08; CoPil_25.03.09), both for AB (IND8) and SC (CoPil_25.03.09; Notes_01.12.08; PV_06.03.09).

This iteration also impacted the peripheral research: in Peri_LAB4 and Peri_LAB5, researchers were asked to stop alternative deposition methods, to focus on plasma technologies and to contribute more directly to the industrialization objectives of Axis-1/SC. Concerning Peri_thesis, the constant redefinition of the thesis (Notes_18.03.08; HV_10.09.08; Notes_01.04.09; Notes_10.09.09) and the pressure about the characterization tasks for Axis-1/SC (HV_10.09.08; Notes_10.09.09) led to a divestment of the researcher (ACA11) and thus the progressive disappearance of Peri_thesis.

Finally, four cases were explicitly taken into account for the analysis of knowledge transfer in Axis-1: (1) Axis-1 (SC) as an exploitation R&D project before the HV of 2008, (2) Axis-1 (SC/LAB4/LAB5) as an exploration R&D project after the HV, (3) Peri_LAB5 and (4) Peri_LAB4 as prospective cases before the HV of 2008.

7.5.2 KNOWLEDGE TRANSFERS IN AXIS-1

In Axis-1, plenary meetings were organized once a month in order to share results and to discuss the next steps of the project. Such an intensive pace allowed for the co-creation of Know-Why about the direction of the collaborative research. From the beginning, the main guiding criteria were about industrial requirements: depositions that respect the esthetic of the products; targets which have better properties than the commercial references, with a visible effect so that customers of the surface manufacturers could assess their quality in a glance. This Know-Why was developed to make sense of the collaborative work and to assess its results. For instance, a dual criterion soon appeared to describe a “good” self-cleaning sample: a sample with a photocatalytic anatase¹⁹ Titanium Dioxide (as characterized in the laboratories) with visible properties (as assessed after outdoor exposition).

Plenary meetings also provided opportunities to share Know-Why about the production methods of the industrial partners as well as about the analysis and

¹⁹ Anatase is a crystallized form of TiO₂. As explained in Chapter 8, one strong interpretive scheme in Axis-1 was the quest for an “anatase” sample because it was thought that the photocatalytic property was linked to the crystallinity of the TiO₂.

deposition techniques used by the laboratories. At first, this Know-Why from the laboratories was not transferred with its associated Know-How: advantages and constraints of the techniques were discussed openly but operational details were supposed to be shared on a “need to know” basis (PV_05.07.07; NOTES_05.07.07, IND9). As explained by one respondent: “We bring the samples (*to the project*) but also – the Know-How is not necessarily the word – but rather the experience we have about the technique”. On the contrary, academic researchers were able to access industrial Know-How as they visited the industrial research centers and were allowed to use some equipment of their industrial partners (ACA8; IND9; Notes_30.12.08). In this case, the academic researchers were able to combine the Know-Why shared by the companies during the plenary meetings with the development of Know-How directly on the machines. Such combination was essential to ensure the transfer from the laboratory to the industrial settings but it was not deemed necessary for the prospective projects (Peri_LAB5 and Peri_LAB4) which did not target an up-scaling phase.

As the project evolved, blocking points appeared and changed the dynamic of knowledge transfer. First, partners realized that their knowledge about the phenomena under study was not wide enough to make sense of some results (NOTES_01.02.08). In fact, I witnessed a growing need for fundamental understandings of the self-cleaning mechanisms as well as about the interaction between the nano-layers and their substrates like the clustering behavior of silver deposition (NOTES_17.12.07, PV_17.12.07). Scientific knowledge of the partners allowed for the identification of exploration paths but additional scientific “Know-Why” was required and subsequently developed to shed lights on those blocking points. As the laboratories were struggling to reproduce the results of the preliminary manipulations, the research partners also developed a shared-understanding about what should be done and how the research should be conducted. Urged by the necessity to “get back on our feet” (IND6) and get out of the “dead-end” (ACA8; Poster1; Poster3), partners redefined the research work as getting “something that works” (Notes_17.12.07) in the laboratory even with unsatisfactory features – thick layer and high temperature – and then trying to reduce the thickness of the layer or the processing heat (Notes_21.04.08; PV_03.12.08).

The iteration from exploitation R&D to exploration R&D also had an impact on the development of Know-How inside the laboratories. At the beginning, the project was seen as an opportunity to widen the Know-How of the laboratories (ACA3). For instance, a new important piece of equipment was bought and broken in at LAB2, a new kind of Plasma Vapor Deposition (PVD) technique was under development in LAB1 and methods for photocatalytic testing were being refined in LAB3. Likewise, LAB4 and LAB5 were developing the equipment required for sol-gel processing.

As Axis-1 required more explorative efforts, the project managers needed to refocus the research capabilities of the project towards the central collaborative research and its underlying concrete targets. As a result, LAB4 and LAB5 slowed down their development of alternative deposition techniques, LAB1 had to leave its new PVD technique out of MEGAPROJECT after that it had failed to prove its applicability in industrial settings, and the researchers from LAB3 were asked to favor the reactivity towards Axis-1 with the existing Go/NoGo screening instead of developing a new quantitative characterization method.

This process of “re-focus” also affected the creation of Know-Why by the academic partners. Indeed, rather than being able to develop more explorative work in parallel with Axis-1, the researchers and their work were channeled towards Axis-1 (IND8). This canalization of Know-Why was important to overcome the technical difficulties of the project: to explain unclear results and to propose new direction to be explored in the framework of the project. It was equally important to justify the “closing of doors”: the concrete products were still the main targets but if the explored paths did not lead to them, members of the project should at least demonstrate and capitalize on the reasons why they were closed (IND8; ACA10; ACA11). The Know-Why created and shared in Axis-1 was therefore combined with the sharing of published papers for triangulation purpose.

Those publications were sometimes posted on the knowledge platform of MEGAPROJECT deployed in April 2008, a website with regulated access that allowed for the sharing of data about a given SP without being shared with the rest of MEGAPROJECT. In Axis-1, the platform also gave access to the samples’

information (name, conditions of deposition, characterizations), the presentations done during the plenary meetings and the associated meeting reports.

Concerning the creation and sharing of Know-Who in the project, I witnessed the creation of links at the individual level as well as the organizational level. From an organizational point of view, the collaborative research allowed for a strengthening of the bilateral links between the laboratories and the two crystallizers as well as the creation of links between the various research institutions (see Chapter 8). Plenary meetings and the visits of the facilities allowed the development of a shared understanding of each other's competences and core activities. At the individual level, occasional visits of researchers in each other's facilities allowed the creation of Know-Who which contributed directly to the project (who to contact to perform test on the machine of a partner for instance). Finding the right person for the right tasks was not the easiest part of the project, especially when this person belonged to another organization, and caused additional delays. Note that the creation of Know-Who was not confined to Axis-1 as the researchers were able to access training opportunities and to learn about new equipment and methods at the level of MEGAPROJECT thanks to the training component of the Marshall Plan.

7.6 SYNTHESIS: SPECIFIC FLOWS IN SPECIFIC PROJECTS

In this section, I present the main findings from the longitudinal case study and the analysis of replicated cases from MEGAPROJECT (SP7, SP9 and SP10): how exchanges between partners evolve as the R&D activities vary between prospect, exploration and exploitation (see Table 24 p. 199).

7.6.1 EXPLOITATIVE R&D PROJECT

In the exploitative R&D projects, knowledge exchanges were revolving around an industrial challenge with the quest for the right design given a set of well-defined specifications. In MEGAPROJECT, academic laboratories were not automatically integrated in this kind of projects. As expressed by one respondent:

We are really close to a final product, so to speak, and I have the impression that the development that academic partners could bring is more upstream, well before what we are doing now. Here, we are assembling layers that already exist, I must say that... the academic partners, I don't know what they could do (IND20).

I nevertheless observed exploitative R&D projects that involved academic laboratories. For instance, in SP9, the lab was in charge of “a small contribution” (ACA14):

If the lab has a contribution, it is really in terms of characterization: we have to determine the optical properties of materials, they send the samples, we measure and give back the properties (...) we send the results and they treat it with their software (ACA14).

As such, the role of the laboratory was one of technical service provider with restricted experimentation. Exchanges were limited to Know-What transfer between partners: specifications against results (ACA14; SP9_18.03.08). This situation was also witnessed at the beginning of Axis-1 when it was acknowledged that “the industrial partners know more than us (*academics*)” (Notes_11.09.07): industrial partners were in charge of the direction of the project (ACA8) and were providing requirement for the next batches based on the characterization results (ACA7). In such cases, academics were involved in the project to accelerate the processes of sampling deposition and characterization: by sharing the work with academics, the industrial partners did not have to do every experiments by themselves and therefore were expecting to save time (IND7).

Another reason was the access to characterization methods that the industrials did not mastered. As a matter of fact, both SP9 and Axis-1 faced situations where they needed some kind of characterization and had to look outside the collaborative research to find a laboratory that was able to measure what they wanted (SP9_17.09.08; Notes_05.05.07). Finally, the academics in Axis-1 also wanted to contribute to the project by explaining the evolution of results based on their existing expertise (IND7): “otherwise, there is no need to come fetch us” (Notes_05.05.07). On the contrary, partners in SP9 were comfortable with the arm’s length arrangement “specification against results”.

In Axis-1, I observed that the definition of requirements could lead to the transfer of Know-How from the industry to the academic laboratories in order to facilitate the realization of the services and ensure the comparability of results (PV_17.12.07; IND9; ACA8). In informing and guiding the academic laboratory, the industrial partners enhance the relevance of the generated Know-What (characterization results for instance), while enhancing the relative absorption capacity (Lane & Lubatkin

1998) of the collaboration: the academic partners is better equipped to face future demands. A lack of access to this Know-How – in particular a lack of access to the persons that have this Know-How inside the company – can be an important source of frustration (Notes_11.05.10). Likewise, the industrial partners need access to the Know-Why behind the methods to make sure that the academic labs are actually measuring what needs to be measured.

Another source of frustration lays in the absence of exploration. Indeed, the *raison d'être* of an academic laboratory is research excellence and the quest for fundamental understanding. When designing an exploitative U-I joint project, partners should ensure that this quest is negotiated in parallel with the exploitative work, not only for the laboratory but also for the individual researcher who is actually doing the job and might grow bored of repeating the same tasks while he was hired as a doctoral candidate. In SP9, researchers were involved in multiple projects and were able to develop new characterization methods and to publish this progress. In Axis-1, LAB4 and LAB5 negotiated the quest by developing peripheral research with alternatives processing methods, LAB2 took opportunity of the project to break in its new equipment, LAB1 was developing a new PVD technique and LAB3 negotiated the conduct of a thesis.

7.6.2 EXPLORATIVE R&D PROJECT

Per definition, exploratory R&D projects include a quest for fundamental understanding and the exploration of one or multiple phenomena within the collaborative research. As such, exploratory activities are associated to other stakes and potential frustrations.

In Hermans and Heck (2010), we identify the lack of alignment between the exploratory nature of a project and the flow of knowledge developed between partners as an important threat for the collaboration. In this example, the coexistence

TABLE 24 ALIGNEMENT BETWEEN SPECIFIC FLOWS AND THE NATURE OF PROJECTS

Projects	Nature and direction	Role of labs	Points of interest
Exploitative R&D project	Creation of Know-What $U \Leftrightarrow I$ Know-How $I \Rightarrow U$ Know-Why $P \Leftrightarrow P$ Creation of Know-How I Creation of Know-Who $P \Leftrightarrow P$	Technical service provider, restricted in the experimentation	Construction of an effective support for Know-What exchanges (platforms) Negotiation of the quest for understanding Transfer of Know-How and Know-Who within the project to develop relative absorption capacity
Explorative R&D project	Creation of Know-What $U \Leftrightarrow I$ Know-How $I \Rightarrow U$ Know-Why $I \Rightarrow U$ Creation of Know-Why $U \Rightarrow I$ Creation of Know-How I	Technical service provider, opened towards experimentation	Alignment between the exploratory nature of the project and the objective of industrialization Transfer of Know-Why between companies and academic laboratories for an enhanced relevance of new scientific knowledge and its integration into industrial settings
Prospective R&D project	Creation of Know-How U Associated Know-What and Know-Why $U \Rightarrow I$ Know-Why $I \Rightarrow U$	Developer of new scientific knowledge relevant for the industrial basis	Transfer of Know-Why from the industrial partners to academics for the orientation of fundamental research. Support of hierarchy : heads of laboratories and R&D industrial coordinators

of the industrialization objective and the quest for understanding was the result of a compromise: the companies, final users, were asking for an operational sensor – whatever its origin – while the academics wanted to explore a promising technology that should have led to an innovative sensor. This arrangement created a drift between parties in terms of timing and flow requirement: while the industrial partners were waiting for “something that works” according to their well-defined specifications and were reluctant to share Know-Why related to their processes (methods and constraints), academics were only beginning to explore the concept and needed this specific Know-Why to select the adequate research paths. Such a lack of focus was experienced as a heavy weight by the academic laboratory.

On the contrary, the quest for fundamental understanding was clearly recognized by industrial partners in MEGAPROJECT (SP7 and Axis-1 after the iteration) which provided partners with plenty of opportunities to transfer Know-Why from the industrial partners to the academic laboratories. In SP7, the exploratory activities were being channeled by the industrial partners: “they are deciding about what needs to be done” (ACA12) but they also shared their vision about the future usage of the product being developed (SP7_10.03.08), chose the materials to be explored and explained the reasons behind their decision (SP7_10.03.08) as asked by the research partners (SP7_15.09.08; ACA12). The sharing of Know-Why was particularly important in SP7: academic partners even took opportunity of the Helicopter View of 2008 to ask the industrial leader to further develop his “vision” of the project and their links to this specific plan. In Axis-1, academic partners were also waiting for their industrial partners to “get out of the fog” (ACA8; Notes_05.05.07): criteria about the right direction and focus were provided during the first plenary meetings by the industrial partners and stayed unchallenged even after the iteration from exploitation to exploration.

Like in exploitative R&D projects, the exploratory activities required the exchanges of Know-What under the form “requirement against results”. But, in contrast with the exploitative projects, the industrial partners were calling for the development of new scientific Know-Why around those results. In SP7, the team work was therefore organized around specific technical points to be resolved through “the science behind” (IND18), the bibliographic work of the academic partners was seen as a source of new ideas for the project (ACA12, SP7_15.09.08) and the presentations of

Know-What such as the characterization results were opportunities to highlight new paths (SP7_10.03.08). In this case, the lack of involvement of the partners who stick to a restricted exchange of Know-What might create frictions in the project: this phenomenon was witnessed in Axis-1 when the R&D managers needed to rechanneled the exploratory effort from the peripheral research to the main collaborative work while an academic partner stuck to its strict role of service provider. A side-effect of this “refocus” and the subsequent inertia of the academic partner was the lack of trust towards academic sidetracks.

The new scientific Know-Why was subsequently integrated to the development of industrial Know-How such as new lines or the elaboration of new materials (IND18). While this work was undertaken by the industrial partners alone in the exploitative projects, the exploratory nature of SP7 required a closer involvement of academic partners. For instance, one researcher from the University of Namur was finally invited to contribute to the elaboration of new components with the industrial partner in complement to his characterization work at the laboratory.

7.6.3 PROSPECTIVE R&D PROJECT

Like exploratory projects, prospective R&D activities are characterized by a quest for fundamental understanding but this time without a clear objective of industrialization. As a matter of fact, neither the peripheral research of Axis-1 nor SP10 were targeting industrialization in the context of the project. In Peri_LAB5 and Peri_LAB4, the laboratories developed new Know-How about sol-gel processing and shared the associated Know-What (bibliography) and Know-Why with the partners of Axis-1, even if it did not always contribute to the main collaborative research. In SP10, research partners were performing technology watch as well as developing new Know-How in order to come to a proof of concept at the level of the laboratory (IND21). As the targeted technology was evolving, some industrial partners took opportunity of the existing development to integrate it into their own equipment. As a result, even if the underlying technology is still “far away from industrialization” (IND21), it nevertheless contributed to the enhancement of industrial competences and the creation of new markets for the industrial partners.

This project also generated various prototypes but the partners in SP10 quickly realized that they were lacking information about what kind of markets could be interested, and which direction should be followed to further develop the prototypes. As a result, an additional industrial partner was brought in during the conduct of SP10 in order to assess the relevance of the prototypes and to provide the required Know-Why (SP10_26.01.09; IND19). In contrast with the specific and sometimes sensible Know-Why exchanges at stake in exploratory projects, such Know-Why concern general markets trends and its transfer is therefore less problematic.

As a result, the development of the absorptive capacity takes a twofold path in prospective project: the direct access to scientific knowledge for the industrial partners on the one hand; the orientation of fundamental research within the academic laboratory on the other hand. Like in the other R&D projects, the transfer of Know-Why from the industry to the university is central as it allows academics to understand the – scientific, organizational, commercial – problems that the industry faces, their causes and consequences. As such, it should diminish the institutional frictions that impede inter-organizational learning (Lane & Lubatkin 1998) as well as the journey in the valley of death (Auerswald & Branscomb 2003, Ford et al. 2007). The orientation of scientific activities into competences that are relevant for the industry is another important stake for the Competitiveness Cluster. In order to ensure the durability of exchanges, the prospective project needs the involvement of the hierarchy from both worlds, even if industrialization might seem far away. It should also support the development of technological platforms that are of interest for both the industry and the scientific search for excellence (IND2).

7.6.4 ITERATIONS AS EMOTIONAL SHOCKS: THE BOOMERANG COMPLEX

The previous sections provided a check-list of expected flows as the R&D projects focus on exploitation, exploration or prospect (see Table 24). While the alignment between expected flows and the nature of the project is an important stake of the collaboration, partners should allow for flexibility as the project might experience iteration. The iteration that I witnessed in Axis-1 was a pivot from exploitation to exploration, a process that might be called joint “opening up” (Holmqvist 2003): from joint acting to joint experimenting.

It was triggered by various factors. For instance, the construction of Axis-1 as an exploitation R&D project underestimated the role of each specific substrate for the development of the targeted properties, jeopardizing the “copy-paste” metaphor. Furthermore, the deposition equipment used in the laboratory was not always as robust as expected, especially at the beginning of the project: the LAB2’s machine experienced some launching difficulties and the technique of LAB1 was still in development (in another axis of MEGAPROJECT as a matter of fact). Finally, other reasons are linked to the uncertain nature of the innovation process (Astley 1985): if we always knew where we were heading, R&D would be called D&D. In this work, I did not further develop the reasons behind the iteration. Rather, I spent more time to understand the experience of it: the impact of the iteration on the collaborative research and its dedicated transfers of knowledge.

First of all, the academic partners shifted from a role of producers of Know-What (conditions of deposition, characterizations, etc.) and recipient of existing scientific Know-Why to a role of producers of Know-Why to explain unclear results, explore new paths and “close the doors”. This shift came along with a reduction of Know-How creation at the level of the laboratory (such as the development of sol-gel methods and other techniques not directly linked to the project) and a reduction of peripheral exploration, in other words parallel research that could have been undertaken by the academic researchers independently of the project. Several difficulties were associated with this shift:

- The design of the collaborative research as depicted in Figure 18 became obsolete. Indeed, the consortium was designed to bring together all the competences needed for the project. As explained by one respondent: “It is a work team that gathers every possible competences for the success of the project” (ACA10). With this design, each collaborator was in charge of a well-defined link of the chain and each link was depending on the other parts of the chain. It created interdependencies in terms of actions and acted as a catalyst to stimulate exchanges around the table. This construction was consistent with an exploitative R&D project, where unclear results were to be explained by the pool of existing scientific knowledge. Once the iteration was acknowledged, the interdependencies shifted from catalyst to

impediment of the collaborative work as the blocking points necessitated quicker feedbacks and reactions.

- The respect of a win-win situation was less clear for some academic partners. When constructed as an exploitative R&D projects, the quest for fundamental understanding was negotiated outside the main project, through peripheral research such as Peri_thesis or through parallel works undertaken by the academic researchers (Notes_11.05.10). As the explorative efforts were rechanneled towards the main project, parallel tracks were closed and the academic partners were restricted in their research work. As found out by Erpicum and Chalant (2010), this tension led to managerial difficulties for the project managers who were in charge of the “channeling”, and to unclear objectives and roles of the partners.

Those phenomena were amplified in the peripheral researches, especially when the laboratories were already wearing a twofold hat: characterizers for Axis-1 and prospector in the peripheral projects. In those cases, the alignment between the nature of the project and the role of the partners was a source of misunderstanding due to both iteration and hybridization.

In this analysis, I uncover a second impact that should not be underestimated: what I called the boomerang complex²⁰. In Axis-1, the iteration was experienced by the participants as a highly emotional event. The failure to reproduce the preliminary manipulations contributed to **the construction of strong shared interpretive schemes**, in particular the necessity to “fall back on our feet” (IND8) and to produce samples characterized as “anatase”. As explained earlier, partners redefined the research work as getting “something that works” in the laboratory even with unsatisfactory industrial conditions, and working towards industrial requirements

²⁰ A complex is a set of mental representations and recollections which have a high affective value, are contradictory, are partially or totally unconscious, and which influence the behavior of an individual (Alhadeff-Jones 2008, Institut National de la Langue Française 2010) or a group of individuals when this set of mental representations is shared.

only in a second step (PV_21.04.08; ACA10). Such collective understanding can be very efficient to channel collaborative actors towards a common goal but it also **creates a blueprint which impedes alternative thinking**. In this project, it was an obstacle not only for the emergence of alternative paths but also for the recognition of alternative solutions (see Chapter 8).

The construction of strong shared interpretive schemes around the pivot was also witnessed in SP10 with its “forward” iteration. SP10 was the most upstream project of MEGAPROJECT (IND5; IND14) and the goal “was not to develop a product but rather to develop competences” (IND19) via technology watch and the development of new technologies at the level of the laboratory (PROJET_MEGAPROJECT). However, as recalled by a respondent (IND5), things accelerated as one partner stopped and said:

Well, maybe we could stop playing, maybe we could stop developing the bibliography; is there a mean to concretize one thing or another?

As a result, the partners of SP10 experienced “joint focusing” : they shifted from a process of exploration to a process of exploitation (Holmqvist 2003). They developed early prototypes and became “more concrete more quickly than expected” (SP10_09.10.08). Even when the “experimental validation on a small scale” (PROJET_MEGAPROJECT) was reached (IND21), partners still wanted to go “from technology watch to something concrete” (NoteIP_08.09.09). As a result, they looked at the ideas, technologies and prototypes that were generated in the project and selected four realization paths that materialized into a brand new “SP17”. SP17 now targets the development of new products in industrial settings (IND21), with a quest for the right design rather than a quest for understanding (IND20), and involves additional partners who know the targeted markets and will be able to commercialize them (IND19; SP10_09.10.08). Like in Axis-1, the iteration was experienced by the partners of SP10 as a highly emotional event: they proudly exhibited their “realizations” during the Helicopter Views of 2008 and 2009, and still present the creation of SP17 as a success story. The strong interpretive schemes “let’s get something concrete out of the innovation” (IND19) accompanied them from the first prototypes to the conduct of their new exploitative R&D projects in SP17.

7.7 CONCLUSION

In this chapter, I conduct an empirically grounded analysis of knowledge transfers in a joint R&D project whose nature shifted from exploitation to exploration. I complement the longitudinal case with findings from smaller replicated cases from the same environment. Through this analysis, I identify three major points of interest.

First, I confirm that the shared definition of a R&D project as an explorative, exploitative or prospective research comes along with specific expectations about the exchanges at hand. The nature of the project influences knowledge sharing by defining the expected outcomes of the project and the right ways to reach it. Exploitation R&D project targets outcomes that are integrated to industrial settings, urging for the transfer of Know-How from the industry to the academic laboratory. It allows for the strengthening of the collaborative links on the basis of complementarities refinement, for instance through the refinement of methods according to the industrial partners' requirements. In this case, the academic laboratory creates mainly Know-What concerning the samples and provides access to existing scientific knowledge. Exploration R&D also targets concrete results in industrial environment but acknowledges blocking points that are explored in the framework of the project, allowing for the creation of relevant Know-Why by the academic partners. Prospect projects acknowledge the quest for fundamental understanding while transferring Know-Why about the industrial settings. In this case, the transfer of Know-How from the industry to the university was less important than the transfer of Know-Why about marketing criteria and industrial production methods.

This first point of interest contributes to innovation studies in a twofold way. First, it contributes to a dynamic view of inter-organizational knowledge transfer (Faems et al. 2005) in the burgeoning field of exploratory and exploitative innovations (Cesaroni 2004, Rothaermel & Deeds 2004, Jansen et al. 2006). I show that exploitative, exploratory and prospective projects imply specific knowledge flows and contribute in different ways to organizational strategies. By doing so, I also expand the interactive models of innovation such as the chained-link model proposed by Kline and Rosenberg (1986). This model sets the role of science

alongside the development process as an indirect driver: by enlarging the basis of existing knowledge and by answering specific problems that the current basis fails to resolve. Kline and Rosenberg (1986) also claim that the return of research findings to the main chain of innovation might be problematic. In this chapter, we see that the joint R&D projects financed by the Competitiveness Clusters allow facilitating the problematic return. It also shed some lights on the stakes of its articulation in terms of required knowledge flows.

Second, I present the alignment between the nature of the project and the expected flows of knowledge as an important stake for the conduct of U-I R&D projects: for instance, if a prospective R&D project does not require the transfer of Know-How from the industrial partner to its own laboratory, a lack of such flows will be deteriorating in an exploitation R&D project. As a result, partners should agree on a common understanding about the nature of the project and make sure that its organization takes into consideration the requested flows. A careful alignments is all the more important since the literature on strategic alliances shows that deficient alignments of objectives (Duysters et al. 1999) and hidden agenda (Hagedoorn 1990, Doz & Hamel 1998) contribute to the failure of strategic alliances. But this work goes beyond the alignment of objectives: even if partners agree about a shared definition of the project, they still need to nurture the specific exchanges that should allow reaching its specific objectives.

Finally, I agree with Carayol (2003) about the importance of a careful alignment during the design phase of the project but I also show that a lack of alignment can occurred during its conduct as the collaborative research experiences iterations. Such iterations can impact the role of partners, jeopardizing the negotiated terms of the project and therefore leading to frustrations and misunderstandings. In particular, I show that the iteration of Axis-1 impacted the quest of fundamental understanding that was implicitly negotiated at the beginning of the project and restricted the academic researchers in their exploratory work. I also show that iterations can be experienced as highly emotional events, influencing the rest of the collaborative work by reinforcing the interpretive schemes that guided the pivot. In the case of Axis-1, the iteration acted as a **“boomerang”** that drove the team away from its original – straightforward – targets, challenging the original alignment of interests and subsequently leading to frustrations and divestments in the project.

When designing this research, I decided to focus on one longitudinal case and a number of replicated cases from the same environment. I acknowledge that is an important limit of this work which could benefit from the conduct of additional cases. In particular, this research area might benefit from the study of typical cases from other sectors or other Competitiveness Clusters (see for instance Hermans and Heck 2010). As highlighted by one respondent (IND18), the Walloon culture might be a powerful determinant of knowledge transfer in clustering initiatives that favors openness and cross-fertilization. The operational conceptual frameworks were therefore built with this target in mind, favoring transferability over sector-relevancy. Another important limit lies in the fact that I focused on knowledge transfer within the project rather than through the project (Jiang & Li 2009). An alternative level of analysis – the organization (laboratory or company) – should allow tackling this limit.

In conclusion, this chapter studies how the nature of the project shapes the expected knowledge flows. I also show that iterations in the nature of the project urges for the renegotiation of the R&D problem and ways to solve it. In the next chapter, I show that such a redefinition of the project is not neutral but on the contrary crystallizes the interests of dominant actors: even if the nature of the project may seem taken for granted, it emerges from a political process of pressure and legitimization as mobilized during power exercises. I also identify the leverages that ordinary actors can mobilize to make sure that the project is still a source of value for his or her organization given the (re)definition of the project.

Chapter 8 LET THOSE WHO LOVE ME FOLLOW ME: POWER EXERCISES IN A JOINT R&D PROJECT

8.1 INTRODUCTION

In the first part of this doctoral work, I highlight a gap in the literature on U-I knowledge transfer (see Chapter 2 – Problem statement) as I chose to explore the phenomenon of targeted transfer in joint R&D projects, one of those less studied channels (Agrawal 2001). In this chapter, I address this research object as a political process: I explore how power exercises inside a collaborative R&D project shape the processes of knowledge creation and exchange between partners so that it creates value for the parent organization. As I focus on power exercise, I acknowledge that (1) power is not endemic but rather a powerful driver of human cooperation (Giddens 1984, Friedberg 1997) and learning (Lawrence et al. 2005) and that (2) power can be exercised by all contributors of the project to shape its course. Findings are drawn from an in-depth longitudinal case – Axis-1 – studied from June 2007 to August 2010. This case study combines data collected through semi-structured interviews, documentation and observation during plenary meetings and team-building events. Events of power exercise – which I call “critical events” – and subsequent impact on knowledge transfers were observed during plenary meetings, recalled by respondents through interviews and codified by the project managers in the minutes of the plenary meetings.

In joint R&D projects, collective and individual actors are driven by diverging goals and interests (Grabher & Ibert 2006). They nevertheless find themselves in a state of interdependency as the Walloon policy requires their cooperation if they want to benefit from the dedicated subsidies. This interdependency is expressed in terms of both consensus and contest (Blankenburg 1998): in order to ensure the cooperation, a local order needs to be installed (Friedberg 1997); partners have to agree about a “problem” and ways to answer it within the joint R&D project (Phillips et al. 2000). The definitions of the problem and its solution are therefore an important stake for the partners (Friedberg 1997): they compete to shape it, enrolling allies to their cause (Latour 1987) even if those allies come from a different world with apparently diverging interests.

The joint R&D project is therefore a privileged empirical field to explore targeted knowledge transfer as a political process: to explore how partners continuously compete about the R&D problem and alternative exploration paths and thereby shape the opportunities for knowledge creation and sharing. This is particularly true in University-Industry R&D projects when the quest for understanding needs to be negotiated. In the previous chapter, I show that shared interpretive schemes about the nature of the project, its finalities and main goals have an influence on the expected roles of partners and on the subsequent knowledge flows. In this chapter, I now focus on how collaborative practitioners can take opportunity of power exercise within the project to shape such flows and make them a source of value for their organization.

In Chapter 4, I present the Structuration Theory (Giddens 1984) as a general framework to understand the political processes at stake in joint R&D projects. Through this prism, the project is seen as a social system characterized by interpenetrating structures (Orlikowski 2000) as partners come from different kinds of organizations. It also allows taking into consideration the individual interests of researchers which do not automatically align with (inter)organizational goals. While the Structuration Theory provides a powerful paradigm to understand knowledge exchange in cooperative contexts (Orlikowski 1992,2002), the complexity and abstract character of elements of this theory have been considered as serious threats for its operationalization (Nizet 2007, Jones & Karsten 2008). For this reason, section 2 develops the conceptual framework used to analyze the impact of social interactions and, more precisely, power exercises on knowledge exchanges. Built on sociological insights from Friedberg (1997), Latour, Callon and their colleagues (Latour 1987, Akrich et al. 1988), Hirschman (1970) and Bourgeois and Nizet (1995), this operationalizable framework is at the same time coherent with and complementary to the Structuration Theory and allows drawing valid conclusion about the phenomena under study. Section 3 summarizes the conceptual framework and presents the methods used to explore it. Section 4 presents the findings of this analysis and I finally conclude in section 5.

8.2 AN OPERATIONAL CONCEPTUAL FRAMEWORK

In this section, I present the main theoretical constructs that helped me to make sense of and build an interpretation from the data. First, I propose a focus on episodic power exercise – namely the discrete and observable political acts initiated by self-interested actors (Clegg 1989, Lawrence et al. 2005) – and highlight three methodological stakes:

- The identification of the actors involved in an episodic power exercise;
- The identification of the leverages that they actually mobilize;
- The punctuation of an observed episodic power exercise.

Secondly, I propose the Exit-Voice-Loyalty-Neglect (EVLN) framework (Hirschman 1970, Rusbult et al. 1982, Bagozzi 1988) as a tool to punctuate the observed episodic power exercises.

8.2.1 POWER EXERCISE

Building on Chapter 4, I define power as **the ability of an actor to reach some results that depend on the action of others** (Giddens 1976, Chazel 1983). I therefore adopt a notion of power as a relational, collusive and instrumental process. It recognizes that knowledge is produced inside a network formed by the partners and through their interactions. In this way, knowledge creation results from political processes but individuals are aware of it and have the capacity not to submit themselves to structures. This notion of power is in line with the goal of this chapter: to explore how collaborative practitioners can take opportunity of power exercise within the project to shape knowledge flows and make them a source of value for their organization.

The literature proposes only a few frameworks to analyze power exercise. One of the most promising frameworks from the Management literature was developed by Lawrence and his colleagues (2005) who distinguish between four forms of power exercise: influence, force, domination and discipline. Building on Crossan et al. (1999), they also propose that each mode is associated with one particular learning process: respectively interpretation, integration, institutionalization and intuition (see Table 25).

TABLE 25 FOUR FORMS OF POWER EXERCISE, ADAPTED FROM LAWRENCE ET AL. (2005)

Strategies for power exercise Modes of power	Manipulation of the costs and benefits associated to a given behavior	Effective restriction of behaviors
Episodic power	Influence <i>Interpretation</i>	Force <i>Integration</i>
Systemic power	Discipline <i>Institutionalization</i>	Domination <i>Intuition</i>

Those four forms are built on two main strategies: (1) the manipulation of perceived costs and benefits associated with different actions; and (2) the effective restriction of available behaviors that other actors can adopt. Lawrence and his colleagues then couple the above strategies with two modes of power: (1) episodic power and (2) systemic power. Episodic power refers to the observable conflicts of interest between identifiable social actors with opposing objectives in particular decision making situations (Clegg 1989, Reed 2006). By contrast, systemic power works through the routines and ongoing practices of a given social system (Lawrence et al. 2005). Both modes can be observed in a joint R&D project: episodic power through agenda setting during the plenary meetings, firing of employees or the negotiation for the amendment of the consortium agreement; systemic power through socialization of projects' members, the physical meeting places and shared equipment.

Two central difficulties are associated with this framework. First of all, Lawrence et al. (2005) distinguish between systemic and episodic power following the actual intervention of an empowered actor (see Table 26). Nevertheless, this distinction is not in line with the relational perspective adopted in this work and which implies that power becomes apparent when it is exercised between partners (see Chapter 4). From this perspective, systemic power becomes effect of power: the consequence of anterior power exercises such as the writing of the consortium agreement. From a structurationist perspective, systemic power thus represents the structures of domination as reproduced through power exercises.

TABLE 26 EPISODIC AND SYSTEMIC POWER

Modes of power	Definition in Lawrence et al. (2005)	Examples	Structurationist interpretation
Episodic power	Discrete, strategic political acts initiated by self-interested actors.	Agenda setting; writing of the consortium agreement; choice of partners and project's tasks.	Power as a relational, collusive and instrumental process that targets decision-making.
Systemic power	Works through the routine, ongoing practices of organization: rather than being held by autonomous actors, systemic forms of power are diffused throughout the social systems that constitute organizations.	Availability of material technologies; physical layouts; socialization and training opportunities.	Systemic power as an effect of power: the consequence of anterior power exercises (the writing of the consortium agreement for instance).

Indeed, even if I focus on episodic power and not on its systemic form, the Structuration Theory informs us that the modalities mobilized by the self-interested actors are drawn from the system and reflect its structural properties. The enrolment and underlying power exercise will therefore have an impact on the way the interpenetrating structures of the project are mobilized by the partners: rules that are questioned, embezzled, followed loyally or even overzealously. For those reasons, I focus on what Lawrence and his colleagues call episodic power as well as their potential systemic effects like for instance the access to a given machine or a training opportunity. This choice is coherent with our definition of power, the research question as well as the goal of this work: understand the leverages that collaborative actors can mobilize inside the joint R&D project.

Secondly, the distinction between force and influence proposed by Lawrence et al. (2005) leads to some difficulties in the collection of data and their analysis. Indeed, the underlying strategies can be easily mixed up: affecting costs and benefits of possible actions might lead to an ad hoc restriction of alternative behaviors; likewise, impeding an action by force could be seen as an extreme influence on its

costs (the potential exclusion of the project's member who does not comply). In order to face this second difficulty, I mobilize insights from Bourgeois and Nizet (1995) who conceptualize the strategies of power exercise in terms of legitimization and pressure (see Table 27).

TABLE 27 THE STRATEGIES OF POWER EXERCISE EXPLORED IN THIS WORK

Strategies for power exercise Modes of power	Manipulation of the legitimacy of a given behavior	Threat to restrict the set of behaviors
Episodic power	Legitimization	Pressure

Rather than effectively restrict potential behaviors – or in other words to resort to force – pressure refers to the *threat* to suppress or restrict the access to some resources and their associated possibilities of actions (Bourgeois & Nizet 1995). The use of a threat implies that the resulting solution is imposed on project's members who do not recognize its legitimacy. Legitimization, on the other side, works through the perceived correspondence between the social norms that are sanctioned by the enrolled partners (“B”) and the solution proposed by the actor who exercises power (“A”). In this way, legitimization influences the interpretation of the costs and benefits of a given behavior, sometimes with effective restrictions, but always by managing to present the solution as legitimate: so that the solution imposes itself as obvious rather than through menaces. The legitimization can be supported by the content of the decision, the process that lead to it as well as the status of an actor (Bourgeois & Nizet 1995).

In conclusion, I refer to pressure and legitimization when considering the strategies deployed by project's members through episodic power exercises. Three first methodological stakes ensue:

- The identification of actors involved in the episodic power event;

- The identification of relevant social norms and other modalities used to establish legitimacy;
- The punctuation of the observed episodes of power exercise, which I call “critical events”.

First, episodic power is exercised by members of the R&D project to stabilize cooperative relationships and to provide direction and meaning to their partners. For Latour, Callon and their colleagues (Latour 1987, Akrich et al. 1988), the alignment of interests between members is realized by a “**translator**” who is able to mobilize a network of relevant contributors towards the interest of one group. As a result, one stake of the observations is to identify those actors who are in charge of enrolling allies: the would-be translators who contribute to the debate during a given critical event. As the research question focuses on organizational value creation, I also looked for the translators who act at the same time as “**relay**” (Friedberg 1997): members of the project who are strongly linked to their parent organization, become the privileged intermediary between the project and the organization and eventually come to personify it. They might be the managers who represent organizational interests and enable access to organizational resources but researchers and other “ordinary” actors are also taken into consideration (Alter 2000).

Second, the translator mobilizes particular tools when resorting to pressure or legitimization. As a result, the second important stake of the analysis is to identify the modalities that are mobilized in the power relationship. For instance, Foucault (1982) proposed to look at “differentiation system” and “instrumental modalities” such as explicit and implicit rules as elements with analytical interests for the study of power exercise. Likewise, Friedberg (1997) argues that the main stake for the analysis of social systems is the identification of relevant rules as it directs our attention to the resources and constraints that are relevant for the actors. Informed by the Structuration Theory, I focus on the three dimensions of such modalities (see Chapter 4):

- The cognitive dimension which refers to the interpretive schemes (goals, roles, scripts) that enrich the joint R&D project (Hargadon & Fanelli 2002);
- The relational dimension which has regards with the social norms that are relevant for the project’s members and give direction for action;

- The structural dimension which concerns the links and configuration of the network of partners (Nahapiet & Ghoshal 1998) or, from the point of view of Giddens, the access to enabling and constraining resources of the project (Giddens 1984): facilities and frustrations.

Those modalities qualify and modify the “R&D problem” that is put into question (Latour 1987) and potentially guide the project in a new direction.

Thirdly, the focus on episodic power implies that a critical event is observed. In order to punctuate the flow of observations, therefore implementing a fined-grain bracketing strategy, I use the Exit-Voice-Loyalty-Neglect (EVLN) framework (Hirschman 1970, Rusbult et al. 1982, Bagozzi 1988) presented in the following sub-section.

8.2.2 PUNCTUATION OF THE CRITICAL EVENTS

THE E-V-L-N FRAMEWORK

Exit, loyalty and voice were originally proposed by Hirschman (1970) as the three main responses to organizational declines. Faced with dissatisfaction at work, employees can either:

- Choose Exit and leave the firm ;
- Choose Loyalty, remain loyal to the managerial team and hope for the best;
- Choose Voice: try to be heard by the board and negotiate some kinds of solutions.

A fourth responses, neglect or apathy, was developed afterward (Rusbult et al. 1982) to reflect the situations where the discontented individual distances himself from organizational interests without actually addressing the problem.

Exit, voice, loyalty and neglect are exclusive and structurally linked (Rusbult et al. 1982, Bagozzi 1988): they differ along dimensions of passivity versus activity and destructiveness versus constructiveness (see Table 28).

TABLE 28 EVLN FRAMEWORK

Destructiveness: Affect the enrolment	Activity: address the source of discontent		Constructiveness: Reinforce the enrolment
	Exit Reconfigured system	Voice Unstable system	
	Neglect Reconfigured system	Loyalty Stable system	
	Passivity: do not address the source of discontent		

Passivity versus activity refers to the impact of the response *on the source of discontent* (Rusbult et al. 1988). For instance, absenteeism or overzealous behaviors do not confront the source of dissatisfaction and therefore should be considered as a passive response (in this case neglect) even if they actually involve some kinds of actions. Likewise, loyalty implies that the employee continues to undertake his organizational tasks but this behavior does not act on the source of the problem. By contrast, exit and voice address the problem – in a very effective way through the exit strategy as the actor who leaves the project also leaves the source of discontent behind him. Another way to look at this axis is proposed by Bajoit (1988) who distinguishes responses that confront social control (activity) from responses that do not question it (passivity). In the case of joint R&D projects, this alternative conceptualization directs our attention on the fact that each member of the project is able to confront (or not) the work of the translator and thus the local arrangement that led to the alignment of interests.

Destructiveness versus constructiveness refers to the impact of the intended response *on the relationship* between the individual and the social system at hand. Voice and loyalty imply that the individual wants to preserve the collaborative link while exit

and neglect have a destructive impact on the relationship. Even if this conceptualization possesses both convergent and discriminant validity (Rusbult et al. 1988), it is not without ambiguities. For instance, the employee who decides to rely on neglect does not break the formal link between him and the firm and might even stay unnoticed. In a joint R&D project, more complex responses might appear like “neglect” from a researcher who decides to unobtrusively take distance from the project while remaining loyal to his research laboratory. In order to avoid such ambiguities, I built on Bajoit (1988) and (Latour 1987, Akrich et al. 1988) to rephrase the impact *on the relationship* as the impact *on the enrolment* of the dissatisfied members: the individual who resorts to exit or neglect decides to stop cooperating and disengages himself from collective interests.

FROM THE TRIGGERING DISSATISFACTION TO THE CLOSURE OF THE EVENT

This framework has been applied in various contexts: supplier-buyer relationships (Kingshott 2006), romantic involvements (Rusbult et al. 1982), location of R&D units (Narula 2002), choice of education system (Hirschman 1970), job dissatisfaction (Withey & Cooper 1989) and many others. In all cases, EVLN are responses to a social discontent: a state of dissatisfaction which results from social interactions (Bajoit 1988).

In this work, I focus on the social discontent that appears when the belief in the collective ability to produce the desired results is put into question, when a protagonist of the project has “*an increasing feeling that something has to be done differently*” (Holmqvist 2003). When a partner is dissatisfied with the conduct of the collaborative research, he can choose to “voice” and bring the source of discontent to the other partners. I consider that the disgruntled partner can express its concern about:

- The R&D problem tackled by the project;
- The identification of alternative ways to solve it;
- The selection of the appropriate path(s) within the project;
- The actual implementation of such exploration paths.

This distinction is brought in a discussion about the decision-making process proposed by Bourgeois and Nizet who build mainly on Hicksons, Mintzberg and

Heller (see Bourgeois & Nizet 1995 p. 127-140). Note that it does not mean that this work sees decision-making as a well-defined, well-planned activity. As expressed by Cohen and his colleagues (Cohen et al. 1972), decision-making in organized anarchies such as the R&D projects is sometimes better described as “*a garbage can into which various kinds of problems and solutions are dumped by participants as they are generated.*” (Cohen et al. 1972 p. 2). In such a view, solutions sometimes precede problems: they are “*answers looking actively for a question*” (Cohen et al. 1972 p. 3). As a matter of fact, the critical events as proposed in this work can be viewed as choice opportunities as defined by Cohen and his colleagues: they are occasions when the partners are expected to produce behavior that can be called a decision. Partners can take opportunities of the critical events to propose a solution that serves their interests and which was just waiting for the right moment to get out of the garbage can.

In this work, the goal is not to build a theory of action out of a theory of plans. Rather, adopting the expression of Suchman (2007), my aim is to “*investigate how people produce and find evidence for plans in the course of situated action*”, especially when power interactions are involved. Thereby, I decided to use the four stages proposed by Bourgeois and Nizet not as a decision-making process but rather as a tool to focus the attention of the researcher to the actual leeway that actors have to speak up. This conceptualization allows for the identification of the “playing fields” (Mintzberg 1983) that actors dare mobilize when triggering a critical event. For instance, an academic professor might openly criticize the R&D problem tackled by the project while a junior researcher might consider himself not competent enough to do so and might therefore prefer to discuss the way it is currently implemented.

This “**voice**” destabilizes the local arrangement and opens a negotiation space where any given actor can propose a solution and becomes a potential translator. In this work, I therefore look for those “voicers” who draw the attention of translators-to-be and might trigger an episodic power exercise. The critical event stays opened until one of the three remaining responses are used. If the power exercise leads to the **loyalty** of other members, the enrolment is successful and the system regains its stabilization. The solutions might not be the “best” or “most valuable” one (Lawrence et al. 2005), but it will be the solution which brings stability back to the

project. As expressed by Friedberg (1997), power can also be defined as the capacity of an actor to make others agree about imperfect solutions without being excluded from social interactions. In the case of **exit** and **neglect**, the power exercise also leads to a stabilized system through its reconfiguration: exiting and neglecting members disengage themselves from collective interests.

8.3 METHODS

8.3.1 RESEARCH STRATEGY: THE LONGITUDINAL CASE STUDY

Apart from rare exceptions like Easterby-Smith et al. (2008) or Lawrence (2005) and despite the growing recognition that researchers should focus on their intertwining for the understanding of learning processes (Ekbia & Kling 2003, Peci et al. 2009), knowledge and power are two concepts that are rarely combined in the field of knowledge management, organizational learning or even innovation studies. For Sargis-Roussel (2005), two reasons might explain this phenomenon: from a theoretical perspective, knowledge management has its roots in modeling and system theory, with few interest in power issues, and from an empirical perspective, power relationships and their effects are difficult to observe and were thus somewhat neglected by the research community. As a matter of fact, power relationships are difficult to grasp for an external researcher. In situ observations and access to the field are needed to witness the actual social interactions (Sargis-Roussel 2005) and subsequent power exercises. Therefore, the research strategy chosen to explore the research question “How does power exercise in the joint R&D project influence value creation for the parent organizations in term of knowledge transfer?” had to reflect this requirement

The research strategy adopted in this work is the longitudinal case study: findings are drawn from an in-depth case study, an R&D project followed since June 2007, which combines data collected through semi-structured interviews, documentation (especially the minutes of plenary meetings) as well as observations during plenary meetings and other events. This research strategy is coherent with the Structuration Theory that acts as a research paradigm for this work: combining semi-structured interviews with the observation of social interactions allows accessing both the discursive knowledge and practical consciousness of the knowledgeable actors (Giddens 1984).

It also takes into consideration the requirement for a longitudinal, diachronic study to explore the structuration process at stake in the project. It allows understanding how the partners gradually built shared interpretive schemes about the project and its objectives and how they agreed about the right ways to handle the experimentation process.

As an example, in Event 11, the definition of a hyper-hydrophilic sample is discussed. Partners shared their understanding of such a property and ways to measure it, gradually constructing their shared meaning of a “hyper-hydrophilic” sample and more generally their shared meaning of a “sample that works”. A few months later, in Event 16, a “crisis” is acknowledged by the partners because of their inability to reproduce such “samples that work”. The defusing of the crisis a few weeks later had a twofold impact:

- It reinforced the interpretive schemes that were discussed earlier;
- It put the experimentation process used to defuse the crisis as the “right” one, the one that managed to get results.

Those discussions happened during the first year of the collaborative research and were therefore missed by one researcher who joined the project in 2009. As a result, the newly-hired researchers had not internalized the shared understanding about “a sample that works” and was working with procedures that confronted the “right ways” of working in the project. As a result, the partners did not fully appreciate the interest of his ideas which, at first, were dismissed from the project. Only a longitudinal approach allows witnessing the resistance of partners to his innovative solution and, more importantly, allows grasping the origin of such a resistance.

From an empirical point of view, long-term exposure in the case and the multiple sources of data allowed for an access to off-record issues, like the disengagement of a partner who deploys a neglect strategy that was not directly observable during the plenary meetings. It also permits a better identification of taboos and contradictions in the discourse of actors. Such a deep access to the field is an essential tool to draw an accurate picture of “competing and opposing loyalties” (Grabher & Ibert 2006), as well as their evolution.

8.3.2 UNIT OF OBSERVATION: THE CRITICAL EVENT

To study the impact of power exercise within this project, I decided to focus on the critical event – or decision-point – as the main unit of observation (Levinson 1985, Leonard-Barton 1990) within the case. I define the critical event as an observable incident which starts when an actor of the project makes himself heard through a “voice” attitude and finishes as the partners adopt a solution that stabilizes the local arrangement; it acts as a trigger for the knowledge creation process (Zahra & George 2002) as it identifies potential problems and activates negotiations about an acceptable solution. As such, it is an interesting unit of observation for the exploration of power exercises (Bourgeois & Nizet 1995) for knowledge creation and exchange.

More precisely, the observation and analysis of critical events were guided by three main analytical components (see Figure 23): (1) the opening of the critical event; (2) the translation; (3) the stabilization or closure of the critical event.

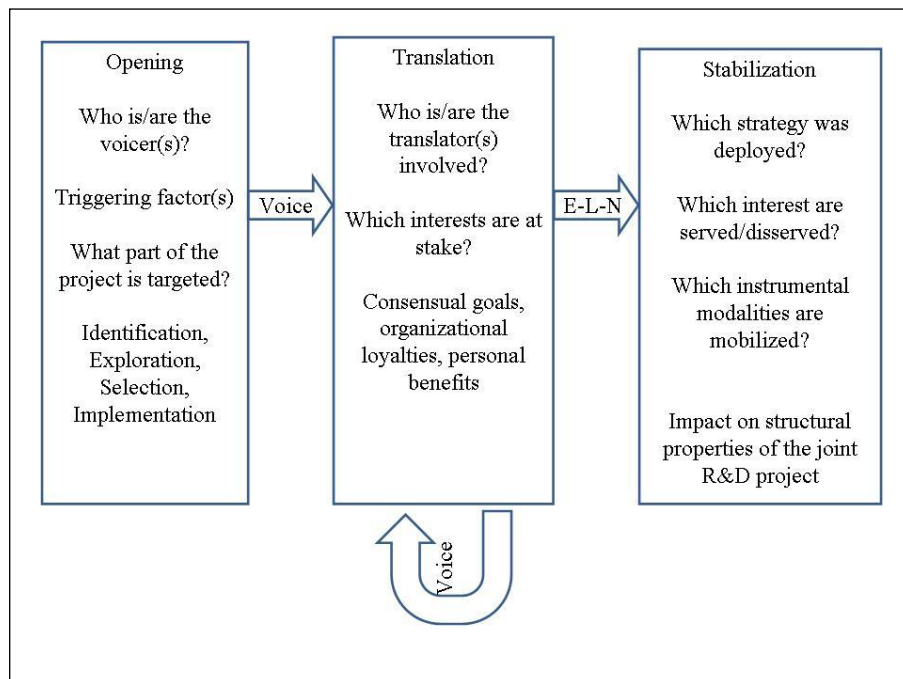


FIGURE 23 CONCEPTUAL FRAMEWORK

The analysis starts with the **opening** of a critical event. This component focuses on the triggering forces: the identification of the voicer (function in the project, hierarchical position, background, etc.), the factors that facilitated his or her intervention and the phase(s) of the R&D project which is targeted. The object of discussion can be:

- The R&D problem itself (“is this problem still worthy to be pursued?”);
- The panel of possible ways to solve it (“maybe there are other alternative paths!”);
- The choice of paths that will be pursued by the partners (“isn’t this new path worthy to be pursued?”);
- Their actual implementations (“is this the right way of pursuing the path?”).

The opening of the critical event where the “*old way of acting is challenged and claimed to be obsolete*” (Holmqvist 2003) has been conceptualized by Holmqvist as the learning process of “opening up”, when partners shift “*from an ongoing process of exploitation to an ongoing process of exploration*”. This event comes from an increasing feeling that something has to be done differently and is therefore followed by the need to experiment and the search for a solution, the elaboration of new goals and strategies. As a result, the intervention of the voicer opens a negotiation space in which each partner can propose a solution and activates a power relationship.

The second component, **translation**, therefore includes the identification of the translator(s)-to-be as well as the interests underlying his or her solution. Indeed, this power exercise involves actors with diverging interests who compete to shape the possible conducts and outcomes of the project (Foucault 1982, Mintzberg 1983). As a result, interests influenced by the consensual goals of the project, organizational loyalty and individual benefits (Grabher & Ibert 2006) should be taken into consideration when analyzing power relationships (Foucault 1982, Friedberg 1997, Blankenburg 1998). Guided by the research question of this study, I also paid a particular attention to translators-to-be who are at the same time relays of their organization (Friedberg 1997).

The third component focuses on the **closure** of the critical event through Exit, Loyalty or Neglect, leading back to a stable system: this last step is conducted if the enrolment is successful (Loyalty) or unsuccessful with a closure of the negotiation space (Neglect or Exit). For Holmqvist, this stabilization leads to the “*selection and modification by a dominant group (Nelson and Winter 1982; Mintzberg 1983), where one group gains the opportunity to consciously control the learning process. Thus, from the power struggle emerges a winner that, based on its authority, steers the learning into exploitation*” (Holmqvist 2003 p. 110). As a result, the analysis draws a particular attention to the interests that are served (and disserved) by such an arrangement, the strategy deployed (pressure or legitimization) as well as the modalities that were mobilized by the actors to impose their solution. Informed by the Structuration Theory, those modalities are drawn from the interpenetrating structures that are relevant for the project.

Such modalities can be inferred by the social researcher through their superficial manifestations (Nizet 2007):

- Interpretive schemes (goals, roles and scripts) evoked in the project ;
- The social norms sanctioned in action ;
- The links and configuration of the network of partners.

But the Structuration Theory also orients the analysis towards the dual process at stake in the closure of critical events: if social structures are the medium of interactions between partners, such structures are at the same time constituted by human agency. In other words, social structures are challenged, reinforced or modified by the project’s interactions through the re-alignment of the norms, goals, roles and scripts that are relevant in the project. The closure of critical events also affects the configuration of the project: the network of “partners”, the relevant Know-Who at stake in the project. As such, impacts on the links between partners (i.e. loss of competences or lack of cooperation leading to unexplored paths) as well as on the other relevant modalities (dismissal of previously relevant schemes, reinforcement of existing scripts) were investigated.

The study of the structuration process at stake in the joint R&D project was supported by a strategy of fined-grain bracketing (Pozzebon & Pinsonneault 2005) as deployed through the punctuation of critical events. Thirty-five critical events were observed, documented and analyzed. They were witnessed through the observation in real-life settings or remembered by respondents, allowing a focus on behaviors rather than impressions (Hargadon & Fanelli 2002). Its effects were traced through the minutes of the meetings, especially through the “further actions” section, as well as during subsequent interactions. Especially, the comparison between the observation of meetings and their associated minutes was very insightful.

A thematic analysis was performed on the interviews with the qualitative data analysis software Weft QDA in order to highlight organizational, inter-organizational and personal interests, R&D tasks, perceived roles and other relevant interpretive schemes. Then, chains of evidence (Yin 1981,1994) related to each critical event were constructed through analysis tables (see Table 29) in order to link constructs with extracts from interviews, observations, minutes, and so on. Such chains of evidence allow for a better comparison of events and conclusion drawing. It also helps managing the iterative process of explanation building as the researcher goes back and forth from new empirical evidence to theoretical explanations (Decrop 1999, Pettigrew & Fenton 2000). After a first analytical effort based on the chains of evidence, a monograph was constructed in order to tell the story of the project, enriched with a narrative thick description of each critical event. Extracts of this monograph are used in the findings section.

TABLE 29 CHAIN OF EVIDENCE RELATED TO A GIVEN CRITICAL EVENT

Event X – Description (LIST OF DATA SOURCES)					
Voice					
Who	Triggering factors	Target	Interests at stake		Comments
Translation					
Who	Relay?	Interests at stake	Interpretive scheme		Comments
Stabilization: closure of the event					
Who	Strategy and responses	Interest served/disserved	Modalities	Impact	Comments

8.4 FINDINGS

In the previous chapter, I show that shared interpretive schemes about the nature of the project have an influence on the expected roles of partners and on the subsequent knowledge flows. In this section, I focus on how collaborative practitioners can take opportunity of power exercise within the project to shape such flows and make them a source of value for their organization. The result section is organized as follows. First, I present an overview of the critical events that I observed in Axis-1. More precisely, I trace the history of the project through the prism of the critical events, from the first crisis of the project to its rebuilding after the Helicopter View of 2008. I also identify important issues that were not discussed openly, thereby shedding some lights on the taboos of the project. Second, I focus on the meaning of “value creation” that emerged from such interactions. I look for the way actors see their contributions to the objectives of the project, to organizational goals as well as to their individual interests. The meaning of “value creation” being shaped by the interactions inside the project, I also emphasize its evolution from the beginning of the collaboration up to its end. Finally, I present the leverages that actors can mobilize during critical events to make sure that the created knowledge is a source of value for their parent organization. I distinguish between three types of leverages:

- From a structural perspective: leverages that have an influence on the configuration of the project ;
- From a cognitive perspective: leverages that have an influence on the definition of the project and other important interpretive schemes;
- From a relational perspective: leverages that have an influence on the norms that are guiding the way the collaborative research is handled.

Note that even if the leverages are presented from three different perspectives, they are highly intertwined. As showed in Chapter 4, a modality such as the shared meaning about “the boundaries of the collaborative research” has an obvious semantic function (to make sense of the context), a syntactic function (to give direction to actions) and a political function (to determine the access to resources). The presentation of findings therefore takes their interconnections into consideration.

8.4.1 OVERVIEW OF THE CRITICAL EVENTS

HISTORY OF THE PROJECT

The plenary meetings acted as a “collective confessional” (Notes_27.01.09) where partners shared constraints, results, frustrations and progresses. When a partner faced a source of dissatisfaction, he had the opportunity to bring it on the table, potentially triggering a critical event. The source of dissatisfaction was discussed and a solution was proposed. Sometimes, the dissatisfaction was triggered by an operational problem, such as the breakdown of a piece of equipment (Notes_10.09.09) or the choice between two exploration paths (Event 8 - PV_131107; IND9). Other times, the matter was more delicate.

For instance, one of the first events that I witnessed was about the level of sharing in the project (Event 2 - Notes_050707, PV_050707, IND9). In this event, one of the senior managers of LAB1 triggered the discussion about “the need to agree about the content” that would be shared by the partners. Indeed, LAB1 was mainly interested in the development of its LAB1_PVD technology and seemed reluctant to share data about this new technology. A discussion followed about an acceptable solution.

At first, the senior manager from LAB1 proposed to “transfer the know-how only when it is necessary, with the necessary person. The coordinators receive the data and diffuse it only when it is necessary”. The reaction of the partners was not very enthusiastic. In response, one of the project managers insisted on the fact that each partner needed “to feel the collaboration” and to contribute to an atmosphere of trust. An academic professor also took the opportunity of this event to remind that “the goal of a laboratory is the reflection about two results; otherwise, there is no need to come fetch us”.

When closing the event, the project managers tried to restore the confidence of LAB1 about the level of confidentiality that would be maintained on the project while making sure that each partner had the right level of information to do their job. They also came back on the need to create a “real collaboration”.

As a result, the minute of the meeting states that:

The lab will only disclose information that it deems necessary for the proper conduct of the project in accordance with the Convention (including information required for a “smart” characterization of samples). This information will be discussed during meetings.

LAB2 monitors samples for all the labs via a table showing all relevant and non-confidential parameters.

As the discussion came to an end, one partner jokingly said that “the project had experienced its first crisis”. In response, LAB1 showed its loyalty to the decision made by the project managers by stating that “it was more a question of clarity, not an issue”. However, this incident also created a negative feeling towards LAB1. **By insisting on the need to develop a real collaboration, the project managers outlined the “right” behavior inside the project** and, consequently, pointed out the “bad” behavior of LAB1. This phenomenon was illustrated a few months later as I asked one researcher about the “negative facet” of the project:

(...) What is unclear, however, is LAB1. For now, this is the downside of the project. They promise us something, with a technique they don’t want to talk about because it is patented etc. As a result, we are working on trust, and the problem is ... – if it works, good for them – but now we don’t know. Here, it is a question of trust.

Now the problem is that **this trust is disappearing a little because during the first meeting there is the boss who said “we cannot share anything unless it works and unless it is absolutely necessary”** and they might be paid or what not. **Which is not really the goal of the project.**

[REDACTED]

This event illustrates the role of critical events in defining the relevant interpretive schemes as well as the norms of the project. In this case, the project was defined as a real collaboration where partners should trust each other. Another important event in this matter was Event 16 which took place during a plenary meeting in March 2008,

nearly one year after the official beginning of the project but only a few months after the hiring of most front-line researchers.

At that time, the partners were stuck because of their inability to reproduce the preliminary samples. The beginning of this meeting was thus dedicated to a discussion about the need to “find something that works”. The presentations that followed elaborated on the same issue: the inability of the partners to reach something that works, to reproduce the preliminary samples or even get a photocatalytic sample. At that point, one manager declared that the project was undergoing a crisis and that the priority was now to “get off the hook”:

We need to fix our objectives; we need to fall back on our feet: to reproduce the preliminary findings, **to find back the anatase** sample rather than diffuse the efforts between PVD and LAB1_PVD.

This focus on preliminary results led the partners in a direction where the priority was to find something anatase “**even if the path is not realist from an industrial point of view**” (PV_18.03.08). Two important rules emerged from this interaction:

- The objective of the project as a quest for anatase surfaces on the basis that anatase (a crystallized form of TiO₂) promotes the self-cleaning property;
- The way to reach such a goal through the technical development of an anatase deposition with thick layer, followed by an effort to decrease its thickness (PV_03.12.08; PV_21.05.08) and, by doing so, to converge to industrial specifications.

While such interpretive schemes emerged from the interactions at hand in the SC subpart of Axis-1, it affected the “more exploratory” subparts, namely what has been called in Chapter 7 Peri_LAB4, Peri_LAB5 and Peri_thesis. Indeed, as the researcher from LAB4 presented his exploratory research, the reaction was in the same line: “they are parallel tracks, it is interesting, but we are still in a crisis situation”. During this meeting, the thesis undertaken by the junior researcher from LAB3 was also targeted. The partners recognized the need to redefine the role of the junior researcher and of her thesis subject in collaboration with MNC2:

The focus of the thesis, an optimal characterization for anti-bacterial deposition, fits perfectly in the framework of MEGAPROJECT, but it is

important not to be vague, we need to specify the characterization to do, to fix the priority (Notes_18.03.08).

The difference between the current state of the project and what was actually planned, as well as the approaching steering committee where the project managers had to report the progress of the project, also triggered an intervention of the project managers at the end of the meeting:

In our feedback to the steering committee, we need to include simple indicators under the form of a smiley (☺) with the appropriate color: green if everything is fine, orange if there is a problem that should be overcome quickly, red if the problem is critical. Until now, we've always been in the green area, but now we have to report an orange smiley which in this case indicates a technological problem (Notes_18.03.08).

The recognition of a crisis, followed by the focus on the quest for an anatase sample, triggered a strong emotional reaction when, a few days later, the researchers finally “got something anatase”. During the interviews that happened three months later, when asked about a day where they really had the impression to have made a leap in the project, the front-line researchers spontaneously evoked the same day, when they finally “saw something anatase”. As expressed by the front-line researcher from LAB2: “when we got out of SME1 (*the location of the March 2008 plenary meeting*), we were in a bad shape, but then a few days later, everything became clearer”. Or as expressed by another researcher: “we see something anatase, let's party!”

Event 16 was followed by a series of bonding opportunities where the industrial partners met with the academic partners lab by lab in order to think about the direction of the project. At the beginning of the next meeting (Notes_21.04.08), one of the project managers explained what happened during the past month, more particularly the decision that had been made with LAB2 during one of those bonding opportunities: LAB2 had proposed two paths that “seemed sound”, on the basis of “what the industrials like” in order to “favor the photocatalytic effect”. During the plenary meeting, the project manager explained that both paths would be developed, “keeping in mind the large scale perspective”. The choice was legitimated by the literature and the work of (undisclosed name), a former researcher from LAB3 who had participated to the development of the easy-cleaning product of MNC2. While

keeping two paths opened, this decision also closed one path that was not in adequacy with the industrial constraints.

At the same time as defining the quest of the project (to find something anatase), Event 16 also had an impact on the way the researchers defined their contribution in the project, namely to produce anatase samples and to provide evidence of their crystallinity. But the events also allow having a glance at their individual interest.

In Event 19 (PV_21.05.08; Notes_07.07.08; ACA6) for instance, the first anatase and photocatalytic samples are discussed by the partners. One of the tests used to assess the photocatalytic property, called the PHT test by the partners, is based on the photochemical degradation of palmatic acid (a fat substance) on the surface: if the fat substance is reduced after UV exposition, then the assessed sample has a self-cleaning, photocatalytic surface. This test is performed at LAB3 by a front-line researcher who, at the beginning, was hired as a high level technician but not as a PhD student. During the discussion about the PHT test, a concern appeared: “the fitting of findings based on the cinetic of the degradation” (PV_21.05.08). In other words, partners took opportunity of the meeting to wonder if they could develop a quantitative ranking of samples on the basis of the speed of degradation instead of the “OK/Not OK” test that is currently performed. The discussion identifies two difficulties concerning the PHT test:

- The front-line researcher needs to make sure that the test actually measures a photocatalytic effect. Indeed, the minutes of the meeting show an intervention of LAB5 discussing the resemblance between a dry palmatic acid and the profile of the dewetting of a film, thereby casting doubt on the validity of the test.
- Even if the test validity is confirmed, the front-line researcher still needs to develop a way to control the thickness of the palmatic acid and to measure its degradation in reliable ways.

In order to address those difficulties, the minutes of the meeting propose two future actions: first, a meeting is organized between LAB3 and LAB5 in order to discuss what is being measured and second, the project managers asked LAB3 to present an

assessment of the quantitative method (is it feasible, interesting from a fundamental point of view, what is the time line for such a development, etc.)

The minutes of the following meeting (PV_07.07.08) confirms that the meeting between LAB5 and LAB3 took place and that the film of palmitic acid “dewets”, inducing a capillary effect in addition with the targeted photocatalytic effect, maybe due to the roughness of the surface. This subject was discussed at the very beginning of the meeting, when the researcher took the stance and brought the subject on the table. As the discussion deviates from the Ok/Not OK test and evokes the possibility of developing a quantitative measurement, one of the project managers suddenly intervenes, calling the quest for a quantitative analysis as “utopic”.

Nevertheless, the researcher had at heart the development of the quantitative method. This thirst for exploration was seen as a trait of character which was shared by “real” researchers, the ones who wanted to learn something new. As expressed by another front-line researcher:

(Undisclosed name) had fun going further than just stupidly do the measures. (...) when I got his measures, it went along with a little explanation: “if you want we can discuss it, just call me” and then I would call and say “This result is strange” and we could talk about it. But now, with (undisclosed name), he sends the results, I get them, but I am kindly requested to do the graphics myself.

In fact, this researcher was looking forward to becoming a PhD student. At one time, I asked him if he was interested by a thesis. His response is the following:

Respondent: I am going to say that, if someone makes me an offer – I would need to think about it, it’s clear – but if someone makes me an offer, that, **that could be very very interesting**. The PhD students of the lab gave me some pieces of advice: “you do your short-term contract, you get yourself know, and after that you can discuss it”. But this piece of advice was given by PhD students who have been here for four years, who are known, while I just came here, I am not known. But if someone makes me an offer, it could be...

Julie: And, in your opinion, who might make you this offer?

Respondent: I am going to say that it depends on who appreciates my work.

Unfortunately for him, the development of the quantitative method was finally dismissed from the framework of the project. The decision was made during the

Helicopter View of 2008 based on the need to focus on what was really important for the project: the “reactivity” of the team concerning the characterization needs was more important than the “fundamental interest” of developing a new quantitative method (see Figure 24).

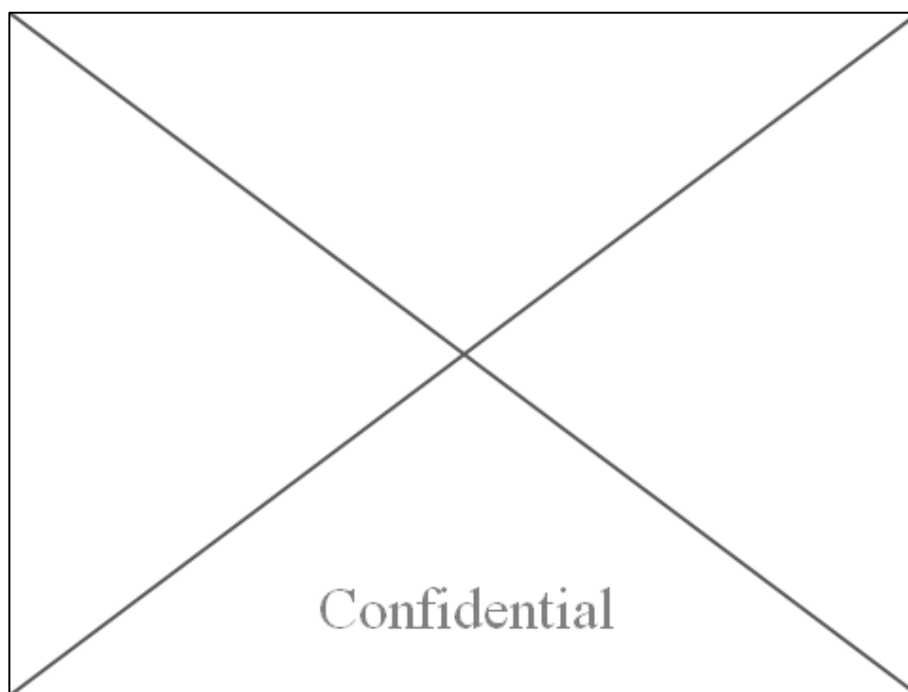


FIGURE 24 EXTRACT (1) OF THE POSTERS MADE DURING THE HELICOPTER VIEW 08

As a matter of fact, the Helicopter View of 2008 was a central event in the project. It got back on most of the issues tackled in critical events since the beginning of the project and settled those issues with interpretive schemes that would prevail during the rest of the project. Adopting the vocabulary of the Actor-Network Theory (Latour 1987, Akrich et al. 1988), the Helicopter View can be seen as an obligatory passage point (Callon 1986) as the project managers defined the interests of other actors in the framework of the project and render them consistent with their own organizational interests, in other words “to quickly find a product that works”.

Another evidence of its importance was the fact that the Helicopter View crystallized the “pivot point” from exploitation to exploration presented in Chapter 7 (see Figure 25). As explained in Chapter 7, the iteration took more than one year:

- A crisis was explicitly acknowledged in March 2008 (Event 16 - Notes_18.03.08);
- The redefinition of the project was discussed in depth six months later during the Helicopter View;
- The redefinition of the project was formally submitted to the Steering Committee in March 2009 (CoPil_25.03.09; Notes_01.04.09);
- The negotiated changes in Axis-1 were formally written down in an amendment of the consortium agreement in October 2009.

Nevertheless, it was the Helicopter View which, in the opinion of the respondents, really represented the pivot: the dismissing of the new PHT method, the closure of the LAB1_PVD path and the realization that the SC and AB products would require more exploration than what was originally thought.

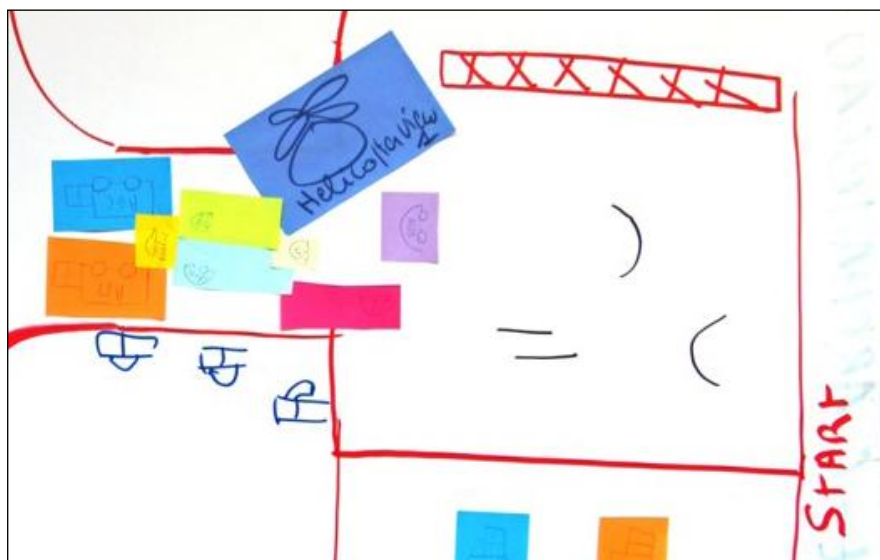


FIGURE 25 EXTRACT OF POSTER3

The Helicopter View was a team-building event for all the employees who were working on MEGAPROJECT, the helicopter view symbolizing the overall view on all the Axes and subprojects. The day was divided into two parts. The first part of

the day was a discussion on “what went well and what went wrong” during the past year of collaboration. The discussion was undergone by collaborative research: the people who usually meet during plenary meetings. The second part of the day was an entertaining “treasure hunt” by groups formed at random with people from the whole MEGAPROJECT. The small groups had to pass multiple ordeals such as crossing a rope bridge, karting, archery, the construction of a raft to find a clue which was floating in the middle of a pool, etc.

The event started as the project managers welcomed the partners around the table and explained the goal of the discussion: to learn from the past year in order to draw conclusions and to improve the collaboration for the coming year. The discussion was presented as an opportunity for consensus reaching: everybody was encouraged to intervene, and the project managers often stopped the discussion to ask if everybody agreed on what was being decided. The minutes of the plenary meeting that took place the day after the Helicopter View therefore states that:

During the Helicopter View day, the objectives about product development were readjusted in function of the technical difficulties at hand and in function of the available time before the end of the two projects of Axis-1 (...) **the various partners share the objectives which were corrected in a realistic manner and commit themselves to do everything in their power to reach those objectives** before the deadline (PV_11.09.08).

As the project managers looked over the main issues of the project, they insisted that they wanted to keep the objective of realization in the industrial environment. As written in the same minutes, “the development should be compatible with an industrialization of the product within two or three years” (PV_11.09.08). At the same time, they recognized the need for more exploration for the development of self-cleaning and antibacterial products, for instance the need to develop characterization methods that would allow for the connection between the characteristics of the sample and their antibacterial properties. In fact, the project managers took opportunity of it to propose a new action plan with narrower targets but with a deeper exploration, thereby qualifying the project as an explorative research (see previous chapter).

While everybody was free to intervene and to propose an exploration path, the project managers nevertheless brought two main criteria that the partners mobilized to assess the relevance of the proposed paths: the future research activities should be

“realistic” and “interesting for the project”. In the case of the PHT method for instance, the “utopist” quest for a quantitative analysis was dismissed in order to favor the reactivity of the lab using the “Ok/Not OK” PHT test.

Two important stakes ensue. First, behind the criteria of “realistic” and “interesting for the project” lies a definition of a legitimate activity: a legitimate research activity in Axis-1 should contribute to the industrialization objectives of AB and SC; all explorative efforts that are not focus on AB and SC lose their legitimacy, if they had any. The impact of this refocus went well beyond the dismissing of sidetracks such as the quantitative PHT test: it affected the legitimacy of the peripheral activities as described in the consortium agreement (Peri_LAB4; Peri_LAB5 and Peri_Thesis). For instance, LAB5 was put in charge of “the development of composites TiO₂-SiO₂ first with sol-gel methods (**short time!**) for a rapid transfer to plasma technologies” (PV_11.09.08). In other words, LAB5 had only a few weeks to “play” with the sol-gel methods before refocusing on SC and its realization objectives. Concerning the thesis, the PhD student was oriented towards the AB subpart for exploration purposes, with most of her SC characterization tasks now realized by the high level technician who wanted to develop the quantitative PHT method.

Second, the criteria tackled the unsatisfactory speed of the experimentation process in terms of reactivity in the labs doing the characterization and in terms of lack of surface production in the labs producing the samples. As explained by a respondent a few weeks earlier when speaking about the level of interaction in the project:

Now, about the work strictly speaking, as you know the project is on stand-by, well, ... not really on stand-by but we lack surfaces and therefore the research is a little stagnant (IND22).

Indeed, the “lack of surfaces” is discussed multiple times during the Helicopter View, especially with LAB1 who justifies their lagging behind with multiple equipment failures, both for the production of SC samples and AB samples. As a result, LAB1 committed itself to a new planning of sample production. The discussion continued the day after the Helicopter View. This time, the plenary meeting was followed by a “strategic meeting” where the front-line researchers (including me) were not invited. As I asked what was on the agenda of this strategic meeting, another front-line researcher told me that it was about the delay in the project, for instance concerning the production of samples, but that he was not really

worry about it because the meeting was mainly targeting LAB1 who, for him, could not justify their delays in a credible way. The meeting was thus seen “as a way of having a good rant” from one point of view and as a “nice meeting to ask people to work a little harder” from the other point of view.

But LAB1 was on the grill for another reason: beyond the lack of sample production, the whole development of the LAB1_PVD technique was called into question into the framework of MEGAPROJECT. During the Helicopter View, professors from LAB1 confirmed that they thought about the LAB1_PVD technique as the “path of the future” (see Figure 26) but the industrials questioned the ability of the technique to reach industrial constraints, especially concerning the speed of deposition. New short term objectives were thus set during the Helicopter View as conditions to continue the exploration of the LAB1_PVD technology as a “realistic path”: from a process point of view, the success of the preindustrial test on the pilot line of MNC2 was required and from a product point of view, a clear proof-of-concept at the level of the lab needed to be developed for December at the last (Notes_10.09.08).

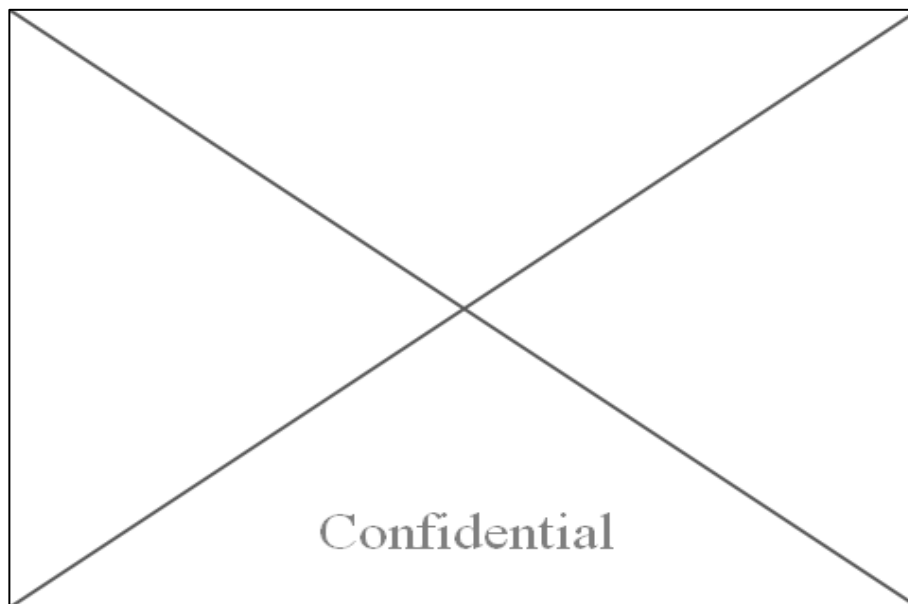


FIGURE 26 EXTRACT (2) OF THE POSTERS MADE DURING THE HELICOPTER VIEW 08

The dismissing of the LAB1_PVD path is an important issue in the project. Indeed, LAB1 benefitted from an important subsidy to develop an LAB1_PVD prototype on

the pilot line in the framework of Axis-1 and Axis-4. As the LAB1_PVD development is questioned, it opens a discussion about the use of the remaining money: the money had to be reallocated inside MEGAPROJECT but LAB1 was not ready to let it go. Both sides had leeway: LAB1 was in charge of the money but, thanks to the “Marshall Plan philosophy”, the industrials were in charge of the definition of the legitimate activities.

December 2008 was thus an important deadline for LAB1: the LAB1_PVD technique was on the line, depending on the success of the pre-industrial testing on the pilot line. During the December 2008 plenary meeting, the project manager from MNC2 triggered the discussion about on-going progress and asked LAB1 “what should be expected on the pilot line from a technological point of view” (Notes_03.12.08). While the front-line researcher argued that they were still optimizing the process, it seemed that the industrials were not very optimistic. In particular, the project managers questioned the speed of the pilot line and asked the front-line researcher for potential paths in order to enhance the process. At that moment, one of the academic professors intervened, saying (Notes_03.12.08):

What the industrials are trying to say is that it is not paying off.

Indeed, the future of the LAB1_PVD was quite dark. In the minutes of the meeting (PV_03.12.08), it is noted that:

For now, we could not find evidence of a contribution of the LAB1_PVD technique to the self-cleaning properties of TiO₂ layers on steel, inox, pre-painted or glass, neither at the laboratory scale nor at the scale of the industrial pilot line in Ramet

A cross-project meeting between Axis-1 and Axis-4 was therefore scheduled in January 2009 in order to discuss the industrial feasibility of the technology and the potential reaching of industrial requirement, “or we stop, we all agree on that?” as asked by a project manager (Notes_27.01.09).

In March, LAB1 had managed to enhance the deposition speed “by a factor of 3” (PV_06.03.09) but it still failed to reach the industrial requirement (CPil_25.03.09). The decision to finally dismiss the LAB1_PVD technique was therefore taken during the steering committee of March 2009, when it was decided to refocus the workforce of LAB1 into the AB subpart of Axis-1. In other words, LAB1 secured

the money that was originally dedicated to the LAB1_PVD development, refusing the reallocation of resources outside its organization. LAB1 kept the money but used it “to boost the efforts” in the AB subpart of Axis-1. The legitimacy of the decision builds on a “technical reason”: to resolve the technical blocking points that were acknowledged by the partners like for instance the development of a barrier layer to moderate the diffusion of silver.

Note that the decision taken in March 2009, based on the threats highlighted in September 2008, would only be materialized in an amendment of the research consortium in October 2009.

In parallel with the decision to stop the LAB1_PVD technology in the framework of MEGAPROJECT, it was also decided to rebuild Axis-1. At the beginning of the plenary meeting of January 2009, the project managers proposed three points of discussion (Notes_27.01.09; PV_27.01.09):

- A potential extension of the project (AB and SC as a whole);
- The “realistic” length of such an extension;
- The new priority (targeted product) in the project.

Because such changes should be decided consensually inside the collaborative research, the project managers presented a summary of the project and “called for everyone to speak up during their presentation to share their feeling”. The minutes of the meeting also noted that “the projects managers will prepare a proposition of objectives/planning that takes into consideration the results of the meeting” (PV_27.01.09). Concerning the objectives, one of the project managers highlighted that “for now the research in Axis-1 did not allow exceeding what currently exists” and therefore “did not allow reaching the objectives of MEGAPROJECT” but she also recognized that competences and comprehension were being developed: doors were being closed. As expressed a few months later during an interview (IND8):

I think that we realize that we are back..., well, we are on an exploratory project because, at the level of the university, the project mostly consists in closing paths.

In the next plenary meeting in April 2009, just before the steering committee that would formalize the changes, the new objectives of Axis-1 are presented and the

extension of the project is expressed as “an additional year to push something out” (Notes_01.04.09).

As exemplified during the Helicopter View, the rebuilding of the project affected AB and SC as well as the peripheral projects such as Peri_LAB4 and Peri_LAB5. I will now focus on the redefinition of the role of LAB5 in the project and the legitimacy of its research activities.

The role of LAB5 was first questioned in the early beginning of the project in July 2007. Indeed, the last point of order on the agenda was the organization of the 1.1.8 section in the planning of Axis-1(Projet_MEGAPROJECT):

The study and comprehension of the mechanisms at the origin of the self-cleaning property and of the surface contamination in order to optimize the deposition.

In other terms, it was the organization of Peri_LAB5 and its connection to the main SC part. The competitive advantage of LAB5 and its main contribution to Axis-1 was linked to its understanding of the “wetting” phenomenon, the ability of a liquid to maintain contact with a solid surface. In direct connection with Axis-1 and more particularly SC, the researchers from LAB5 were asked to measure the wetting capability of some screened samples through a dynamic approach as well as to interpret results when discussing the next batches.

The wetting angle – or contact angle – is the angle formed by a liquid droplet, in this case water, with the surface under study. The smaller the angle, the better the wetting property: a droplet with an obtuse contact angle is a droplet that “beads” on the surface (see Figure 27 a) ; a droplet with a wetting angle of less than 90° on the contrary means that the droplet spreads over the surface, thereby draining away impurities (see Figure 27 b). Technically, the curve formed by the upper surface of the droplet is also called the liquid “meniscus”. This meniscus is produced in response to the surface of the sample: a hydrophilic surface will trigger a plane meniscus (de Ruijter et al. 1997).

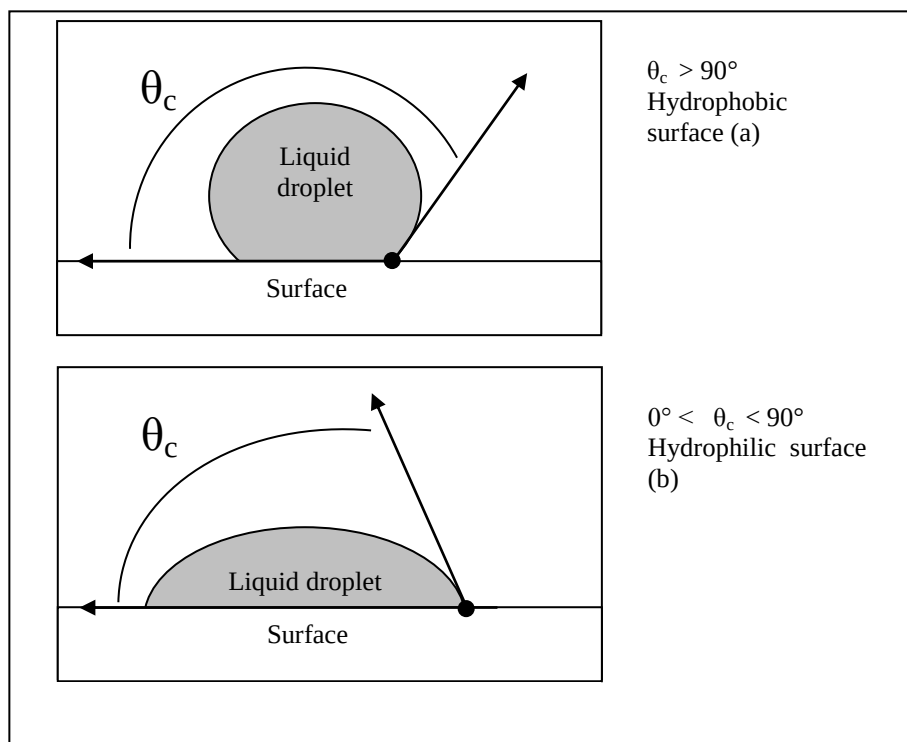


FIGURE 27 WETTING ANGLES ON HYDROPHOBIC AND HYDROPHILIC SURFACES

Event 5 (Note_050707; PV050707; IND8) was triggered by the head of LAB5 concerning the connection to Axis-1 and more precisely the procedures requested for the analysis of the wetting capability. Indeed, they needed to define a strict protocol (measurements can be realized after contamination of the surface, after an UV exposition of a given time with a given type of lamp, etc.) and to know the intrinsic characteristic of the sample in order to be efficient. Another stake of this event was the choice of the measurement technique: a statistic measurement that can be done automatically by a machine, or a dynamic approach through a time-consuming manual procedure. Indeed, the dynamic procedure studies the changes in the liquid meniscus when a force is applied to the droplet. For instance, the curve can be forced to move by plunging a rod into the droplet (de Ruijter et al. 1997). This procedure thus required the manual plunging of the rod and the careful documentation of the time-dependent meniscus.

Through the stabilization of the event, it was decided to send five referential samples to LAB5 in order to define the best procedure for a dynamic measurement. While it

was not very clear from the observation of the plenary meeting if the stabilization was indeed realized, the minutes of the meeting materialized this decision as well as the role of LAB5 for the measure of dynamic wetting in the framework of the project, the static measurement being made in-house by the industrial partners. **But in exchange for the arduous manual work that was requested by the dynamic approach, the minutes also recognize the essence of Peri_LAB5: the development of composite surfaces through sol-gel processing.**

This event presents the dual role of LAB5 in Axis-1:

- Characterizer and expert in the wetting phenomenon in SC;
- Producer of sol-gel composites for Peri_LAB5.

Two important observations follow. First, the production of sol-gel samples is presented to the partners of Axis-1 as a “compromise” while, for the researchers from LAB5, this activity was of central importance. It was well-acknowledged in the consortium agreement and it guided the hiring of researchers on Axis-1. As expressed by a respondent from LAB5:

In Axis-1, we had to do the synthesis of sol-gel, and it was perfect because I had seen it a little during my studies. This is the reason why I also work on Axis-1.

Second, the prospective nature of Peri_LAB5 and its objectives was ignored, thereby overlooking the hybridization of Axis-1 (see Chapter 7).

The refocus of Axis-1 on the activities that were “realistic” and “interesting for the project” challenged the legitimacy of Peri_LAB5 that has been acquired in Event 5. During the Helicopter View of 2008, LAB5 was put in charge of “the development of composites TiO₂-SiO₂ first with sol-gel methods (short time!) for a rapid transfer to plasma technologies” (PV_11.09.08). In other words, LAB5 had only a few weeks to “play” with the sol-gel methods before refocusing on SC and its realization objectives. Concretely, LAB5 was asked to realize two actions (PV_11.09.08):

- LAB1_PVD Action for LAB5: bring its expertise in terms of layer characteristics in order to stimulate the wetting of the surface (effect of the potential densification of the layer with LAB1_PVD on the wettability? other?) in order to optimize the deposition. .

- Sol-Gel Action for LAB5: provide MNC1 with a sol-gel TiO₂ on glass in order to study the crystallinity and the wettability of the layer.

Both roles are acknowledged but the role of producer is put on the grill. LAB5 is given only a couple of months to demonstrate the “credibility” and the “interest” of sol-gel for SC.

In March and April 2009, as the discussion on the redefinition of the project was on-going (PV_06.03.09; Notes_01.04.09; PV_01.04.09; IND8; ACA11; PV_21.10.09), the fate of Peri_LAB5 was hanging by a thread. In the plenary meeting of April 2009, LAB5 presented its sol-gel findings to the partners who, instead of treating the outcomes as prospective findings, assessed the samples based on the same requirements as in SC. Particularly, one project manager interrupted the presentation by pointing out that the layer was too thick to reach the specification of the project:

Project manager: It I interesting but it is too thick.

LAB5: We are trying to fix that with temperature.

Project manager: But the goal is to decrease the temperature, or we change the technology!

Those interactions eventually discredited Peri_LAB5 and its legitimacy in Axis-1 (ACA11). The tensions about the existence of Peri_LAB5 are particularly vivid in the posters drawn by the partners at the end of the project (see Erpicum and Chalant 2010). While most posters only represent Axis-1 as composed of SC and AB, a researcher from LAB5 depicted the ambiguity of Peri_LAB5 in the following way (see Figure 28):

- Axis-1 (AB and SC as a whole) is represented as the main broad road;
- The production of sol-gel products (Peri_LAB5) is represented as a sidetrack leading to a dead-end, or more precisely a road-block;
- The contribution of LAB5 in terms of characterization is represented as a path in parallel of the main road;
- Its contribution in terms of understanding, on the contrary, is drawn as a tortuous and slippery road.

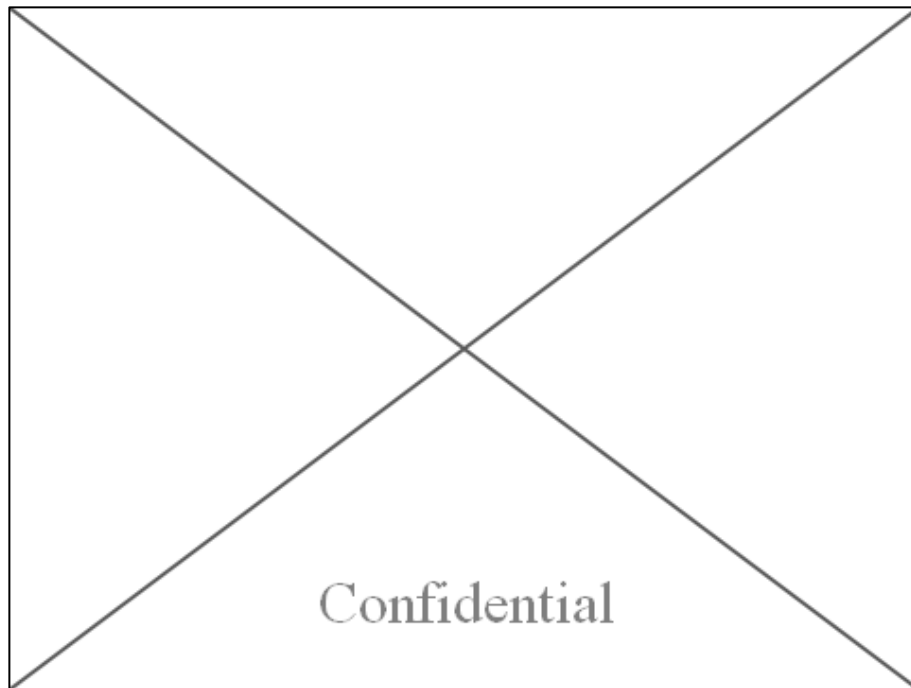


FIGURE 28 EXTRACT OF POSTER4

The distinction between the contributions in terms of characterizations and in terms of understanding echoes the distinction that was highlighted in the previous chapter between the transfers of Know-What and the eventual transfer of Know-Why. As the need for Know-Why was intensified by the iteration, LAB5 had a hard time to adapt its role of characterizer even if the project managers kept outlining their role as a provider of understanding.

As expressed by a partner:

Your role is not to work on sol-gel but rather to help us understand how a surface should be. You have capabilities about the wetting phenomenon, so help us understand that.

Indeed, to compensate for the dismissing of Peri_LAB5, the project managers emphasized the competence of LAB5 regarding the wetting phenomenon as “interesting for the project”. As explained by a respondent:

They came back with a considerable contribution at the level of the project. And I find it truly remarkable. (...). It was quite unexpected (IND8).

The subsequent refocus of LAB5 is therefore presented in a very positive way and as driven by legitimacy rather than through pressure (Notes_27.01.09). As expressed by the head of LAB5 during the April 2009 plenary meeting:

I am very satisfied by the collaboration of the past few weeks. It doesn't work but it is coherent.

As a reaction, one of the project managers retorted:

It is like looking for the Holy Grail, but we know we are not going to find it.

SOME PRELIMINARY INSIGHTS

Some trends are highlighted by the events presented supra as well as in the thick description of the data. First of all, as expected, closures (or stabilizations) were mostly brought by the project managers, with some exceptions like for instance in Event 34 (Notes_10.09.09) when a front-line researcher proposed to transmit a message to his boss regarding the discussed dissatisfaction. More or less thirty minutes later, one of the project managers came back to the event and proposed an alternative solution.

Except during semi-structured interviews and informal conversations, “speaking out” was not easy for academic **front-line researchers**. It was nevertheless favored by two main factors: the presentation of their results during plenary meetings and the intervention of their boss. Concerning the conduct of Axis-1, the main target was the implementation: front-line researchers took opportunity of their presentation to share difficulties such as the measure of heat during the deposition process (Event 23 – Notes_10.09.09) or the access to the right equipment (Event 26 – Notes_03.12.08). When targeting exploration or selection, the academic front-line researchers did not question the choices that were made but rather proposed alternative paths. In other occasions, they also asked for more guidance: such events refer to the need of Know-Why requested by the academic partners when working in an exploitative or exploratory R&D project (see previous chapter).

Concerning their bosses, **the academic professors** also brought implementation as the main target of their dissatisfaction (at least during the plenary meeting). In line with the behavior of their employees, professors targeted exploration to ask for more

guidance: in Event 4 (Notes_05.07.07), the choice of material was presented as an important stake for the professor who was waiting for the industrial partners to decide on the matter. In the two events targeting the selection phase, the academic partners took opportunity of their “voice” to highlight a selection criterion that flattered either the technology or the competences of the lab.

For instance, in Event 15 (PV_01.02.08), the partners discussed the absence of the distinctive signal of silver presence in a couple of samples. Two hypotheses were formed: the diffusion of silver in the surface (matrix), which was unlikely because the deposition was made at ambient temperature, or the heterogeneous deposition of silver with the formation of discontinuous nodules on the TiO₂ or SiO₂ matrix. At that moment, the head of LAB5 notes that based on his experience on polymers with silver the composition of silver on the matrix might vary with time because of the mobility of silver on the surface. As a result, the project manager took notes of the usefulness of measuring the composition of silver on both fresh and aged samples.

In contrast with academic partners who did not question the R&D problem, **industrial front-line researchers** targeted the “identification” and “exploration” phases as a source of dissatisfaction. They mostly recognized the difficulty of the tasks at hand and the exceptional ambitions of the project given the time span. Only one front-line researcher really confronted the R&D problem tackled in Axis-1 when he realized that the photocatalytic effects of the surfaces affected the organic pollution but not the inorganic one, thereby restricting the self-cleaning properties “per design”. This point of view on self-cleaning products was brought during the last meeting by the employee of SME1, who considered himself as an “U.F.O” in Axis-1 (HV_16.10.09) and as an outsider who was taking “a very objective look on the facts”.

Project managers also directly addressed the “identification” and “exploration” phases. The most important event in that matter was the Helicopter View of 2008 when the R&D problem was refined and some exploration paths were closed. This trend is in line with the configuration of the Competitiveness Clusters policy as appropriated by MEGAPROJECT’s actors (see Chapter 6): selected subprojects were supposed to address industrial problems and the research institutions were there to help them resolving it. Other sources of dissatisfaction were therefore

related to the role of partners and the rechanneling efforts after the iteration from exploitative R&D to exploratory R&D.

TABOOS

While the observation of critical events allows identifying the “hot” topics in the project such as the role of LAB5, the development of a quantitative PHT method or the dismissal of the LAB1_PVD technique, some issues were banned from the discussions in plenary meeting and thus kept away from the analysis of critical events.

A first example of taboo was the potential impact of regulations on the commercialization of antibacterial products, especially in protected sector such as the agro-food industry or hospitals. The issue was raised by the front-line researcher from SME1 during his interview:

Behind the work of Axis-1, there is a legislative aspect that we failed to integrate, or at least that we do not look at yet. This is about the fact that we could use the surfaces in the agro-food industry and that there is an enormous legislative aspect that we failed to integrate. If I take for instance the case of glass surfaces with silver deposition, if they go to the health care environment or the agro-food business, silver is totally banned. So if we want to integrate that kind of sectors, we are going to need additional toxicological studies, and it is an enormous work.

A few months later, the front-line researcher from SME1 brought back the issue, this time in plain sight during the Helicopter View of 2008. The intervention was taken into consideration and put in the poster as a critical factor for the AB subproject at the same level as the planning of the characterizations (see Figure 29). Nevertheless, it was the only time that it was discussed in plain sight or even evoked in project.

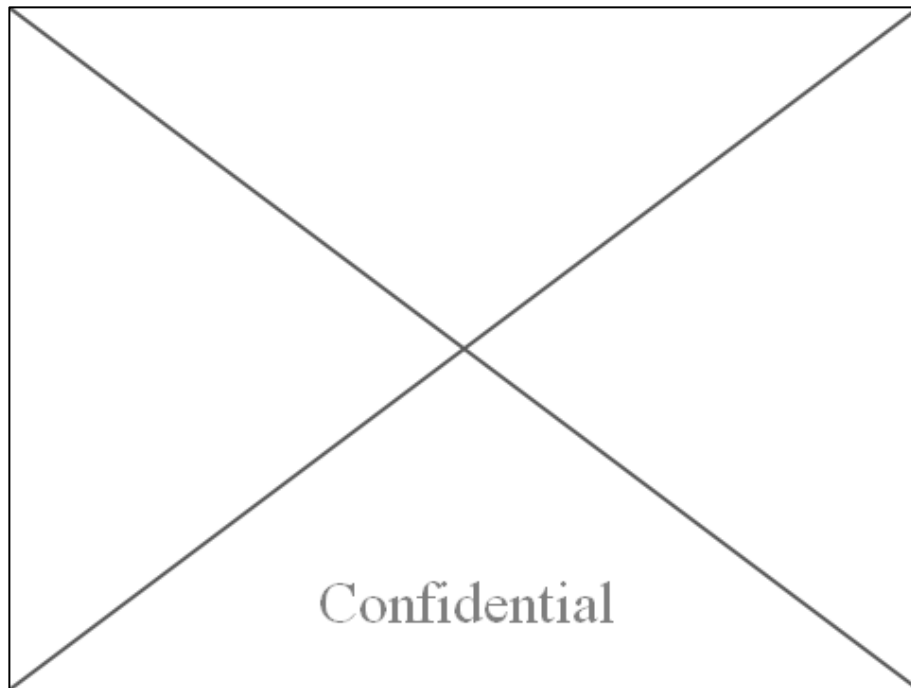


FIGURE 29 EXTRACT (3) OF THE POSTERS MADE DURING THE HELICOPTER VIEW 08

Another taboo was identified as I interviewed this front-line researcher. As he was speaking about the potential regulation threats on the AB products, he claimed that:

Maybe it is more penalizing for MNC2 who positions itself with antibacterial steels.

The underlying taboo is about the drift in Axis-1 in terms of properties and substrates (ACA11; IND22; PV_23.06.10): on the one hand, SC properties on glasses and thus mainly driven by MNC1; on the other hand, AB properties on steel products and thus mainly driven by MNC2 (see Figure 30).

One the one hand, the division of Axis-1 between the SC and the AB subpart was explicitly acknowledged inside the collaborative research. Moreover, it was recognized by the partners that the copy-paste metaphor at the origin of the project was obsolete: research findings on a given substrate were not really transferable to the other substrate. The collaborative research nevertheless kept its unity for the sharing of equipment, of common methods and of common soiling, even if they finally realized that the dirtying of glass and steel were influenced by different kinds of contaminators (Notes_11.05.10).



FIGURE 30 POSTER1

On the other hand, the phenomenon that was less clear and kept implicit during the plenary meetings was the divestment of MNC1 in the AB subpart and the divestment of MNC2 in the SC subpart. Some pieces of evidence about such a drift are found in the interviews of respondents. As expressed by a researcher working on SC (ACA11):

Now that (undisclosed name, researcher from LAB4) has shown that by changing the pressure it works on pre-painted too, I have better contacts with MNC2, and more feedback, but a lot less than with (undisclosed name, researcher from MNC1) of course, with him it has been a continuous exchange. There has been a slack period with MNC2, when we were not communicating because we had nothing to say to each other. But it just depends on their interests.

The progressive divestment was also superficially evoked during critical events about other matters. As an example, Event 17 (Notes_18.03.08) discusses the diffusion of silver in a batch of glass samples that have to undergo tempering. The technical stake is to keep the silver layer in place, and thus the antibacterial property, even after the tempering which is undergone through the heating followed by rapid cooling of the product. One of the paths to resolve this issue is to find a matrix that would actually keep the silver in place by limiting the diffusion process. Unfortunately, one of the project managers dismisses the TiO₂ layer as an adequate matrix and thus questions the goal of the collaborative research to find a TiO₂ product through plasma surface treatment that could reach the specification. As expressed by a project manager:

Maybe that we will not resolve this problem here (*in the project*) (...) It will not be a TiO₂, sorry (undisclosed name, researcher from LAB1).

Another piece of evidence is the Steering Committee of April 2009 where encouraging findings are identified for glass products but not for pre-painted and stainless-steel (CoPil_25.03.09). But maybe the most vivid illustration is the poster draw by (undisclosed name), the front-line researcher from LAB1 who joined Axis-1 after the dismissing of the LAB1_PVD technique when it was decided that LAB1 would boost its efforts on the AB subproject. On this poster (see Figure 31), we can see his arrival on the project on year two and his commitment to the AB subpart. We can also see that the MNC1 research center was not active on “his” project, the road of the MNC1 research center fading away after year two.

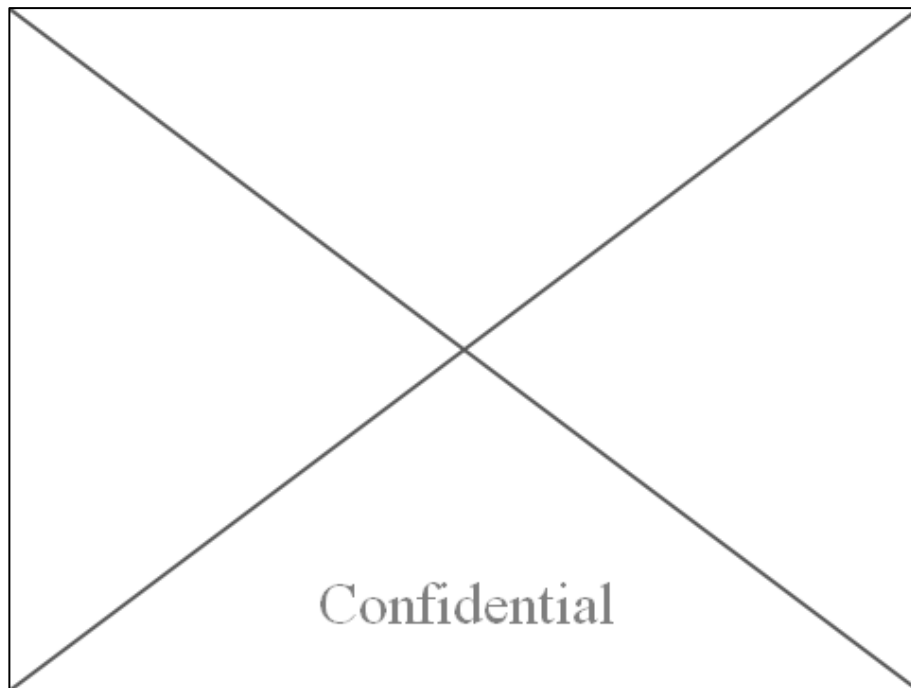


FIGURE 31 EXTRACT OF POSTER5

The drift in Axis-1 in terms of properties and substrates was kept implicit and unquestioned by the partners, mainly because it was justified by technical reasons that were themselves undisputed. Nevertheless, it had some important impacts on the configuration of the project. For instance, because the junior researcher from LAB3 was partially financed by MNC2, her thesis was oriented towards the AB subpart of the project where MNC2 was the most active:

I am on both sides (*of the project*) but for the moment **I am heading towards silver, they want to push me there for the thesis (...) they orient me towards the deposition of antibacterial TiO₂.**

When her colleague (the one who wanted to develop a new PHT method) left the project after the Helicopter View of 2008, she found herself stuck with a load of characterization for both SC and AB. Coupled with a lack of supervision and the insecurity about her yearly renewable contract because of the financial crisis and the extension of the project, she progressively divested herself, not directly from Axis-1 but rather from her PhD thesis project. As expressed by a respondent:

She do not want to do thesis, Yes, she'll do her job until she finds something else, but, to do a thesis, she is not interested anymore. Not under those conditions.

Like the critical events, this taboo allowed to identify – and explain – some aspects of the interests of partners. In the next section, I focus more directly on this issue.

8.4.2 INTEREST ALIGNMENT

Through the study of Axis-1, I was able to observe that the distinction between the bosses (the academic professors and the project managers) and the front-line researchers (the “little hands” as called by one respondent) was a reality for the respondents: it was explicitly recognized during discussions and interviews and it was also palpable during the plenary meetings. This distinction was significant for the actors in terms of both power and knowledge creation. As expressed during an interview:

Respondent: Unfortunately, I, “little hands” as would say Prof. (undisclosed name) – the little hands of Prof. (undisclosed name) – the little hands like me, or (undisclosed name, researcher from LAB3), we don't always know where to look for the information.

Julie: Why? Because you don't have enough links?

Respondent: I don't have enough links to know where or what to look for. It's always the problem. **Or people just tell me to get lost.** Let's be clear about that. That's what happened with (undisclosed name).

Indeed, managers and academic professor were deemed to be more “powerful” and the front-line researchers sometimes felt “powerless” and “frustrated” as they faced problems in the project and were not able to overcome them without the professor or the managers granting access to the adequate resources. But this situation is just the

beginning of this work. As a reviewer of this work said: **“managers manage, professors are the experts, and researchers carry out the daily work... what else can we learn from the case?”** Following on from that statement, the goal is to explore how power is exercised not only by those who are usually seen as powerful actors but also by the ordinary ones through translation in order to shape knowledge creation at the advantage of their organization. The goal is to identify the leverages that those actors can actually mobilize to create value for their organization: when the managers manage, when the professors provide expertise, and when the researchers carry out the ordinary work.

But it is still necessary to understand what “value creation” means for them and to recognize that value creation for an organization is not necessarily the same as value creation for the project or even for the individual himself. Indeed, I observed that the alignment between the project’s goals, the parent organizations’ objectives and the personal interests of the actors is not automatic. The focus on “interest”, or “value creation”, as understood by the actors is important when studying power interactions because *“power is linked to the pursuance of interests and people interests may fail to coincide”* (Giddens 1976), especially in University-Industry research projects. Besides, rather than being conceptualized as deep psychological urges of the respondents, interests can be seen as temporarily stabilized outcomes of previous process of enrolment (Callon and Law 1982 in Clegg 1989) as underwent during critical events.

In Event 16 for instance (as described in the previous section), the partners recognized that the project was in a technical crisis because of their inability to produce a photocatalytic sample. The recognition of the crisis, followed by a focus on the quest for an anatase sample, triggered a strong emotional response when the researchers finally “got something anatase”. The finding of anatase samples was recognized by front-line researcher as an important step in the project. From that event, value creation by the front-line researchers for the project meant “get something anatase”: to produce the right samples or to find crystallinity when doing the characterization. But if interests are shaped through the interactions, they also evolved. As the SC subpart of the project seemed to be failing in terms of its realization objectives, value creation by front-line researchers for the project progressively turned from “getting something that works” to the “closing of doors”.

As expressed by a front-line researcher who joined the project after the Helicopter View of 2008:

In my opinion, at the beginning, they really wanted something, let's be clear, they had an idea, they were really interested in it, and then we progressively demonstrated that it was not feasible: the specifications they wanted with the conditions they wanted. We had to adapt and now we continue the project because we have the means to continue it and to close the doors. As (undisclosed name) says: "we need to close the doors". And if a door stays open at the end of the project, it's this one that they'll explore themselves afterwards.

Besides, the front-liner researchers recognized that by working on the project they could contribute to the collaborative research (in terms of the production of anatase samples or, later on, the closing of doors) as well as to their own organization. In particular, they could contribute to the lab in terms of publications, conferences and other knowledge-based products such as a PhD thesis.

In other words, value creation took a different meaning depending on the point of view of the actor: vertically as people come from various organizations and functions (value creation has a different meaning for the front-line researcher than for his or her boss), as well as horizontally between the project level, the organizational level or the individual level.

TABLE 30 VALUE CREATION IN THE JOINT R&D PROJECT

Value creation By \ For	The collaborative research	The organization	The individual
Project managers	The advancement of the project: “ to get something ”, the industrial targets as defined for the project; to channel the allies towards it	The sustainability of the firm: to contribute to new products’ launching and to the access of new markets	Career development in the firm: improvement of technological and managerial competences
Academic professors	The advancement of the project: to provide adequate resources (both human and technological) to reach project’s targets	The sustainability of the laboratory: to contribute to the training of researchers and to the development of competences for the laboratory	Research excellence in pet projects To be a real partner Pride in accountability
Front-line researchers (research institutions)	The advancement of the project: “ to show something ”, to contribute to scientific results and to the achievement of project’s targets To close the doors	The visibility of the laboratory in terms of knowledge products: thesis and publications	Tree-fold interest: To learn, to contribute and to develop his or her address book/resume. Pride in accountability
Front-line researchers (companies)	The advancement of the project: “ to show and get something ”, the industrial targets as defined for the project	The sustainability of the firm: to contribute to new products’ launching and to the access of new markets	Career development or consolidation in the firm, i. e. through evaluation and associated individual objectives

In this section, I therefore present how the respondents (project managers, professors and front-line researchers) see their involvement in the project as a source of value for:

- The collaborative research: how respondents think that they are actually contributing to the project's interests;
- Their organization: how the respondents can take advantage of their research activities inside the project to secure organizational interests;
- Themselves as entrepreneurs of their own human capital, thereby informing how, as individuals, they can take advantage of the project to secure their own interests.

Note that, in order to protect the confidentiality of the sources, interests are not presented individually but rather by category of actors depending on their function and parent organization (see Table 30).

For managers, individual interests were represented by career evolution within the firm through good evaluation and the development of competences, both in management and technological development, and the joint R&D project provided an empirical field to develop such competences. From the organizational point of view, the main interests were represented by the launch of new products and the exploration of new markets to ensure the sustainability of their industrial R&D centers, using the joint R&D project to access complementary knowledge and resources and to accelerate the process. At the project level, value creation meant to reach the targets: "to get something" before the end of the project.

Note that such interests evolved along with the project itself. At the beginning, Axis-1 was seen as a copy-paste project, or in other words as a quick way to bring new products on the market and to show that the money was well-spent by the Walloon Region. As the project evolves, the critical events like the one that took place during the Helicopter View reinforced the goal to "get a product" and to quickly show something. An intervention of the coordinator of MEGAPROJECT (and director of the MNC2 research center) during the Helicopter View strongly reinforced that interpretive scheme: during the first part of the day, he came to the table where the

partners of Axis-1 were discussing and addressed the collaborative research, saying that the goal of the project was to bring products very quickly on the market but that it was far from being reached.

It influenced the project well after the Helicopter View. In Event 28 for instance (Notes_27.01.09), the managers discussed the potential extension of the project in order to “at least have a success”. Later, they presented the extension as “an additional year to push something out” (Notes_01.04.09) of the project. But as they realized that a product might never go out of the project, they focused on the closing on doors. As expressed by a project manager one year after the Helicopter View:

(...) at the level of the university, the project mostly consists in closing paths. It doesn't allow bringing the expected product yet but, from another point of view, if at the end of the project we can conclude that it is not feasible, it will be a result in itself, it will not be what was initially expected but, well, why not, if science and technique say so. But we need to make sure that we have explored it in the most scientific way, and that we explored everything that needed to be explored.

Concerning the project managers, I witnessed a strong horizontal alignment:

- Between the individual level and the organizational level through the anchoring of the managers in the industrial R&D centers.
- Between the project level and the organizational level through the interpretive schemes provided by the Competitiveness Clusters policy, in particular the selection of subprojects that address industrial problems.

Indeed, the joint R&D project in MEGAPROJECT was seen as an instrument for the industrials, led by the industrials (see Chapter 6). As such, value creation at the project level was meant to contribute to value creation within the firm. Given this alignment, answering the research question “how does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer” therefore means to focus on the leverages that project managers mobilized in order to stimulate the knowledge flows requested by the nature of the project as identified in the previous chapter. More precisely, value creation in terms of knowledge transfer meant to access and exchange the pieces of knowledge that are the most relevant to develop the industrial targets, within the project but also internally by internalizing the created knowledge.

Concerning the academic professors, value creation at the project level meant providing the adequate resources to the collaborative research in terms of technological equipment and methods but also in terms of human resources. Researchers were hired in order to contribute to the project while being trained within the collaborative research. Indeed, the project was seen as a mean to sustain the work of the laboratory through its financial supply and the opportunity to develop its competences. At the individual level, academic professors are led by the search for scientific excellence in their field of expertise: pet projects that are pursued as personal favorites of the professor and which are not necessarily aligned with the on-going joint R&D project.

As a matter of fact, Axis-1 was sometimes seen as a way of doing some cash, the academic researchers being underlings for the industrials – which is consistent with the role of an academic lab in exploitative project (see Chapter 7). This role of technical service provider with restricted experimentation was negotiated with the possibility to develop sidetracks that were acknowledged by the consortium agreement, like Peri_LAB5, or the possibility to develop Know-How, like LAB2 and its acquisition of a new piece of equipment. As the project evolved and the exploration in Axis-1 gained importance, some academic professor failed to adapt while others, by contrast, progressively resisted their role of “luxury provider” in order to become “real partner”. This phenomenon is explained by the fact that such partners progressively felt that the project’s findings were nourishing internal industrial R&D but that they were not kept abreast of those internal developments. While they were contributing to the development of the necessary Know-Why, they were kept in the dark concerning its internal use inside the industrial facilities.

As presented in the previous chapter, the alignment was not always automatic but at the level of the project, actors usually found a way to cooperate through consensus and compromises. For instance, an exploitative R&D project could be a source of money for the laboratory in order to buy pieces of equipment and materials for more exploratory works. In the case of LAB3, the role of underlings in Axis-1 was negotiated with the possibility to exchange Know-Why and develop exploratory work inside Axis-1 under the form of a thesis. For the point of view of the academic professor, the research activities inside the project also contributed to future

opportunities. As expressed by a respondent about the way his lab benefits from the project:

(...) Contacts with the industrials. It is the main point. Even if the collaboration of MEGAPROJECT ends, because we had the opportunity to work together there is a chance to work again together in the future on other products. And because contacts have already been taken, it will strongly ease the exchanges. In my opinion, it's the key parameter.

As a result, besides looking at the specific flows for the project, academic professor might also try to consolidate the links with the industrials and to enhance the visibility of the lab in terms of competences beyond the ones strictly needed on the project.

Another way to create value for the lab in terms of knowledge creation is either to:

- Shape the knowledge flows by aligning the project goals with publications goals;
- Restrict the activity in the project in order to discharge the front-line researchers and let them sidetrack on more exploratory work.

One stake of the analysis is therefore to explore such strategies and to identify the leverages mobilized to create value for the lab.

But professors are not the only one able to do so. Front-line researchers are able to shape knowledge flows inside the project to make it valuable for the laboratory. They are also able to create personal sidetracks in order to publish outside of the scope of the project. For instance, the articles published by the researcher from LAB2 were about a peripheral subject that was not of immediate importance for Axis-1. Unfortunately, the alignment of interest between the project interest, their loyalty to the laboratory and their role as “*entrepreneur of their own human capital*” (Grabher & Ibert 2006) was not an easy task for front-line researchers. In the case of Laurent for instance, such peripheral exploration was made during work hours that were supposed to be dedicated to Axis-1.

Because researchers were usually asked to contribute to the scientific visibility of the laboratory through knowledge products such as publications and thesis, they

sometimes felt torn between their loyalty to the lab and the project's interests. Indeed, front-line researchers were usually hired on the basis of the project. Sometimes, they were only involved on Axis-1, thereby nurturing their motivation to contribute to the project: to provide the necessary scientific results to achieve industrial targets. Indeed, the will to “show something” and thereby contribute to the project was shared by most of the researchers (i.e. Notes_11.09.08; ACA15; ACA10) but the load of characterization and production tasks that went along affected their capacity to create publishable results.

Another source of misalignment had regards with personal interests. In the project, individual interest was materialized in three ways:

- To contribute: behind the unpleasant feeling of showing up in a plenary meeting without findings because the machine is broken, you find an intrinsic motivation to contribute, especially after critical events such as Event 16 when the goal of the research is redefined as “finding something anatase”.
- To develop his or her resume, not only in the academic world but also in the industry. For instance, the goal of (undisclosed name) was to develop contact with industrials in order to enhance the desirability of his resume as a future professor.
- To learn: a researcher starts (and stays in) an academic career in order to continue to learn something in his or her everyday activities. It was the case of (undisclosed name) for instance who wanted to develop the quantitative PHT method.

In the case of the PHT method, the criterion “realistic” and “interesting for the project” dismissed the expectation of the young front-line researcher. If the Helicopter View was an obligatory point of passage in the sense that it allowed the project managers to define the relevant identities and interests at hand in the project, it also triggered the departure of actors who refused such identities and interests. For this researcher for instance, the Helicopter View generated a lack of alignment between the project interests and his own personal ones. As a result, he barely hesitated when an opportunity was offered to him to leave the project and to do a

thesis instead in another lab. Contrarily, researchers who stayed on the project embraced the criteria. As expressed by the other junior researchers from Liege, her thesis needed to contribute directly to Axis-1:

Respondent: (...) In general, when you are alone on a thesis, you organize your time as you wish, you see the people you want to see. **Here, it is much more difficult to be able to... Everybody is interested, you cannot do useless things.**

Julie : Is there some things that you would have like to deepen and lack time to do so ?

Respondent: Yes, there is the work on microscopes. **I wanted to do the training but I don't think that it will bring a lot of information at the level of the project**, because a lot of microscopic work is already done in MNC2. But for me it would be much more interesting.

While front-line researchers in academic labs struggled to combined personal, organizational and inter-organizational interests, industrial front-line researchers in companies defined value creation mainly in organizational terms: to ensure the sustainability of the firm through the development of new products and the access to new markets, not only in the framework of Axis-1 but also internally. A good evaluation towards such goals was meant to consolidate their position within the firm.

In conclusion, value creation at the project level was defined in similar or at least complementary terms by the actors. They contributed to the same accepted goals of bringing “quick concrete products”, either by doing the right characterizations or by closing doors. Thanks to the legitimacy provided by the Marshall Plan, the industrial targets were well-accepted by the partners, at least for the main collaborative research. Horizontal alignment between the project level, the organizational level and the individual level was also well-designed for industrial partners, both for managers and front-line researchers. The alignment between the project level and the organizational level was less straightforward for the academic professors but the involvement of the lab in the project was usually negotiated with compensations such as the development of peripheral projects or the development of Know-How.

By contrast, academic front-line researchers were facing a schizophrenic process: project and organizational loyalties were not automatically aligned, and their

individual interests were potentially disrupting or enhancing at both levels. For instance, the thirst to learn could be channeled either towards the project or towards the conduct of a thesis within the laboratory, but the lack of learning opportunities could also lead the researcher to look for another job, leaving both the project and the organization.

As such, shaping the project and the subsequent knowledge flows in favor of his or her parent organization was not always evident. In the next section, I explore the leverages that actors mobilized to do so.

8.4.3 LEVERAGES AND IMPACT ON KNOWLEDGE EXCHANGES

In this section, I explore in more depth the leverages that actors – front-line researchers, academic professor and managers – can deploy through power exercise to shape knowledge creation at the advantage of their organization. I also acknowledge their frustrations as power exercise fails to achieve their goals. As a result, I want to provide practitioners with a deeper understanding of the stakes and means that they can mobilized during power exercise in order to reach acceptable compromises. If “managers manage, professors are the experts, and researchers carry out the daily work”, what are the leverages that they can mobilize so that collaborative knowledge exchanges contribute to organizational goals while preserving inter-organizational and individual interests

FROM A STRUCTURAL PERSPECTIVE: LINKS CREATION AND REINFORCEMENT

From a structural perspective, I identify four complementary strategies that partners followed to influence value creation for their parent organization: bridging, bonding, spinning-out and assimilating (see Table 31).

TABLE 31 LINKS CREATION AND/OR REINFORCEMENT IN JOINT R&D PROJECTS

Supported interactions as part of the collaborative research		Supported interactions in periphery of the collaborative research
With existing members of the collaborative research	Bonding: Creation of privileged opportunities for knowledge sharing Integration of a peripheral research	Spinning-out: Creation of a peripheral research more or less in line with the collaborative research
With external actors	Assimilating: Integration of a new participant in the collaborative research	Bridging: Granting access to organizational resources, technicians and experts

In the literature on social capital (i.e. Putnam 1995, Nahapiet & Ghoshal 1998, Burt 2004), bonding refers to linkages within a focal group (Putnam 1995, Adler & Kwon 2002). In the joint R&D projects, bonding implies the reinforcement of an existing link in the framework of the collaboration. It enables a privileged access to knowledge exchanges. For instance, Event 4 provided a project manager with a bonding opportunity between her and the team from LAB1.

Event 4 took place during one of the first plenary meeting when the team from LAB1 asked their industrial partners to choose the priority matrixes (between TiO₂, SiO₂ or ZrO₂) for the development of the AB products (Note_050707; PV_050707; PV_270507). The discussion that followed between the project managers and the members of LAB1 allowed determining a set of criteria for the assessment of the matrix: esthetics, properties of the coating, durability of silver as the antibacterial agent, costs of targets and speed of deposition. Nevertheless, the team from LAB1 recognized that they were not able to make a sound choice and needed the industrials to make it. For the industrial, the question seemed trivial: “it doesn’t matter which one is the first, we need to test the three matrixes”. Besides, the need to keep the project on track was advanced: “what can you get your hands on?”. As a way to stabilize the event, the project manager from MNC2 finally proposed to organize a technical meeting between her researchers and LAB1 to discuss this matter in more depth.

By inducing such a bonding opportunity, the partners identify a matter that needs decision-making. In this case, the industrial had to make sure that the matrixes would satisfy industrial constraints and they were able to take advantage of the bonding experience to do so. In other words, they made sure to share the relevant Know-Why when choosing a matrix. In this way, they contributed to value creation for their parent organization by consolidating the required flow inside the collaborative research. But bonding can also be used to nourish internal R&D activities. In this case, joint experimenting (Holmqvist 2003) between the partners fosters internal R&D activities. As expressed by one respondent about the internal use of joint experimenting:

They came back with a considerable contribution at the level of the project. And I find it truly remarkable. In fact, I took up one of the presentation here internally – because we have another “self-cleaning” project – I took up their slide to share their contribution in terms of comprehension. It was quite unexpected (IND8).

Bonding could be initiated by the project managers as well as by the academic researchers. In Event 16 for instance, the identification of a crisis was followed by a series of bonding opportunities in order to “get back on feet”. The industrial partners met with the academic partners lab by lab in order to think about the direction of the project. In the case of the bilateral meeting with LAB2, the bond was initiated by the front-line researcher in order to propose some paths to finally get the anatase samples. In this case, he created value for the parent organization by proposing paths aligned with the project while “breaking in” the new machine. It was also a good opportunity to discuss the competences of the lab and to enhance the quality of exchanges inside the project.

In contrast to bonding, bridging foregrounds to linkages between groups (Putnam 1995, Adler & Kwon 2002). In the joint R&D project, it implies the creation of a link with an external actor: a bridge is created between the project and an external actor who will not become a “partner”. For instance, one of the partners can set up a bridge between him and a new subcontractor in order to enhance the relevance of its methods for the project. Even if the subcontractor does not become a “partner” welcome at the table, such a bridge enable value creation for the project as well as for the organization that works on the bridge.

For instance, in July 2007, I witnessed an event about the choice of a laboratory for the antibacterial measurements (Note_050707; PV_050707; IND22; PV_131107). At that time, the consortium agreement was written (but not signed yet) and the partners had been identified but an uncertainty remained concerning the identity of the laboratory that would perform the antibacterial measurements. This event therefore targets the identification of an external organization for the characterization of the AB samples. The dissatisfaction was clear for both project managers as this measure of performance was a critical task for the AB subpart of Axis-1. The targeted stage of the R&D project was not the R&D problem; in fact the goal of finding an anti-bacterial product was quite clear. But they still needed to explore the set of alternative laboratories that could perform those tasks and to choose the more adequate subcontractor. As such, the goal of this critical event was twofold: to form a list of candidates and to determine the criteria that would lead the selection of the subcontractor, such as “a well-known laboratory, because we need a reliable option” (Note_050707).

Three names finally sprang from the discussion. They did not seem to be new for the partners (in fact, they had already been discussed in previous meetings by the partners involved in the strategic discussions of MEGAPROJECT) but a systematic comparison had not been done yet. In the course of the discussion, one project manager proposed to conduct a benchmarking of the three candidates against criteria such as costs and response delays in order to complement existing information. Because the antibacterial measurements were somewhat linked to the stain characterization methods developed by SME1, the second project manager then insisted on including SME1 in the benchmarking process “in order to avoid overlap inside the project”. As a result, the critical event closed on the decision to benchmark the three labs in close collaboration with SME1.

Through this intervention, the project took advantage of the expertise of SME1 who accompanied MNC1 and MNC2 when examining the relevance of the three potential labs. A deadline for the selection of the subcontractor was even fixed for early September. Nevertheless, the visit to ULB, the laboratory that was finally selected, did not happen before the 22th of November 2007. In the minutes of the November plenary meeting (PV_131107), the ULB is presented as the favorite

“subcontractor” because of the potential link with the University and despite of potential durability problems linked to the retirement of the Professor in charge of the measurement. Another stake that appears later on was the role of the ULB lab as a subcontractor for some measurements required by law for antibacterial products in the agro-business.

The decision to involve SME1 in the benchmarking process and to work with the ULB was particularly important because SME1 successfully identified a gap in the method developed by ULB for the decontamination of surfaces. The researcher was able to point to the laboratory that the method they were using to “wash” the surface of the samples before measuring its antibacterial properties in fact affected the structure of the surface and subsequently the targeted properties. One year later, the senior researcher of SME1 spontaneously remembered this episode:

Outside of the meetings, I do not necessarily interact with other partners for the surfaces themselves. However, I have some interactions for our expertise: we are going, for example, to ULB, with Professor (undisclosed name), who makes very, very sophisticated manipulations about the decontamination of surfaces.

Because we already did some research in the past, MNC2 asked us to go see this Professor in order to discuss the development of some manip’... One stupid thing for example, when we went to see him for the first time, we realized that he was cleaning the surfaces with a very aggressive product. He had not integrated at all the fact that the surfaces could be ... could lose their effectiveness because they could leach a layer of TiO₂.

As a result, they decided to work on collaboration with ULB on the development of a new non-aggressive washing method to decontaminate the samples before measurement. This bridge between SME1 and ULB was particularly important because, as a subcontractor, ULB was not part of the collaborative research. In other words, the ULB was not a “partner welcome around the table”; even if performing a critical AB task, it did not have the chance to participate to the monthly plenary meetings and therefore was not always aware of the stake of the project.

Another example of bridge is when a project manager enables the access to an organizational piece of equipment or to a technician so that the academic researcher can experiment directly on the machine. Even if the technician does not become a “partner” of the collaborative research, such a bridge enables the access to industrial

Know-How as requested in exploitative and explorative R&D projects. Such a bridge was witnessed in Event 26 in December 2008 (Notes_03.12.08) when (undisclosed name), newly-hired by LAB2 to replace (undisclosed name), explained that LAB2 machine was working at full capacity and that the boss had even proposed to work on shift in order to optimize the machine schedule. To allow the progress of the project, a project manager then proposed to use some pieces of equipment in MNC1. The proposition then triggered a discussion about the transferability of results and the constraints of the MNC1 equipment.

One of the stakes when establishing such a bridge is the actual access to the individual who is not part of the collaborative research and therefore does not necessarily share the same norms. In the case of Axis-1, people tended to be there for each other but the technicians were not always on the same page. Even if the project manager gave access to him during a plenary meeting, it was not always clear if she had hierarchical power over him and if he will actually arrange smooth exchanges.

At the end of the project for instance (Notes_11.05.10), the front-line researcher from MNC1 and the one from LAB2 discussed the problem of transferability of encouraging results from LAB2 to MNC1. As they were trying to understand why they were failing to successfully transfer it, they came up with what they called the “coater effect”: the fact that differences in the coaters in LAB2 and MNC1 might explain the different results. The next steps were therefore to identify the parameters of the coaters (such as speed of deposition, length between the cathode and the surface, etc.) that are the most relevant for the transfer and to try to optimize it. To do so, the front-line researcher from LAB2 needed to meet the technicians who have a deep knowledge of the MNC1 machine. Unfortunately, the persons were not available and the researcher from LAB2 grew frustrated with the lack of access.

While the literature on social capital only identifies two strategies when bringing people together – **bonding** when they are alike, **bridging** when they are not alike (Putnam 2002) – I identify two additional strategies that can be used to stimulate exchanges:

- The reinforcement of a link between two existing partners who decide to “**spin out**” from the main collaborative research and create a peripheral research.
- The **assimilation** of an external actor who become a legitimate part of the group, a “partner welcome around the table”.

The distinction on the one hand between bridge and assimilation and on the other hand between bond and spin-out is brought by the structurationist perspective used in this work. Indeed, the Structuration Theory defines the relevant social system in terms of interdependencies of actions, not of actors, thereby introducing a complementary dimension (see Table 31 p. 261): whether the stimulated exchanges are integrated to the main interactions of the group (assimilation and bond) or on the contrary developed outside the collaborative research (bridges and spin-out).

In the case of bridges for instance, even if it contributes to the project, the external actor stays an external actor and their interactions are not part of the collaborative research. The bridge between SME1 and ULB is a good example: it contributed to the relevance of the AB measurements in Axis-1 but the partners working on the AB subparts were not necessarily aware of the peripheral interactions that had occurred between SME1 and ULB.

Likewise, the interactions channeled by a spin-out are no longer a part of the collaborative research. Even if the actors still belong to the group for some of their R&D activities, their spin-out can be a project of a different nature (more prospective for instance) with different types of objectives and deadlines. Nevertheless, it can also feed the collaborative research in an indirect way or even contribute to internal organizational activities. For instance, a thesis can be seen as a spin-out connecting a lab and a company: the thesis can be carried out at the same time as the joint R&D project but it has an existence of its own.

On the contrary, assimilations and bonds stimulated exchanges inside the collaborative research. Assimilation for instance integrates an external actor who becomes a partner of the project. Therefore, the stake of the assimilation is the sharing of the relevant interpretive schemes and norms that may seem taken for granted for the other partners.

A typical example in joint R&D projects is the assimilation of newly-hired researchers to replace the people who are leaving the project before its end. In December 2008 for instance, Axis-1 welcomed two new partners: (undisclosed name) who replaced (undisclosed name) at LAB2 and (undisclosed name) who replaced (undisclosed name) as the LAB4 researcher. It was just after the Helicopter View, at the same time as the rechanneling of the exploratory work at LAB4. (undisclosed name) was a post-doctoral researcher highly motivated to work with the industrials and expert in plasma technologies. Instead of resisting the rechanneling of the LAB4 exploratory efforts, he took for granted the industrialization objectives and engaged in SC and the quest for a product that could be easily transferred to the industrial facilities.

Thanks to his background in Physics, this researcher identified a flaw in the prospective composites that have been formerly developed by LAB4. His explanation supported the absence of effects of the layers developed by his predecessor and was used during the steering committee to promote the development of an alternative solution: the development of an amorphous TiO₂ which could be hyper-hydrophilic thanks to very high pressure. Indeed, while dismissing the previous work of LAB4, the newly-hired researcher also wanted to propose a solution. As expressed by the respondent, the goal was not to come and throw away what has been done before him, saying “it doesn’t work, it doesn’t work”, but rather to contribute to the project with a concrete proposition.

Unfortunately, he had a hard time to share his ideas. As expressed by (undisclosed name), the other newly-hired on the project: “I was astonished by the way they were reacting to his ideas”. It was true for the dismissing of the earlier LAB4 work as well as for his new solution. In the plenary meeting of April 2009 for instance, one of the project manager insisted on the fact that the research activities in Axis-1 “needed to make sense” and that she was not sure that his work was making any. As a result, she concluded his presentation saying that she did not think that the paths should be explored.

Different factors contributed to the resistance to his ideas, like for instance denial: how is it possible that “it has never hit us” (Notes_01.04.09). But in my opinion, the main reasons were to be found in the previous critical events, in particular Event 16

and the definition of the “right way” to find a “product that works”, as well as in the fact that pressure had already been investigated, albeit in another context (Event 24 - Notes_11.09.08). In Event 16, the priority was to find something anatase “**even if the path is not realist from an industrial point of view**” (PV_18.03.08). As described supra, two important rules emerged:

- The objective of the project as a quest for an anatase (crystallized) sample.
- The way to reach such goal through the technical development of an anatase deposition with thick layer, followed by an effort to decrease its thickness (PV_03.12.08; PV_21.05.08) and by doing so to converge to industrial specifications.

In his solution, the new LAB4 researcher was contravening both rules:

- He was looking for an amorphous (non-crystallized) sample instead of anatase (crystallized) sample; he was also contravening the hypothesis that the hydrophilic property was linked to the crystallinity of the surface.
- He was producing a sample with the right industrial specifications from the start instead of producing something that works in the lab and then trying to converge to industrial requirements.

But because he was new on the project, he had not internalized the interpretive schemes that emerged from Event 16 and other interactions. Like the other newly-hired, he was unable to understand the resistance of his partners. His ideas finally gained credibility when he benefitted from the support of the head of LAB2.

By contrast, the assimilation of (undisclosed name), the researcher from LAB1 who joined the team as part of the boost on the AB subproject, was less problematic. In his case, the assimilation was facilitated by his early involvement in MEGAPROJECT: he worked as a researcher on Axis-4 on a subproject which was dismissed along with the LAB1_PVD technique. As a result, he knew the project and its stakes and had already interacted with the partners.

Each strategy has specific difficulties and risks. When bonding, for instance, the lack of transparency about one’s interests can lower the level of trust and goodwill

of the partners. For instance, the managers sometimes act as gatekeepers who access external knowledge and dispatch it internally. Such a behavior can be seen as opportunistic, keeping the academic partner in a position of “service provider” rather than “real partner” (ACA10; ACA11) as expected by the participants of the collaboration. In the case of bonding through the integration of a peripheral project into the main collaborative research, managers should also pay a particular attention to the interests of the researcher. Indeed, the formal definition of the collaborative research is often the product of a compromise between the industrials and the academic professor, thereby neglecting the individual interest of the researcher.

As a matter of fact, the integration of a thesis in a joint R&D project is a perilous task. For instance, a junior researcher who is developing a cheaper component instead of a state-of-the-art solution shows loyalty to the project for reasons that are not legitimate in the context of his or her thesis. For that reason, a “spin-out” strategy might be more appropriate and allow for a better alignment of interests. By creating this spin-out, partners also create new opportunities for exchanges and, more importantly, alternative ways of exploring the phenomenon under study. Indeed, the main competitive advantage of universities as a research partner is “*their competence in generating new original findings and new approaches to problem solving*” (Debackere & Veugelers 2005). Opportunities for creative thinking could be stimulated by the use of spin-outs that escape the definition and ways of doing of the main collaborative research.

In this case, delicate issues include:

- The allocation of resources between the main collaborative research and its peripheral parts while keeping the researcher interested.
- The blurring barriers between the main research and the peripheral parts and the risk of confusion resulting from the overlapping.

Finally, when link creation involves an external actor, the main risk lies in the sharing of norms. On the one hand, bridging implies interactions with an actor who is not part of the main collaborative research, does not consider himself or herself as a “partner” and thereby does not share the norms and values of the project. There is also a risk of frustration if the access is granted during a plenary meeting but the

resources stay inaccessible. If proposing a bridge can be done by all actors, note that project managers and academic professor have more leeway: they are in charge of organizational resources such as complementary equipment, methods or experts. As such, they are able to propose additional resources that underline the competences of their organization. Such links contribute to value creation at the level of the project through the supply of adequate resources and, subsequently, at the level of the organization through an enhanced visibility of its competences.

On the other hand, assimilating means welcoming a new member and transferring the norms and values that may seem taken-for-granted for the other partners. As seen in the example of Hussein, a mutual understanding about the nature of the project and the way to reach its objectives is not naturally reached. It needs a specific effort. Assimilating might also be threatened by the lack of credibility of the new-comers. Without the support of head of LAB2, it is not sure that I would have been accepted as part of the collaborative research in Axis-1.

FROM A COGNITIVE PERSPECTIVE: DEFINITION OF THE PROJECT

In the previous section, I identify four leverages that actors can mobilize to stimulate exchanges at the advantage of their organization. Bonds, bridges, assimilation and spin-out have specific stakes and risks but they share a common trait: there are about links creation. What distinguish them from one another are the boundaries of the project: who is deemed to be called a partner and what should be discussed at the table.

As explained in Chapter 5, Axis-1 was seen by the partners as the relevant unit of collaboration. It was favored by the project managers in order to stimulate exchanges between people working on Titanium Dioxide, whatever the substrate and the expected properties. By keeping in the dark the drift that affected the collaborative research, they also kept the unity of the project. In other words, project managers defined the boundaries of the collaborative research and consequently the nature of the links as bonds, bridges, spin-outs or assimilations.

As expected, project managers are thus privileged actors regarding the exercise of power in plenary meetings. Indeed, they are in charge with decision-making and closure in the critical events. They question each phase of the R&D project: the

R&D problem, the exploration of alternative paths, the selection of promising ones and their implementation. As representative of their organization, they are also controlling the access to organizational resources such as equipment, technicians and experts. But another important source of power was the definition of the project itself, its nature and boundaries.

Along with the boundaries of the collaboration, project managers took opportunity of the critical events to introduce and reinforce the relevant interpretive schemes for the project such as the importance of the industrial targets (or, at the end of the project, the “closure of doors”) and the need to focus efforts in that direction at the expense of peripheral targets (Notes_01.04.09; PV_06.03.09; IND8). In other words, project managers mobilized the interpretive schemes that resulted from the appropriation of the Competitiveness Cluster policy by MEGAPROJECT’s actors (see Chapter 6).

For instance, the Helicopter View of 2008 and the subsequent amendments on the project were justified by three main interpretive schemes: the struggle against dispersed innovative efforts, getting concrete results and the leading role of industrials (see Chapter 6). Building on the leadership provided by the Competitiveness Cluster policy, the industrial project managers outlined the discussion about future exploration paths through two new interpretive schemes that would influence the rest of the project: future research activities had to be “realistic” and “interesting for the project”. As expected, *“the rules and resources that are the most influential in the structuring of the collaboration”* were *“those drawn from the institutional field of dominant actors (...) those with the greater formal authority, resources and discursive legitimacy”* (Phillips et al. 2000) as provided by the configuration of the Competitiveness Cluster policy.

By doing so, the industrials were able to define the nature of the project and to legitimate the specific flows that would help reaching its objectives. As saw in Chapter 6, the “Marshall Plan” projects are projects for the industrials, led by the industrials. By shaping the activities in the project, they concurrently diverted goals that were not aligned with their own. As expressed by a respondent about the gains of academic laboratories:

Now, **I have nothing against the industrials, they have their objectives, but they are more winners than others.** (undisclosed name) **will not have even one publication; (undisclosed name) isn't probably finishing her Thesis, so, he lost everything.** He developed a technique that probably is not going to be used anymore, (undisclosed name) tried to modernize it, to enhance it, to go further, (...) the things of (undisclosed name), I got them, they are beautiful, but we cannot publish it, we don't even have an error bar (...) **We should have had someone to counter balance with MNC1 and MNC2, but I don't see who, that's the problem. Well, I see someone but he is not there anymore, (undisclosed name), who was "old enough" between brackets, to say: here is the idea of the university.** But, from a certain point of view, he was always seen as subordinated to (undisclosed name), which is logical. But in my opinion, it could have been him.

In the discourse of this post-doctoral researcher who found himself too young to counterbalance the power of the project managers, we can nevertheless discern the leverages that front-line researchers could have mobilized to reach organizational goals. As a matter of fact, I observed that front-line researchers had the opportunity to mobilize another kind of leverage for value creation: the definition of *the set of possibilities* within the collaborative research. As expressed by one respondent (IND22):

You need to know that in this project – fortunately because otherwise I could not get through – I am not involved in the strategic discussions. I am here to give a feedback and **tell what is possible and what is not.**

Indeed, they are in charge of producing the scientific results that will confirm or, on the contrary, close the promising paths. In Axis-1, front-line researchers were also able to propose new exploration paths that would be of value for the project and, hopefully, for the academic laboratory in terms of new publications or thesis material: even when triggered by others or about an implementation issue, critical events were privileged opportunities to propose alternative solutions. As a matter of fact, front-line researchers participated to the translation phase in 50 % of the critical events.

After Event 16 for instance, the crisis was followed by a series of bonding opportunities to discuss the direction of the project. In one of those meetings, the researcher from LAB2 proposed two paths that “seemed sound”, based on “what the industrials like” in order to “favor the photocatalytic effect”. During the next plenary meeting, the project manager explained that both paths would be developed, “keeping in mind the large scale perspective”. In fact, by mobilizing the interpretive

schemes provided by the industrials, the front-line researcher successfully imposed the paths that he wanted to develop and even found time to work on a side project for the laboratory. Eventually, the publications that resulted from his work are the only concrete outcomes of Axis-1 (beside this thesis).

FROM A RELATIONAL PERSPECTIVE: NORMS IN THE PROJECT

When mobilizing an interpretive scheme, the actors trigger its semantic function: interpretive schemes are used to make sense of the context and to communicate this meaning to others in the project. But, as shown in Chapter 4, modalities also have a syntactic function: to give direction for action. When defining the project – its nature and boundaries, the project managers also defined the norms and values of the project: the right way of doing the research. The Marshall Plan for instance provided interpretive schemes like “projects for the industrials, led by the industrials”. Concurrently to its obvious semantic function, such modalities also provide direction for action: in a Marshall Plan project, it is normal to be led by the industrials.

I also witnessed the influence of the Marshall Plan through a complementary way. In Axis-1, and more generally in MEGAPROJECT, the Marshall Plan was used as a “totem” as proposed by Wallemacq (1998): not as a descriptive concept but rather as a method of thinking, a magical world, an incantation to “*express something new that escapes previous conception*” (Wallemacq 1998). As expressed by Wallemacq: “*there (is) no need to know the exact meaning of the word. It was as if the aim of the word was less to denote than to evoke*”. As such, the Marshall Plan provided an ideal, the redeployment of the Walloon Region, as well as a vague but unifying sense of the collaboration: “we need to feel the collaboration” (Event 2 Notes_05.07.07) ; “we are there for each other” (ACA6), that’s the spirit of the Marshall Plan. Using the Marshall Plan as a totem rather than a descriptive concept allowed flexibility in its use to lubricate the collaboration and to bind people together. But, conversely, it also provided chances of clash when expectations were not met: “the Marshall Plan, what a bullshit”.

If the project managers could use such norms to shape the interactions in the project, the front-line researchers were, in turn, able to mobilize them at the advantage of their organization. In Event 27 (Notes_11.09.08) for instance, the front-line

researcher from LAB2 presents the results for some TiO₂ depositions with thin layer (for aspect constraints) on pre-painted steel. The results are not positive, closing the single TiO₂ layer as an interesting path. Because the Helicopter View that happened the day before had opened the path to more exploratory works if focused on SC, the front-line researcher then proposed a solution: the exploration of composites and more particularly the addition of a flash of silver realized at high pressure. He then added that such a path could bring interesting insights about the link between pressure and the increase in size of silver clusters, a fundamental objective that his boss and he had already mentioned at the lab.

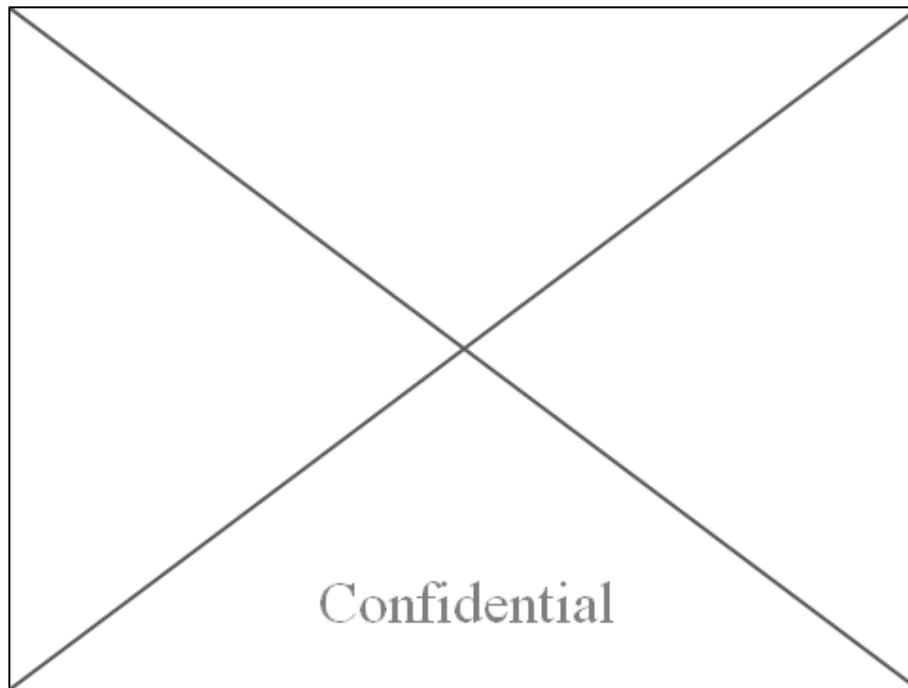
Five minutes later, his boss arrived and contributed to the discussion by presenting additional theoretical arguments. He backed the proposition of his researcher about doing a batch of samples with silver flashes but the idea was then dismissed by a project manager on the basis that the aim of Axis-1 should be “the exposition of samples with better performance, even if we don’t understand the science which is behind”. “In order to avoid going into non-relevant discussions”, she then supported her justification by summarizing the decisions that had been taken during the Helicopter View and that he had missed.

Despite the intervention of the project manager, the academic professor came back on the proposition of his researcher, this time mobilizing modalities of Axis-1: he rephrased the experiment as a tryout on a large sample directly on the track in order to “show something” and to make (undisclosed name) happy. Indeed, (undisclosed name), the director of the MNC2 research center and coordinator of MEGAPROJECT, had taken opportunity of the Helicopter View to address the partner of Axis-1. During the first part of the team-building day, he had argued that the Marshall Plan was there to “help each other out and to show results”, insisting on the fact that Axis-1 was not on the right trail concerning this facet of the Marshall Plan. This time, the experiment was accepted, followed by two interventions:

The project manager: “after that, let’s see if something works out!”

The academic professor: “after that, let’s write a paper!”

In the minutes of the meeting, the information that relates to this event is put in bold:



Note that when the LAB4 researcher came back with the idea of using pressure for the creation of amorphous self-cleaning samples, he ignored the interpretive schemes that had been reinforced in this event like for instance the quest for an anatase sample. Beyond the reinforcement of the anatase quest, this event also **mobilizes and reinforces a modality related to the “right way” of doing research in Axis-1:** proposing encouraging results that need to be optimized in the lab but that should be quickly transferable to the industrial research centers.

This example shows that front-line researchers can indeed propose paths that are interesting for their organization by mobilizing the project’s norms as a way to legitimate the proposed activities. But another condition is highlighted in Event 27: the proposed paths have to be supported by the academic professor, the “real expert” (ACA8). Unfortunately, these two conditions – support of the academic professor and legitimization through the norms of the project– were not always met. In fact, the front-line researchers felt increasingly powerless and under pressure, especially after the refocus of innovative activities that came along with the iteration (see previous chapter).

As a result, sidetracking was considered as an alternative strategy when the researchers failed to legitimate his ideas. Sidetracking is the exploration of

alternative paths or peripheral phenomena that could be translated into scientific publications or even into concrete products for Axis-1 but that are not conducted in plain sight. Such sidetracks would escape the way of doing research as defined in the project along with the “panoptic” look of managers (see Pichault 2009) and the pressure of the project.

While such peripheral projects were conducted outside the collaborative research, I witness two phenomena that brought results back from sidetracks to Axis-1. First, sidetracked outcomes gained visibility when the project failed to reach its operational objective of “getting something that works”. Because the project needed concrete results, whatever its nature, the publications developed by LAB2 and even this thesis were included as outcomes. Second, results from the work of the LAB4 researcher finally joined back Axis-1 as he gained credibility thanks to the head of LAB2. Six months after the dismissing of his ideas, the interest of his work was finally recognized. Along with this come-back, the quest for a sample that works was refined: instead of linking the self-cleaning property with the crystallinity of the sample (see Event 16), the property was now linked to the photoconductivity of the TiO₂, crystallized or amorphous (PV_21.10.09).

8.5 CONCLUSION

In this chapter, I explore how actors in joint R&D projects can take opportunity of critical events to influence value creation for their parent organization in terms of knowledge transfer.

I identify four main strategies deployed by actors as well as their specific risks and stakes:

- Bonding, the reinforcement of a link in the framework of the collaborative research.
- Spinning-out, the creation of a peripheral research between participants.
- Bridging towards external actors for the access to complementary resources.
- Assimilating through the integration of new human resources to the project.

Such links were brought to the collaboration through the closure of critical events. They addressed dissatisfactions about the conduct of the project by stimulating knowledge exchanges but were also used by actors to shape the direction and usefulness of the flows by taking organizational interests into account.

Project managers are confirmed as privileged actors regarding the exercise of power in plenary meetings. They question each phase of the R&D project: the R&D problem, the exploration of alternative paths, the selection of promising ones and their implementation. As representative of their organization, they are also controlling the access to organizational resources such as equipment, technicians and experts. But another important source of power was the definition of the project itself as well as the reinforcement of its relevant rules through the closure of critical events.

Indeed, the focus on critical events allows for the observation of the modalities that are the most relevant in the project as well as their reinforcement through closure: “the urge to get something that works at the end of the project” and “the need to focus on plasma surface treatment” provided the legitimacy of the decisions. As proposed during the Helicopter View, the research activities in Axis-1 had to be “realistic” and “interesting for the project”. As such, it outlines an Knowledge-Based approach of the role of Management: “*the role of managers not as directing other people, but as enabling the performance of collaborators by shaping the (inter)organizational context (rules, values, boundaries)*” (Tywoniak 2007). In this case, the role of managers was facilitated by the Marshall Plan by two complementary ways: on the one hand through the policy configuration (see Chapter 6) and on the other hand by using the Marshall Plan as an incantation, a metaphor mobilized to express the ideal of the collaboration and how it should evolve.

While some front-line researchers felt powerless and under pressure, others took opportunity of the critical events to shape knowledge flows at their advantage or at the advantage of their lab. Indeed, I observed that front-line researchers had the opportunity to mobilize another kind of leverage for value creation: the definition of *the set of possibilities* within the collaborative research; qualifying the explored paths through the generation of scientific results and proposing new direction. In Axis-1, front-line researchers were able to propose new exploration paths that would

be of value for the project and, hopefully, for the academic laboratory in terms of new publications or thesis material: even when triggered by others or about an implementation issue, critical events were privileged opportunities to propose alternative solutions. Two conditions are nevertheless highlighted. First, front-line researchers can indeed propose paths that are interesting for their organization if they are mobilizing the project's norms and interpretive schemes as a way to legitimate the proposed activities. Second, the paths had to be supported by the academic professor, the "real expert" (ACA8).

Paths were subsequently granted or dismissed by managers. In the latter case, the institutional and physical separation of the actors allowed for sidetracking at the benefit of diverse interests: contribution to the project in spite of the dismissal of the solution and/or contribution to organizational interests in terms of knowledge-based products.

To summarize, this chapter provides an operational framework to study power exercise and its influence on value creation in terms of knowledge transfers between partners. Through its structurationist prism, it also complements the Knowledge-Based approach advocated by Nahapiet and Ghoshal (1998) with a consideration for the alignment process, both horizontally between the project level, the organizational level or the individual level and vertically as people come from various organizations and functions.

Three important limits should be acknowledged. First, I focus on knowledge transfer within the project rather than through the project. As proposed in the previous chapter, future research could benefit from an alternative unit of analysis: the organization. Second, I recognize that the type of management style could have an impact on the punctuation of the critical events (Pichault 2009). It would be worthy to investigate if a polyphonic management style stimulates the "voice" of ordinary actors as well as the target of their dissatisfaction. Third, the focus on critical events during plenary meetings does not give access to strategic discussions. As a matter of fact, academic professors did not question the R&D problem during plenary meeting because strategic discussions were rather evoked at the level of the Steering Committee or during specific meetings that excluded front-line researchers (Notes_11.09.08). Such a limitation was tackled by the long-term immersion on the

field and by multiple data sources. Nevertheless, the target of this work is precisely to give a voice to front-line researchers. Thereby, experiencing the same fields of action than front-line researchers provided a unique perspective on their interpretations.

Chapter 9 CONCLUSIONS

9.1 ON A SITUATED APPROACH OF KNOWLEDGE TRANSFER

In this thesis, I address a central challenge: the exploration of U-I knowledge transfer as a socially embedded process, as a situated activity that involves academic and industrial partners as they interact for knowledge creation and sharing within a common covenant, in this case the joint R&D project. Such an approach rests on three basic assumptions:

- (1) The recognition of U-I relationships as a two-way relationship rather than a linear arm's length transaction (Harmon et al. 1997, Meyer-Krahmer & Schmoch 1998, Santoro & Saporito 2003).
- (2) The importance of knowledge co-creation and sharing rather than just transfer (Lubatkin et al. 2001, Faems et al. 2007, Tywoniak 2007, Jiang & Li 2009).
- (3) The importance of actions, especially social interactions, for transferring knowledge rather than technology and formal appropriation (von Krogh & Roos 1996, Pfeffer & Sutton 1999, Bozeman 2000, Dietz & Bozeman 2005).

Two main tools are deployed to reach this goal: on the one hand a set of qualitative, longitudinal methods to explore the empirical field and on the other hand the Structuration Theory as the main theoretical framework of the thesis.

First, I build on an in-depth case study to approach U-I interactions. This strategy combines three features requested for the study of knowledge transfer as a situated phenomenon:

- A qualitative approach for the study of intangible flows (Lockett & Thompson 2001): it allows gathering a rich dataset to explore actor discourses as well as (inter)organizational phenomena (Link et al. 1998), especially power interactions (Sargis-Roussel 2005).
- A longitudinal approach to explore contemporary events (Yin 1994), gain trust and access off-record issues.

- A naturalistic approach to be close to the data and the informants (Decrop 1999); to witness social interactions when the phenomenon of interest – knowledge transfer – and its context – the joint R&D project – are difficult to distinguish from one another (Yin 1994, Salminen et al. 2006).

The qualitative, longitudinal case study has two additional advantages: its coherence with the Structuration Theory and the triangulation of respondents and data sources to access the various points of view in U-I collaborations. Last but not least, the empirical field was also a decisive factor in this work: the richness and ease of access of MEGAPROJECT allowed for the elaboration of sophisticated designs to explore each specific research question, from multi-level studies to theoretical and literal replications.

The second tool is the mobilization of the Structuration Theory (Giddens 1984) as an integrating theoretical framework (Pozzebon 2004). Through this prism, collaborations are seen as social systems characterized by interpenetrating structures (Orlikowski 2000, Phillips et al. 2000) as partners come from different kinds of organizations and are “*simultaneously embedded in the webs of obligation and loyalty to the project team, the firm, and to their role as entrepreneur of their own human capital*” (Grabher & Ibert 2006). In other words, this framework is coherent with the intended situated approach and complements Knowledge-Based streams (i.e. Kogut & Zander 1992, Nonaka & Takeuchi 1995, Kogut & Zander 1996, Spender 1996, Nahapiet & Ghoshal 1998, Cook & Brown 1999) with a consideration for interest alignment and power interactions.

In this concluding chapter, I summarize the findings that were generated in this work. First, I present the theoretical contributions: a synthesis of key theoretical findings and answers to the research questions. Then I present the managerial contributions of the thesis: on the one hand five practical suggestions for policy makers and on the other hand five recommendations for collaborative practitioners – the participants in joint R&D projects. Finally, I present the limitations of this work along with the research paths that they suggest.

9.2 THEORETICAL CONTRIBUTIONS

The three research questions explored in this work (see Table 33 p. 290-291) foreground to different subfields in innovation studies. They anchor their relevance in different research communities and mobilize operational frameworks related to different scientific disciplines. This disciplinary variety is acknowledged in innovation studies (Nooteboom 2000, Fagerberg & Verspagen 2009) and more particularly technology transfer (Mowery & Shane 2002, Reisman 2005): subfields highlight different facets of U-I knowledge transfer. In this work, the use of the Structuration Theory enables cross-disciplinary discussions and conclusions.

This section is organized as follows: first, I present the main theoretical contributions by briefly answering the three research questions that drove the thesis (see Table 33). Then, I present the key findings of each chapter along with the future research paths that they unlock.

9.2.1 ANSWERING THE QUESTIONS

HOW DOES POWER EXERCISE BETWEEN PARTNERS INFLUENCE VALUE CREATION FOR THE PARENT ORGANIZATIONS IN TERMS OF KNOWLEDGE TRANSFER?

Through the observation of Axis-1 and the systematic comparison of the critical events that animated the project, I was able to show how power exercise between partners can be used to stimulate knowledge exchanges at the advantage of a parent organization. In particular, the analysis shows that the influence of power exercise on knowledge transfers is mediated by two main leverages:

- The (re)configuration of the relations that form the partnership;
- The (re)definition of the project along with its relevant rules: interpretive schemes with a semantic function and norms with a syntactic function.

Concerning the reconfiguration of the project, critical events provided partners with occasions to propose spontaneous new arrangements as well as solutions that were just waiting to “get out of the garbage can” (Cohen et al. 1972). In particular, the analysis identifies four strategies used by partners to reconfigure the network of relations: *bonding*, the reinforcement of a link in the framework of the collaborative

research; *spinning-out*, the creation of a peripheral research between participants; *bridging* towards external actors and finally *assimilating* through the integration of new human resources to the project. As proposed in the previous chapter, each strategy implies specific risks and stake and should not be confused with the other strategies. As a take-away, partners should elaborate on two important dimensions when proposing new arrangements: (1) whether the new arrangement involves actors that were considered as partners prior to the reconfiguration and (2) whether the new arrangement implies that the new research activities are part of the collaborative research.

Specifically, bridging implies that a partner of the project gains access to external resources, such as a specific measurement equipment, an external actor such as a subcontractor or an in-house expert which is not part of the collaborative research. In bridges, the external actor is not considered as a partner and will stay out of the collaboration even after the creation of the link. By contrast, assimilating implies that the link created with a new actor qualifies him as a new partner. In the case of bonding, the new arrangement involves actors that were actual partners and whose interactions within the new arrangement are part of the collaboration: the link is reinforced. The last strategy, spinning-out, is maybe also the more delicate one: when spinning-out, actual partners of the collaboration create a new link which is now a separate peripheral project. Such “partners” might continue to come to the plenary meetings or even take actions that directly contribute to the original project, such as characterization tasks, but they concurrently develop a peripheral project which excludes the other original participants.

Through such arrangements, partners propose a solution which supports the interest of their parent organization, or at least what they think is its interest. For instance, creating a bridge between the academic researcher and the in-house experts of his or her own organization allows a project manager to ensure a smooth transfer of Know-How as needed in concretization projects, thereby contributing to the achievement of the industrial targets set in the project. Especially in the case under study, I witnessed a strong alignment of interests between the project level and the firm level: an arrangement that contributed to value creation at the level of the project consequently contributed to organizational goals.

In contrast, organizational value creation for the academic partners was expressed in terms of enhanced visibility:

- On the one hand through the generation of publications and other knowledge-based products which were not automatically “desirable” in the project. Arrangements that contributed to value creation thereby included spinning-out: the creation of peripheral projects, with or without the original partners, in order to create new Know-Why which was not necessarily expected in Axis-1;
- On the other hand through the emphasis of the laboratory competences as a way to advertise it for future projects. For instance, bridging allowed for the advertising of the lab competences that were not originally promoted in the consortium agreement. It permitted the deepening of Know-Who between partners.

The second leverage, the definition of the project and its relevant rules, is closely related to the reconfiguration tools. First, the definition of the collaborative research and its boundaries consequently qualifies the nature of the links as bonds, bridges, spin-outs or assimilations. Second, when proposing a new arrangement, actors mobilized the rules of the project in order to justify them. As a matter of fact, I observed that front-line researchers had the opportunity to mobilize another kind of leverage for value creation: the definition of *the set of possibilities* within the collaborative research: the qualification of the explored paths through the generation of scientific results and the proposition of new directions.

In Axis-1, front-line researchers were able to propose new exploration paths that would be of value for the project and, hopefully, for the academic laboratory in terms of new publications or thesis material: even when triggered by others or about an implementation issue, critical events were privileged opportunities to propose alternative solutions. Two conditions are nevertheless highlighted. First, front-line researchers can indeed propose paths that are interesting for their organization if they are mobilizing the project’s norms and interpretive schemes as a way to legitimate the proposed activities. Second, the paths had to be supported by the academic professor, the “real expert” (ACA8).

The focus on critical events allows for the observation of the modalities that are the most relevant in the project as well as their reinforcement through closure: “the urge to get something that works at the end of the project” and “the need to focus on plasma surface treatment” provided the legitimacy of the decisions. As proposed during the Helicopter View, the research activities in Axis-1 had to be “realistic” and “interesting for the project”. As such, it outlines an Knowledge-Based approach of the role of Management: “*the role of managers not as directing other people, but as enabling the performance of collaborators by shaping the organizational context (rules, values, boundaries)*” (Tywoniak 2007), or in this case by shaping the inter-organizational context. In Axis-1, the role of managers was facilitated by the Marshall Plan by two complementary ways: on the one hand through the policy configuration and on the other hand by using the Marshall Plan as an incantation, a metaphor mobilized to express the ideal of the collaboration and how it should evolve. By answering the next question, I explore how the policy was appropriated by MEGAPROJECT partners.

HOW DID THE COMPETITIVENESS CLUSTER POLICY INFLUENCE COLLABORATIVE BEHAVIORS IN A JOINT R&D PROJECT?

To answer this question, I firstly identify the program configuration of the Competitiveness Cluster policy on the basis of the documents and speeches provided by the relevant public authorities. The program configuration of the Competitiveness Clusters is composed of the six following features (see table 32):

- (1) The promoted pattern is the organized network configuration;
- (2) The clusters are defined in order to stimulate cross-fertilization;
- (3) The emergence process of the cluster builds on the combination of a technocratic selection followed by a bottom-up approach for the definition of the areas of foci;
- (4) The qualification of the cluster requires a balanced involvement of actors;
- (5) The clusters have an earmarked source of subsidies to launch the Competitiveness Cluster projects;
- (6) The clusters need to reach a critical mass that allows for global competitiveness and visibility.

TABLE 32 PROGRAM CONFIGURATION AND TRANSMISSION AT THE PROJECT LEVEL

Competitiveness Clusters	Transmission to MEGAPROJECT & Axis-1
Promoted pattern: Organized network configuration	MEGAPROJECT as a multi nodal network: 23 partners around 2 Large Enterprises as crystallizers Influence of pre-existing Regional Clusters, local “grappes” and other organized networks such as Agora Axis-1 as a multi nodal network: 8 partners around 2 Large Enterprises as crystallizers
Division of scope: Cross-fertilization	MEGAPROJECT: steel production, glass production, laser surface treatment, solar technologies, spatial technologies, organic chemistry, plasma surface treatment, etc. Axis-1: Steel producer, Glass producer, Chemistry, Nuclear Physics, Eco-friendly detergent producer ...
Emergence process: Technocratic selection & bottom-up approach	Struggle against dispersed innovative efforts: formalization of five strategic foci and inclusion of MEGAPROJECT in the first orientation; selection of vacuum surface treatment as an integrator
Membership: Require a balanced involvement of research actors, training centers and (large and small) companies	MEGAPROJECT: 7 universities, 4 research centers, X training centers, 3 Large Enterprises, 9 Small and Medium-sized Enterprises Incentive to include more SMEs than initially designed Axis-1: 2 MNCs, 1 SME, 4 academic labs, 1 research center
Financial tools: Dedicated R&D projects funding and temporary support of the operational cell	Incentive to gather and “talk”: the Competitiveness Clusters as a “meeting point” Selection of subprojects that address industrial problems and that meet the definition proposed by the Walloon Government Legitimate the leading role of industrial partners Tension between exploration and exploitation: focus on getting quick concrete results “for the redeployment of the Walloon Region”
Critical mass: International competitiveness & visibility	Incentive to include more partners than initially designed Technological choices influenced by the size of the partnership: a technology with application in mass markets as well as niches of interest for the partners

Then, I explore their transmission at the project level through their appropriation by collaborative practitioners in MEGAPROJECT and Axis-1. As a matter of fact, the six identified features had a strong impact on the way MEGAPROJECT partners organized their collaborative work. Beyond the network structure promoted by the policy and reproduced at the level of MEGAPROJECT and Axis-1, the Competitiveness Clusters provided strong interpretive schemes such as (see table 32):

- A Struggle against dispersed innovative efforts;
- A focus on direct outcomes and the creation of activities;
- The predominance of the industrial targets;
- The leadership of industrial partners.

Such interpretive schemes enabled collaborators to make sense of the context they acted in and to communicate this meaning to each other. **The policy therefore influenced the collaborative behaviors by providing the interpretive schemes that define what is normal in the context of MEGAPROJECT and what is not; what should be done in the project or what should not. This set of rules also allows the partners to have a common definition of their joint R&D project – their “Marshall Plan” project – in spite of the various horizons and interests of its participants. It lubricates the collaboration** not only during the design phase of the project, with academic professors agreeing on the fact that:

The nucleus is not the research into laboratories; it is the industrials and their problems (ACA4)

But also during the conduct of the collaborative research. As expressed by a front-line researcher in Axis-1:

We try to be there for the others: people help each other, try to be available (...) as a matter of fact, also for you! (ACA6)

While this appropriation was seen by the partners as a natural process, leading them to think that, for instance, each “Marshall Plan” project should be led by industrial partners and should lead to industrial outcomes, the Structuration Theory as

mobilized in the thesis allows taking distance from this taken-for-granted interpretation of the policy and identifying the factors that led to this specific one.

First, the role of the authorities as “animator” (Diez 2001), in other words as a generator of norms for local agents, was favored by the financing of R&D projects with an earmarked budget. The Competitiveness Clusters policy provided collaborative practitioners with the concrete possibility to materialize partnerships into what they called the “Marshall Plan” projects. But another factor that I would like to highlight is the role of the administrative authorities, namely the Directorate General for Economy, Employment and Research (DG06) in the shaping of such Marshall Plan projects. Indeed, the DG06 was in charge of the operational monitoring of the projects, not only for the administrative follow-up of expenses but also during the construction of the project to make sure that the emerging collaboration effectively matched the ambitions of the Competitiveness Clusters. As showed by Fallon and Delvenne (2009), the administration was invited since the early meetings of project evaluation in order to identify the potential blocking points in function of their own lens.

The members of DG06 were the privileged interlocutors of the practitioners during the design of the Marshall Plan project. For instance, the inclusion of additional SMEs in MEGAPROJECT did not follow an epiphany about the role of SMEs in R&D projects. Instead, it was being monitored by the administration in order to make sure that the Marshall Plan project respected the “balanced involvement of actors”. While the transmission of some features was straightforward, like the network configuration or the stimulation of the cross-fertilization, others created tensions such as the targets of the joint R&D projects financed by the Competitiveness Clusters. As expressed by one partners:

Industrialization was a sacrilegious word. We had to take away two semesters dedicated to industrialization because the Walloon Region did not want to subsidize it; yet, the definition of the Competitiveness Clusters says the contrary! (SME1)

The administration of the Walloon Region therefore had an important role in shaping the project and the norms that would prevail in their conduct. By answering the next question, I highlight the operational consequences of this shaping in terms of required knowledge flows.

TABLE 33 RESEARCH QUESTIONS

	Q1	Q2	Q3
Research question	<i>How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer?</i>	<i>How did the Competitiveness Cluster Policy influence collaborative behaviors in a joint R&D project?</i>	<i>How does the nature of the R&D project influence knowledge sharing between partners?</i>
Theoretical contribution	Knowledge transfer as a socially embedded process in joint R&D projects		
	Power as an essential factor for knowledge creation (Ekbia & Kling 2003, Lawrence et al. 2005, Peci et al. 2009), especially in innovation (Easterby-Smith et al. 2008) and U-I relationships (Blankenburg 1998)	Behavioral impacts of a publicly promoted policy on R&D practitioners (Buisseret et al. 1995, Georghiou 2003), especially in a cluster initiative through a bottom-up, participatory approach (Diez 2001)	Dynamic view of inter-organizational knowledge transfer (Faems et al. 2005) taking into account exploratory and exploitative innovations (Jansen et al. 2006)
Practical	Provide collaborative practitioners with new insights about the conduct of joint R&D projects		

Practical purpose	Outline the leverages that individual partners can mobilize so that collaborative knowledge exchanges contribute to organizational goals while preserving inter-organizational and individual interests	Understand the rationale of the policy at hand. Outline challenges and broad policy lessons in publicly promoted clusters. Provide collaborative practitioners with new insights about the impact of the policy on their behaviors	Gain more understanding about the role of universities in different types of projects (exploration – exploitation – prospect) and about expected flows in each type of projects
Key Findings	Structural leverages: bonding, spinning-out, bridging and assimilating. Main stake: the sharing of norms following that the stimulated exchanges are integrated to the main interactions of the group (assimilation and bond) or on the contrary developed outside the collaborative research (bridges and spin-out). Relational and cognitive leverages: proposition of paths mobilizing the rules of the projects with support of the academic professor	The policy provides as set of relevant interpretive schemes. This set of rules allows the partners to have a common definition of their joint R&D project – their “Marshall Plan” project. The appropriation of the policy features is facilitated by an earmarked budget for the Competitiveness Clusters projects as well as by the early involvement of the administration	The nature of the project influences knowledge sharing by defining the expected outcomes of the project and the right ways to reach it. The analysis confirms the alignment between the nature of the projects and the specific flows as an important stake for U-I collaborations. It also shows that iterations in the nature of the project might threaten the relevancy of the designed flows

HOW DOES THE NATURE OF THE R&D PROJECT INFLUENCE KNOWLEDGE SHARING BETWEEN PARTNERS?

By answering the first two questions, I also show how the negotiations around the table – when designing MEGAPROJECT as a whole as well as during the plenary meetings of Axis-1 – shaped the R&D project: its legitimated goals and the right ways of reaching them. In the case of Axis-1 for instance, the project was defined as a typical Marshall Plan project with the goal of bringing quick concrete products on the market. In other words, it was identified as an exploitative R&D project.

The central knowledge flows between universities and firms in exploitative R&D project are the exchanges of Know-What: specifications against results. As such, the role of the laboratory is one of technical service provider with restricted experimentation. Nevertheless, because exploitative R&D projects target outcomes that are integrated into industrial settings, it requires other specific flows. In Axis-1, I observed that the definition of specifications could lead to the transfer of Know-How from the industry to the academic laboratories in order to facilitate the realization of the services and ensure the comparability of results. In informing and guiding the academic laboratory, the industrial partners enhance the relevance of the generated Know-What (characterization results for instance), while enhancing the relative absorption capacity (Lane & Lubatkin 1998) of the collaboration: the academic partners is better equipped to face future demands. A lack of access to this Know-How – in particular a lack of access to the persons that have this Know-How inside the company – can be an important source of frustration.

Likewise, the industrial partners need access to the Know-Why behind the methods used by the academic laboratories to make sure that they are actually measuring what needs to be measured. Academic partners also provide access to existing scientific knowledge: sharing of existing Know-Why about the phenomenon of interest in the project without the possibility of creating new publishable results.

By contrast, exploratory R&D projects acknowledge blocking points that are explored in the framework of the collaboration, allowing for the creation of relevant scientific Know-Why by the academic partners. Like in exploitative R&D projects, the exploratory activities required the exchanges of Know-What under the form “specifications against results”. But, in contrast to the exploitative projects, the

industrial partners were calling for the development of new scientific Know-Why around those results. This new scientific Know-Why was subsequently integrated to the development of industrial Know-How such as new lines or the elaboration of new materials. While this work is undertaken by the industrial partners alone in the exploitative projects, exploratory projects require a closer involvement of the academic partners

In the case of exploratory R&D projects, the lack of involvement of the academic partners who stick to a restricted exchange of Know-What might create frictions in the project. Likewise, I observed that the exploration needs focus: academic laboratories asked for the transfer of industrial Know-Why and associated Know-How about methods and processes in order to select the adequate research paths. In the absence of such flows, the lack of focus was experienced as a “dead weight” by the academic laboratory. Unfortunately, industrial partners might be unwilling to transfer such sensitive flows.

In the case of prospective R&D projects, the transfer of Know-How and firm-specific Know-Why from the industrials to its academic partners is less sensitive. Indeed, prospective R&D activities are characterized by a quest for fundamental understanding but this time without a clear objective of industrialization. This time, the required Know-Why concern general markets trends and the processes used by the industry as a whole and its transfer is therefore less problematic. The transfer of Know-Why from the industry to the university is nevertheless still central as it allows academics to understand the – scientific, organizational, commercial – problems that the industry faces, their causes and consequences. Other flows at hand are the direct access to scientific knowledge under the form of sets of Know-What (like a literature review) and the newly-created scientific Know-Why.

By answering how the nature of the project influences knowledge sharing between partners, I present the alignment between the nature of the project and the expected flows as an important stake for the conduct of U-I R&D projects. For instance, if a prospective R&D project does not require the transfer of Know-How from the industrial partner to its own laboratory, a lack of such flows will be deteriorating in an exploitation R&D project. As a result, partners should agree on a common

understanding about the nature of the project and make sure that its organization takes into consideration the requested flows.

If I agree with Carayol (2003) about the importance of a careful alignment during the design phase of the project, I also show that a lack of alignment can occurred during its conduct as the collaborative research experiences iteration. Such iterations can impact the role of partners, jeopardizing the negotiated terms of the project and therefore leading to frustrations and misunderstandings. In particular, I show that the iteration of Axis-1 impacted the quest of fundamental understanding that was implicitly negotiated at the beginning of the project and restricted the academic researchers in their exploratory work. I also show that iterations can be experienced as highly emotional events, influencing the rest of the collaborative work by reinforcing the interpretive schemes that guided the pivot. In the case of Axis-1, the iteration acted as a **“boomerang”** that drove the team away from its original – straightforward – targets, challenging the original alignment of interests and subsequently leading to frustrations and divestments in the project.

9.2.2 KEY FINDINGS

CHAPTER 6 – CONFIGURATION IN THE FLESH

This chapter sheds some light on the way program configuration affects community identification and learning objectives (Autio et al. 2008) through its influence on collaborative behaviors. An important theoretical contribution ensues: the six criteria resulting from our analysis can be used to compare and characterize publicly promoted clusters, thereby contributing to a comparative approach of clustering initiatives. Indeed, the concept of cluster is quite ambiguous in the literature (Nishimura and Okamuro 2010), suggesting the need for tools that facilitate the comparison of clustering initiatives and related theoretical contributions.

For instance, Nishimura and Okamuro study a Japan’s clustering initiative and find that *“participation in the cluster project alone does not affect R&D productivity of firms”* (2010 p. 22), thereby urging for the creation of additional links outside the cluster. Using the six criteria, one can see that this policy is characterized by a promoted network configuration, a spontaneous emergence of the clusters and flexibility in terms of membership but without emphasis on cross-fertilization. The

latest characteristic might be an important contingency factor of clustering initiatives and explain the specific finding of Nishimura and Okamuro (2010), thereby limiting its transferability to other policies.

As a result, future research on cluster initiatives might benefit from comparative studies building on the six identified criteria. Particularly, the comparison between the Walloon initiative and the ones that inspired the Walloon Government – like the French Competitiveness Clusters – might shed some lights on the specificities of each cluster policy. Indeed, even if the French initiative shares with the Walloon Competitiveness Clusters the same name and definition – the combination on a given territory of companies, training centers and research units which engage in partnerships to create synergies around innovative joint R&D projects and experience critical mass that allows for international visibility – a preliminary comparison allows identifying important differences (see Table 34).

TABLE 34 A PRELIMINARY COMPARISON OF WALLOON AND FRENCH POLICIES

Target	Walloon Competitiveness Clusters	French Competitiveness Clusters
Promoted pattern	Organized network configuration	Organized network configuration
Division of scope	Cross-fertilization	Cross-fertilization
Emergence process	Combination of technocratic selection & bottom-up approach	Bottom-up approach
Membership	Require a balanced involvement of actors	Require a balanced involvement of actors
Financial tools	Dedicated R&D projects funding	Channel to existing subsidization sources
Critical mass	International competitiveness and visibility	Flexible: From regional competitiveness to global competitiveness & visibility

First, the French Competitiveness Clusters emerged following a bottom-up approach (Bayenet & Wunderle 2009). The success of the call for Clusters influenced the French Government project: while it originally targeted the creation of 15 Clusters, more than 70 networks finally emerged as Competitiveness Clusters. Today, 77 Clusters exist but only 7 have a critical mass that allows for global competitiveness and therefore really match the original definition of the Competitiveness Clusters. By contrast, the Walloon Government bet on a combination of technocratic selection to ensure international competitiveness and visibility with a bottom-up approach in order to actively involve the actors from the identified areas.

The comparison also allows identifying a third criterion of major importance: the financial tool of the cluster initiative and, in particular the existence of a regional earmarked budget instead of a channel to existing sources like in the French initiative (Weil & Fen Chong 2008). Indeed, we saw in this doctoral work that the identity of the joint R&D project as a Marshall Plan project acted as a generator of norms. Therefore, it might be interesting to compare the Walloon case to the collaborations actually conducted in France in the absence of such phenomenon.

Beyond the comparison of specific configurations, future research should also track key performance parameters over time and explore the specific and combined effects of the policy features. In particular, the exploration of promoted cross-fertilization might shed some light on the role of public policies in overcoming the “cost of openness” in a given network: the reduction of transaction costs within a cluster (Lorenzen and Foss 2003) at the expense of external relationships (Maskell 2001). Policy makers would also benefit from empirical works on the way the investing region actually benefits from the Competitiveness Clusters in terms of opportunity identification for existing firms and new ventures.

CHAPTER 7 – THE BOOMERANG COMPLEX

As expected, Chapter 7 contributes to a dynamic view of inter-organizational knowledge transfer (Faems et al. 2005). First, I propose a new typology of joint R&D projects that builds on the burgeoning research on exploratory and exploitative R&D at stake within or between firms (Koza & Lewin 1998, Rothaermel & Deeds 2004, Jansen et al. 2006) while taking into account the specificity of U-I collaborations (Stokes 1997).

Second, I show that exploitation, exploration and prospect R&D contribute in different ways to organizational strategies and inter-organizational complementarities. Exploitation R&D project targets outcomes that are integrated to industrial settings, urging for the transfer of Know-How from the industry to the academic laboratory. They allow for the strengthening of the collaborative links on the basis of complementarities refinement, for instance through the refinement of methods according to the industrial partner's requirement. In this case, the academic laboratory creates mainly Know-What concerning the samples and provides access to existing scientific knowledge. Exploration R&D also targets concrete results in industrial environment but acknowledges blocking points that are explored in the framework of the project, allowing the creation of relevant Know-Why by the academic partners. Prospect projects acknowledge the quest for fundamental understanding while transferring Know-Why about the industrial settings. In this case, the transfer of Know-How from the industry to the university was less important than the transfer of Know-Why about marketing criteria and industrial production methods.

This chapter opens interesting venues for future research. First, more work is needed concerning the transferability of such findings, in particular the exploration of similar dynamics in other industrial settings as well as in joint R&D projects that focus on “soft” disciplines and intangible economic sectors. For instance, private collaborators might belong to the service sector or to knowledge-intensive firms such as financial institutions or consultancy businesses. Likewise, academic partners sometimes belong to the faculties of Law, to business administration departments, schools of economics, etc. Second, this research area should benefit from a broader analysis of the congruence between expected and realized flows in joint R&D projects, especially if linked with an assessment of the project performance. Third, similar questions are worthy to be asked in other settings such as inter-firm R&D collaboration as well as internal projects.

CHAPTER 8 – LET THOSE WHO LOVE ME FOLLOW ME

Finally, Chapter 8 identifies four main strategies deployed by partners as well as their specific risks and stakes: *bonding*, the reinforcement of a link in the framework of the collaborative research; *spinning-out*, the creation of a peripheral research

between participants; *bridging* towards external actors and finally *assimilating* through the integration of new human resources to the project. Such links are brought to the collaboration through the closure of critical events. They address dissatisfactions about the conduct of the project by stimulating knowledge exchanges but are also used by actors to shape the direction and usefulness of the flows by taking organizational interests into account.

While front-line researchers are not involved in the closure of critical events, they contribute to the translation by defining the set of possible actions: qualifying the explored paths through the generation of scientific results and proposing new direction that are subsequently granted or dismissed by managers. In the latter case, the institutional and physical separation of the actors allow for sidetracking at the benefit of diverse interests: contribution to the project in spite of the dismissal of the solution and/or contribution to organizational interests in terms of knowledge-based products. Future research should focus on the performance of such strategies as well as the link between sidetracking and the management style adopted by project managers.

Finally, this chapter provides an operational framework to study interest alignment and power exercises. By focusing on critical events, it allows observing the modalities that are the most relevant in the project, their reinforcement through closure as well as the interests served and disserved by the process. If critical events provide the norms that legitimate the decisions within the project, they also shape expectations in terms of future actions and more generally about the philosophy of the collaboration. When such expectations are unmet or, in other words, when a participant feels that the social contract is bound to be broken, the resulting dissatisfaction is rarely brought on the table, especially when the discontented participant is a front-line researcher. Unfortunately, front-line researchers are also the most unstable actors in terms of interest alignment. As a matter of fact, U-I R&D projects suffer from a high turnover of academic researchers which could be moderated by a specific management of the alignment process either in the main collaborative research or through peripheral subprojects. As a result, more work should be done about the factors leading to such a successful alignment.

9.2.3 SYNTHESIS

On the basis of the three empirical chapters and their dedicated research questions, a number of transverse conclusions can be drawn. First, this work shows that the role of universities in the innovation process is even more various than supposed by the interactive models of innovation. In a world where innovation policies are still highly influenced by the linear model (Godin 2006), it is important to testify about the variety of roles taken by universities and the points of attention that need to be carefully organized when launching University-Industry collaborations.

Secondly, the case that has been studied highlights that such University-Industry collaborations should not be undertaken to speed up the experimentation process: the coordination of R&D tasks, the concrete exchanges of samples and even the transfer of information under a standardized form would counteract such a goal. Instead, joint R&D projects should be used to access unique competences as well as alternative ways of doing a research. As proposed by the structurationist lens, the overlapping of structures should allow the possibility “*to act otherwise*” (Giddens 1984) in which “*lies the potential for innovation, learning and change*” (Orlikowski 2000). As such, differences should be promoted instead of minimized.

Thirdly, when combining firms and academic labs in a joint project, the search for a compromise should be favored over the search for a consensus. As an example, exploitative R&D project might benefit from the intervention of an academic lab when specific competences are needed or when a quick access to the knowledge bases is required. Because exploitative projects rest on a quest for the right design, the quest for understanding should be negotiated under the form of a compromise.

Finally, the building of a compromise should take into account the organizational interests of the partners around the table, as well as the interests of the front-line researchers who will undertake the research work. As seen in Axis-1, the high turnover of front-line researchers strongly delayed the project. The search of compromises as urged supra should therefore also include the individual level.

In order to reach those objectives, I propose the combination of two tools:

(1) The definition of a joint identity for the main collaborative research as more than the connection of the parent organizations. In the case of the Competitiveness Clusters, partners are members of a Marshall Plan project; they are more than members of an organization who happen to work on a joint R&D project. A joint identity allows recognizing the specificities of each member and their particular contribution to the collaborative research. It also allows binding people together and helps the emergence of shared interpretive schemes about the roles and duties of each member.

Such a collective understanding can be very efficient to channel collaborative actors towards a common goal but it also **creates a blueprint which impedes alternative thinking**. In Axis-1 for instance, I show that it sometimes acted as an obstacle not only for the emergence of alternative paths but also for the recognition of alternative solutions. For that reason, a strong identity of the main collaborative research could be combined with peripheral projects.

(2) The peripheral projects is a sidetracked research that would allow for compromises while taking the front-line researchers into consideration. It might be interesting in exploitative R&D project when the quest for understanding is negotiated outside the main collaborative research, in explorative R&D project when the confidentiality agreements threaten the publications of findings or even in prospective projects when the partners identify concrete outcomes. Peripheral projects might also be desirable in order to escape the strong interpretive schemes of the main collaborative research and, instead, explore alternative paths.

In fact, one of the main advantages of the situated approach developed in this thesis is to make visible the rules mobilized by MEGAPROJECT's actors in action, thereby identifying the relevant structuring processes of the project. In this case, the Competitiveness Cluster policy and the Marshall Plan of Wallonia had a decisive influence by two complementary ways. On the one hand, the appropriation of the policy configuration generated norms such as "the urge to get something that works at the end of the project" and "the need to focus on plasma surface treatment" which, in turn, provided the legitimacy of the decisions within the project. On the other hand, the Marshall Plan was used as an incantation, a metaphor (Wallemacq 1998)

mobilized to express the ideal of the collaboration and how it should evolve, thereby lubricating social interactions. But, conversely, it also provided chances of clash when expectations were not met: “the Marshall Plan, what a bullshit”.

In my opinion, the central contribution of this work is therefore to propose the Structuration Theory not only as an integrative framework but also as a tool for studying U-I knowledge transfer through a situated approach. Such a perspective draws the attention of researchers and their readers away from the mainstream “one-way flow” conceptualization of U-I knowledge transfer and rather present U-I knowledge creation as an embedded, situated action. As expressed by Anderson (2003): *“cognition is, rather, a situated activity and suggests that thinking beings ought therefore be considered first and foremost as acting beings”*. As a result, the next section presents managerial contributions: the practical recommendations that acting beings (managers, researchers, academic professor and policy makers) can mobilize in their work.

9.3 MANAGERIAL CONTRIBUTIONS

When discussing the outcomes of the thesis in terms of managerial implications, I faced a dilemma that the researchers studying public policies and their instruments have met before: as researchers, should we provide normative recommendations on the basis of our findings or should we refuse a normative role and instead define our contribution in terms of bringing an account of its impact on social actors? Especially when working on a single case like MEGAPROJECT, should I seek for generalization or instead recognized the specificities of the findings?

The insights that are developed in this thesis build on a single case, MEGAPROJECT. Nevertheless, the richness of the case provides insights that, in my opinion, shed new – **modest and complementary** – light on the objects that practitioners handle daily: the Competitiveness Clusters, the joint R&D projects and the interactions inside them. In this section, I therefore share the insights that might broaden the understandings of practitioners. Without having the ambition to bring normative answers, I merely call attention to some points of interests and suggest directions for further explorations.

In this work, I align with Amblard and his colleagues (1996) about the role of researchers in Management: to instruct organizational actors so that they make better decisions. By providing new substantive models that reflect the interpretive processes at stake in the joint R&D project, I therefore allow actors to have a fresh look on their daily collaborative practices and partners: to make sense of otherwise confusing actions. At the policy level, I also want to contribute to the “*knowledge base necessary for designing innovation policy*” (Fagerberg & Verspagen 2009): I want to highlight potential pitfalls in the Walloon cluster initiative so that policy makers may learn from this case.

In this section, I therefore present the practical contributions of the thesis: on the one hand five implications for policy makers and on the other hand five recommendations for collaborative practitioners – the participants in joint R&D projects. Finally, I identify the alienating structures that shape the work of researchers in today’s universities. While those recommendations are parts of a thesis in management and are presented under this formal format, their diffusion to practitioners might benefit from an alternative medium such as training sessions or presentations.

9.3.1 POLICY MAKERS & PUBLIC AUTHORITIES

First, this work shows that the Competitiveness Clusters impacted the partners of MEGAPROJECT by creating strong interconnected links. Because partners share existing collateral assets but also develop competences as needed by the project, the partnering network might experience a “lock-in”: once investments are made according to the consortium choice, a lock-in may prevent local firms from experiencing alternatives and opening new paths. This lock-in phenomenon might impede the future development of the investing region. For that reason, public authorities should explore in more depth this “dark side” of cluster initiatives.

Indeed, I witnessed a positive bias towards regional cluster initiatives, not only in Belgium but worldwide. As an example, the US National Academies, specifically its division on Policy and Global Affairs²¹ held two important conferences on clusters:

²¹ <http://sites.nationalacademies.org/pga/index.htm>

the first one in June 2009 and the second one in February 2010. Both conferences provided opportunities to exchange best practices (i.e. OCDE 2007), to present success story and to enhance the visibility of local initiatives. Nevertheless, not a single presentation directly addresses the lock-in phenomenon. I am not saying that clusters should not be supported but that policy makers might benefit from further works on such side-effects.

Link to the risk of lock-in, Chapter 6 highlights two specific challenges arising from the Competitiveness Clusters policy: due to the risk of decreased attractiveness of the Competitiveness Clusters after the innovative phase, local authorities should (1) make sure that the exploitation of the R&D projects effectively benefits the investing region and (2) provide mechanisms that favor path-breaking thinking.

The first challenge calls for a debate about what constitutes a “benefit in the investing region” for the industrial partners as well as public authorities. Indeed, the Walloon Region insisted on the creation of new activities in Wallonia: the creation of jobs and the manufacturing of the concrete outcomes in Wallonia. Instead, some industrials question that point of view. As expressed by a respondent:

We should not hide the fact that we are a multinational company which is not based in Belgium... Therefore, the criterion of job creation and creation of... it should be enlarged: the creation of Know-How instead of asking for the creation of 500 or 5000 jobs in Belgium. (...) I am convinced that it is a fabulous asset for Belgium. The state knows it, the region knows it, but it is much simpler to speak about job creation when speaking with the average man on the street.

Even during the conduct of the collaboration, discussions about the exploitation of concrete outcomes were still fuzzy. The actors focused on R&D tasks that should bring “quick concrete results”, but the question of their exploitation was unresolved. Because some industrial R&D centers refer to headquarters and production centers outside the investing region, I think that this debate is worthy to be explored.

The second challenge refers to the flexibility that is needed to “break the path” while knowledge transfer and competence building inside a joint R&D project require strong ties between actors. Inside MEGAPROJECT, prospective R&D projects helped identifying promising economic areas but they were also channeled by the consortium choices and the Competitiveness Clusters areas of foci. Due to the risk

of decreased attractiveness of the Competitiveness Clusters after the innovative phase, public authorities could explore additional mechanisms that would favor path-breaking thinking. At the Cluster level, mechanisms about the emergence of new Competitiveness Clusters might be investigated. A potential direction is the dynamics between Regional Clusters and Competitiveness Clusters, from regional to global competitiveness. As a matter of fact, some clusters such as the Infopole (the ICT Regional Cluster of Wallonia) are working on the development of their critical mass to become a Competitiveness Cluster. Likewise, the transformation of the old Competitiveness Clusters should also be investigated.

Building on the key findings of the thesis, policy makers could also benefit **(3)** from the six criteria identified in Chapter 6 to better discriminate between initiatives. Indeed, as expressed by Asheim and Isaksen (2002), “it is important, analytically *as well as politically*, to distinguish between different types of RIS” (emphasis added), including regional clusters. As a result, a tool that allows for the comparison and interpretation of findings related to past or coming initiatives is important for researchers invested in that field as well as for the practitioners that actually design the policy.

In Chapter 7, I draw attention to an important shortcut in the definition of joint R&D projects as proposed by the Walloon Government: “*those projects either target the **concrete realization** of industrial applications within three years, or the building of a **prospective** vision about a given theme as a way to ensure the competitiveness of industrial members of the cluster*” (Gouvernement Wallon 2005). More precisely, I mobilize the literature on dynamic R&D (i.e. Koza & Lewin 1998, Rothaermel & Deeds 2004, Jansen et al. 2006) to underline that realization projects might be driven by complementary but distinct engines: exploitation and exploration. As a result, public authorities could **(4)** refine their definition of U-I joint R&D projects and benefit from a better understanding of the innovation dynamics that drive each type of project.

The typology developed in Chapter 7 might also be used by public authorities as a “new pair of glasses”, a new way of looking at the projects, their specific stakes and challenges. It also highlights the various roles that an academic laboratory can play in joint R&D projects, thereby reinforcing the interests of the interactive model of

innovation as well as the Triple Helix: in contrast to the linear model, basic science is not necessarily the driver of innovation but it might support it alongside the main chain of innovation.

Finally, this work highlights that the role of the authorities as “animators” (Diez 2001), in other words as a generator of norms for local agents, was favored by the financing of R&D projects: the Competitiveness Clusters policy provided collaborative practitioners with a structure to materialize the potential partnerships and to appropriate the new set of rules.

Because the generation of norms implies their appropriation by practitioners in action, public authorities (5) can influence this appropriation through two main leverages:

- Obviously through the *ex-ante* writing of the policy: the definition of the field of action, in this case the joint R&D projects in the Competitiveness Clusters. As a matter of fact, it supports the relevance of the fourth proposition.
- In the field, through the reinforcement of the ideal of the policy through direct interaction with the collaborative practitioners.

In the case of MEGAPROJECT, the administration played an important role in the field. As confirmed by Fallon and Delvenne (2009), the administration was invited since the early meetings of project evaluation in order to identify the potential blocking points in function of their own lens. One important challenge therefore consists in a careful alignment between the ideal of the policy as intended by policy makers (and more broadly by the government) and its interpretation by the administration in charge with the concrete implementation of the policy: the monitoring of the calls for projects, the allocation of resources, the audit of allocated subsidies and so on. This recommendation is all the most important in the case of the Walloon Competitiveness Clusters: in Fallon & Delvenne (2009), the authors also show that the Walloon Government largely casted aside its administration when defining the policy. Particularly in MEGAPROJECT, it resulted in important delays and tensions during the launch of MecaTech and its first R&D projects.

9.3.2 COLLABORATIVE PRACTITIONERS

The mobilization of interpretive schemes and norms is identified as an important stake in this work. Chapter 6 focuses on the generation of such interpretive schemes for the design of MEGAPROJECT and Axis-1 while Chapter 7 and Chapter 8 show their mobilization in power exercises, in particular in the critical events related to the nature of the project: the iteration from exploitation to exploration as well as the legitimacy of peripheral projects and their links with the main collaborative research.

As a result, managers in joint R&D projects should **(1)** rethink their work as proposed by Tywoniak (2007): “*not as directing other people, but as enabling the performance of collaborators by shaping the organizational context (rules, values, boundaries)*”, or in this case by shaping the inter-organizational context. In Axis-1, the managers implicitly played this role: they shaped the boundary of the collaborative research, defined the relevant interpretive schemes such as the fact that research activities should be “realistic” and “interesting for the project”, namely Axis-1. By rendering this role explicit, I hope to modestly enhance the visibility of such leverages. I also remind that the sharing of norms or even the development of a joint understanding about the project is not taken for granted and that the cohesion of the collaborative research might benefit from a more systematic examination of such leverages.

Such a conceptualization of management is particularly interesting in multi-partner projects when contributors belong to external organizations and therefore come under another hierarchy. Nevertheless, potential traps should be acknowledged such as the risk of “clash” when the discursive rules and values are not actually promoted in the field. The case under study also renders explicit another downside of such process: the norms and values that drive the collaborative research also define its limitations. As shown in Chapter 8, a collective understanding can be very efficient to channel collaborative actors towards a common goal but it also **creates a blueprint which impedes alternative thinking**. For that reason, a strong identity of the main collaborative research could be combined with peripheral projects in order to create alternative paths.

In Chapter 8, I identify bonds, spin-outs, assimilations and bridges as interesting strategies for knowledge transfer inside the joint R&D project. In this context, the management of the project's boundaries is of particular importance: privileged links between participants of the project can be either bonds or spin-outs, with their specific stakes and difficulties, depending on the negotiated boundaries. In particular, the role of spin-out between participants of the main collaborative research should be highlighted. By creating spin-out, partners create new opportunities for exchanges and, more importantly, alternative ways of exploring the phenomena under study. Indeed, the main competitive advantage of universities as a research partner is *"their competence in generating new original findings and new approaches to problem solving"* (Debackere & Veugelers 2005). As a result, **(2)** opportunities for creative thinking should be stimulated by the use of spin-outs that escape the definition and ways of doing of the main collaborative research.

Finally, the typology of R&D activities explored in MEGAPROJECT provides a new way of looking at the projects along with three specific recommendations. First, I show that the alignment between the nature of the project and the expected flows is an important stake of the U-I collaboration. Therefore, collaborative practitioners could **(3)** use the resulting check-list to organize their future collaborative research and to defuse potential blocking points. For instance, if a prospective R&D project does not require the transfer of Know-How from the industrial partner to its own laboratory, a lack of such flows will be deteriorating in an exploitation R&D project: the academic researchers might need to get access to the industrial equipment in order to understand the constraints of the manufacturing process. As a result, partners should agree on a common understanding about the nature of the project and make sure that its organization takes into consideration the requested flows.

Secondly, I provide empirical evidence of iterations: changes in the nature of the project and dedicated flows. As a result, **(4)** partners should take into account the evolving nature of joint R&D projects and integrate in their collaborative framework the requested flexibility of roles, in particular regarding the academic partners. In Axis-1 for instance, the iteration rendered obsolete the original organization of the project as a "chain of samples" (see Chapter 7). It also affected the exploratory efforts of the academic labs, urging for a (re)negotiation about the quest for understanding.

Thirdly, this model underlines the importance of Know-Why exchanges between partners. In contrast with the literature of U-I technology transfer which focuses on the one-way flow of scientific knowledge from the university to the industry, this work highlights the transfer of Know-Why from the industry to the university: marketing criteria, production constraints, challenges for the future at the firm level in concretization projects and at the level of the industry in prospective projects. In MEGAPROJECT for instance, I observed that exploratory projects need focus: academic laboratories asked for the transfer of industrial Know-Why and associated Know-How about methods and processes in order to select the adequate research paths. In the absence of such flows, the lack of focus was experienced as a “dead weight” by the academic laboratory. Unfortunately, industrial partners might be unwilling to transfer such sensitive flows.

Likewise, partners in SP10, a prospective project, quickly realized that they were lacking information about what kind of markets could be interested, and which direction should be followed to further develop their prototypes. As a result, an additional industrial partner was brought in order to assess the relevance of the prototypes and to provide the required Know-Why (SP10_26.01.09; IND19). But the partners also recognized that the introduction of the new partner into SP10 was not taken for granted: original partners needed to be convinced of its usefulness and trustworthiness. Because such exchanges are crucial in University-Industry joint R&D projects, collaborative practitioners (5) should establish mechanisms that enable them.

9.3.3 ON THE STATUS OF ACADEMIC RESEARCHERS

In this subsection, I propose an additional recommendation that involves collaborative practitioners as well as policy makers. I address the issue of alienating structures at stake in U-I collaboration and more generally contract-based research in universities: prevailing structures that prevent researchers from self-realization and that should be exposed and transformed (Chua 1986, Orlikowski & Baroudi 1991).

In joint R&D projects, researchers have a taken-for-granted precarious position: hired on a short-term basis, they work on a project defined and launched by the head of the laboratory who provides the legitimacy of his or her employees but, nevertheless, takes distance with the on-going project to turn to the next contracts.

As a result, the project usually presents a “win-win” situation at the organizational level, in particular regarding the quest for fundamental understanding between the laboratory and the industrial partner(s). But it ignores the individual interest of the researcher who is not yet hired.

As showed in Chapter 8, front-line researchers from academic laboratories are consequently torn between project’s interests, their loyalty to the laboratory and their role as “*entrepreneur of their own human capital*” (Grabher & Ibert 2006). In Axis-1 for instance, project and organizational loyalties were not automatically aligned, and their individual interests were potentially disrupting or enhancing at both levels. The thirst to learn could be channeled either towards the project or towards the conduct of a thesis within the laboratory, but the lack of learning opportunities could also lead the researcher to look for another job, leaving both the project and the organization. This schizophrenic process led to the divestment of researchers who sometimes even left the project.

However, academic researchers are important contributors in the joint R&D project: they define the set of possible actions through the qualification of explored paths and the proposition of new direction (see Chapter 8). Some researchers are also highly motivated people who are ready to face a precarious social status for the possibility to learn and to contribute to scientific progress, in this case in collaboration with the industry. But this motivation is also unstable as highlighted by the high turnover of academic researchers not only in MEGAPROJECT but in U-I collaborations in general.

As a result, a deeper debate about the status of academic researchers should be initiated, involving collaborative practitioners as well as policy makers and more generally public authorities. In the meantime, public authorities should support sidetracking in U-I knowledge transfer, not only to transform it into spin-outs through the (re)connection with a partner but also for the self-realization of academic researchers. It should benefit the academic researcher but also U-I collaboration through the retaining of talents.

9.4 LIMITATIONS

In this section, I highlight the main limitations of this work and propose ways to tackle them. Thereby I recognize that limits are also enablers of the research: it defines the methodological and theoretical choices that guided the research (mainly the exploration of Q1) but, at the same time, it also channels the exploration efforts. By identifying such limitations, I therefore also unlock future research paths.

The first limitation is related to the unit of analysis chosen to address the research questions. By defining the case as the collaborative research, I focus on knowledge transfer within the project rather than through the project (Jiang & Li 2009). I explore what can be learned within a project and how project's members make sure that the newly-created knowledge is relevant for the parent organization. While it is important to understand those formal relationships in depth (Broström 2010, Núñez-Sánchez et al. 2010), *“whether these relationships create learning for a few individuals or whether the learnings are diffused throughout the organization”* (Cyert & Goodman 1997) still needs to be investigated. As expressed by Bruneel et al. (2010): *“although focusing on project-level interactions can uncover important issues arising from exchanges within a project, the limitation is that it captures information on only one among what may be a portfolio of projects”*. An alternative level of analysis – the organization (laboratory or company) – should allow tackling this limit by taking into consideration the whole portfolio of joint R&D projects.

Second, this work does not tackle a question of great importance for the research community as well as for practitioners and policy makers (Núñez-Sánchez et al. 2010): the evaluation of collaborative projects and, more particularly, the performance or efficiency of knowledge transfers between partners. From the political perspective adopted in this work, bites of answers can be found in the degree of joint satisfaction for the diverging interests (Pichault 2009); as a matter of fact, the difficult alignment of interests for front-line researchers as highlighted Chapter in 7 and Chapter 8 might point to a weak performance of Axis-1. Nevertheless, this work should benefit from complementary perspectives (Pichault 2009) such as the degree of realization of initial objectives and the degree of integration of existing knowledge. The joint R&D project and subsequent

knowledge transfer might also be investigated through survival analysis, with a focus on the link between characteristics and performance.

Thirdly, I decided to focus on the dynamics between universities and firms, thereby neglecting the power relationships between firms. Nevertheless, an analysis of inter-firm interactions might be particularly interesting, especially in the case of MEGAPROJECT when multiple industrial partners cooperate. Those firms, big and small, are not competitors at the beginning of the project but the development of competences and the sharing of knowledge might fill in original differences. The case of glass and steel products is quite obvious: even if, at the beginning, the surface producers compete on different markets, the development of surfaces with similar properties (like for instance indoor antibacterial surfaces) might trigger an unexpected competition. As a result, the dynamics at stake in joint R&D projects might benefit from the literature on strategic alliances (i.e. Doz & Hamel 1998, Koza & Lewin 1998, Das & Teng 1999, Alvarez & Barney 2001).

Finally, one might question the choice of the Structuration Theory as an adequate framework to study U-I knowledge interactions. Indeed, the formalization of the Structuration Theory in the seminal book “the Constitution of Society: outline of the Structuration Theory” (Giddens 1984) was followed in the late 80’s by enthusiastic supporters as well as virulent detractors. In fact, three central critics are addressed to Giddens’ work.

First, some scholars point to the omelette-like nature of the Structuration Theory (Zhu 2006), insisting that “*his work is not just wide-ranging and diverse but shallow and eclectic*” (Giddens & Pierson 1998 p. viii). When referring to the role of the unconscious in the Structuration Theory, Willmott (1986) for instance is critical of Giddens’ work for its easy surrender of human actors to the ontological security of routine (Whittington 1992).

Second, critics are triggered by the ambition of Giddens to realize the micro-macro-transition: to overcome the dualism between voluntarism and determinism and to rather propose a duality of structure where “*structural properties of social systems are both the medium and outcome of the practices they recursively organize*” (Giddens 1984 p. 25). By doing so, Giddens invites critics from both end of the spectrum. As expressed by Archer (1996 p.86), the Structuration Theory “*oscillates*

between the two divergent images it bestrides: between (a) the hyperactivity of agency, whose corollary is the innate volatility of society, and (b) the rigid coherence of structural properties associated with the essential recursiveness of social life". Archer finally argues that Giddens' support of a methodological bracketing focusing either on the analysis of strategic conduct or on the analysis of institutions *"merely transposes the dualism from the theoretical to the methodological level"* (Archer 2010 p.237).

Third, the virtual nature of structures has been an easy target of critics based on the argument that if structures are only instantiated in action, they are a product of contemporary practices and are therefore unable to account for the effects of past social practices (see Jones & Karsten 2008). For Whittington (1992), this particular criticism – the conflation of action and structure – is misplaced and neglects the continuity of instantiated structures as memory traces in people's mind. In this work for instance, I was able to grasp the superficial manifestations of structures through the modalities used during critical events as well as the modalities that had a latent reality but were not mobilized in the critical events. See for instance the Event 27 (Notes_11.09.08) as described in Chapter 8 (p. 275-276) where the academic professor decides to mobilize modalities that are legitimate from the point of view of the project managers, even if he is driven by an interest for fundamental understanding.

In the 90's, the literature on the Structuration Theory took an important turn, from critical assessments to empirical implementations. This wave is supported, among other things, by the Information System research community with scholars such as Orlikowski, Sahay or Walsham (i.e. Orlikowski & Robey 1991, Orlikowski 1992, Brooks 1997, Sahay & Walsham 1997, Barrett & Walsham 1999). In the late 90's and beginning of 2000, it was followed by essays in the field of Strategy and Organization (Pozzebon 2004) with works such as Hargadon and Fanelli (2002), Phillips et al. (2000), Sydow and Windeler (1998) and of course Orlikowski (2002). This doctoral work is in line with those authors who draw on Giddens' work *"in a sympathetic, but critical fashion"* (Jones & Karsten 2008 p. 146). Indeed, I acknowledge and account for the difficulties of the Structuration Theory when using it to explore U-I relationships and subsequent knowledge transfers.

9.5 FINAL WORDS

To conclude, I confirm the theoretical and practical interests of a situated approach of U-I knowledge transfer. I also present the main contributions of this work in terms of theoretical advances and managerial contributions while acknowledging its limitations. In particular, I provide practitioners with new “pairs of glasses”, new ways to look at the practices at stake in University-Industry collaborations. I hope that it will effectively bring more understanding, practical solutions or tools to make better decision and support the self-realization of partners in the joint R&D projects.

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APPENDICES

APPENDIX 1: GLOSSARY AND ACRONYMS

AB: Antibacterial. Axis-1, the collaborative research studied in this work, is composed of two subprojects: “Antibacterial” and “Self-Cleaning” following the targeted properties of the research.

ACAx: When I cite or refer to industrial respondents, I use (INDx), while I use (ACAx) for academic respondents. See appendix 5 for an exhaustive list of data sources.

Axis-1: the central case studied in this work is a collaborative research named Axis-1. Axis-1 is a subpart of MEGAPROJECT and is itself composed of two subprojects: “Antibacterial” and “Self-Cleaning”. Both subprojects have dedicated legal agreements, resources and deadlines but the majority of partners worked on both sides and considered Axis-1 as one project.

CR: Research Center.

DRX: “Diffraction par Rayon X”. X-Ray Diffraction is a specific analysis technique.

EVLN: Exit-Voice-Loyalty-Neglect is a model developed by Hirschman (1970) to describe individual reactions to organizational decline. Faced with dissatisfaction at work, employees can leave the firm (Exit), remain loyal to the managerial team and hope for the best (Loyalty) or try to be heard by the board and negotiate some kinds of solutions (Voice). A fourth responses, neglect or apathy, was developed afterward (Rusbult et al. 1982) to reflect the situations where the discontented individual distances himself from organizational interests without actually addressing the problem.

HV: Helicopter view, the annual team building event of MEGAPROJECT.

INDx: When I cite or refer to industrial respondents, I use (INDx), while I use (ACAx) for academic respondents. See appendix 5 for an exhaustive list of data sources.

I: Industry.

I => U: Sharing of industrial knowledge with the academic partners.

IP: Intellectual Property. A product of the intellect that has commercial value, including copyrighted property such as literary or artistic works, and ideational property, such as patents, appellations of origin, business methods, and industrial processes (The American Heritage, Dictionary of the English language).

ISR (or **ISL**): Industry-Science Relationships or Industry-Science Links.

KBV: The Knowledge-Based View of the firm is a perspective that arose in opposition with the transaction cost theory (Nahapiet and Ghoshal 1998) and which proposes *"that a firm be understood as a social community specializing in the speed and efficiency in the creation and transfer of knowledge"* (Kogut and Zander 1996 p. 503).

KT: Knowledge Transfer.

KVA: Knowledge Value Alliance. In their search for a relevant unit of analysis for research project evaluation, Rogers and Bozeman (2001) propose the Knowledge Value Alliances: *"an institutional framework binding together, in a knowledge covenant, a set of directly interacting individuals from multiple institutions, each contributing resources in pursuit of a transcendent knowledge goal"*.

MEGAPROJECT: MEGAPROJECT is a joint R&D project associated with MecaTech, the mechanical engineering Competitiveness Cluster. It brings together more than 20 partners: 12 firms, 7 universities and 3 semi-public research centers. This mega-project is part of the first call for projects of the Competitiveness Cluster; it was even considered by the respondents as the main structuring tool of MecaTech. It was also constructed as a portfolio of project: Axis-1 is a subpart of MEGAPROJECT.

MNC: Multinational Corporation.

P <=> P: Exchanges between Partners.

PV: Minutes of plenary meetings.

Q1: How does power exercise between partners influence value creation for the parent organizations in terms of knowledge transfer? This research question is developed in Chapter 8.

Q2: How did the Competitiveness Cluster Policy influence the collaborative behaviors in a joint R&D project? This research question is developed in Chapter 6.

Q3: How does the nature of the R&D project influence knowledge transfer between partners? This research question is developed in Chapter 7.

R&D: Research and Development is the “*creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications*” (OCDE 2002).

RBV: Resource-Based View.

SC: Self-Cleaning. Axis-1, the collaborative research studied in this work, is composed of two subprojects: “Antibacterial” and “Self-Cleaning” following the targeted properties of the research.

SME: Small and Medium Enterprise.

SP: Subproject.

TiO₂: Titanium Dioxide. “*When TiO₂ absorbs UV light, very strong oxidation power is produced, decomposing most organic compounds adsorbed on its surface. Such a photo-induced reaction is called **TiO₂ photocatalysis** (Fujishima et al., 2000a). Since **TiO₂-coated materials** can achieve clean conditions only with sunlight and rainwater, without using any chemicals, they do not require large facilities, maintenance, or experience for their utilization, and can actively **contribute to environmental preservation**” (Baba et al. 2010, emphasis added). For those reasons, self-cleaning and antibacterial TiO₂-coated materials were developed in Axis-1.*

TTO: Technology Transfer Officer

U: University.

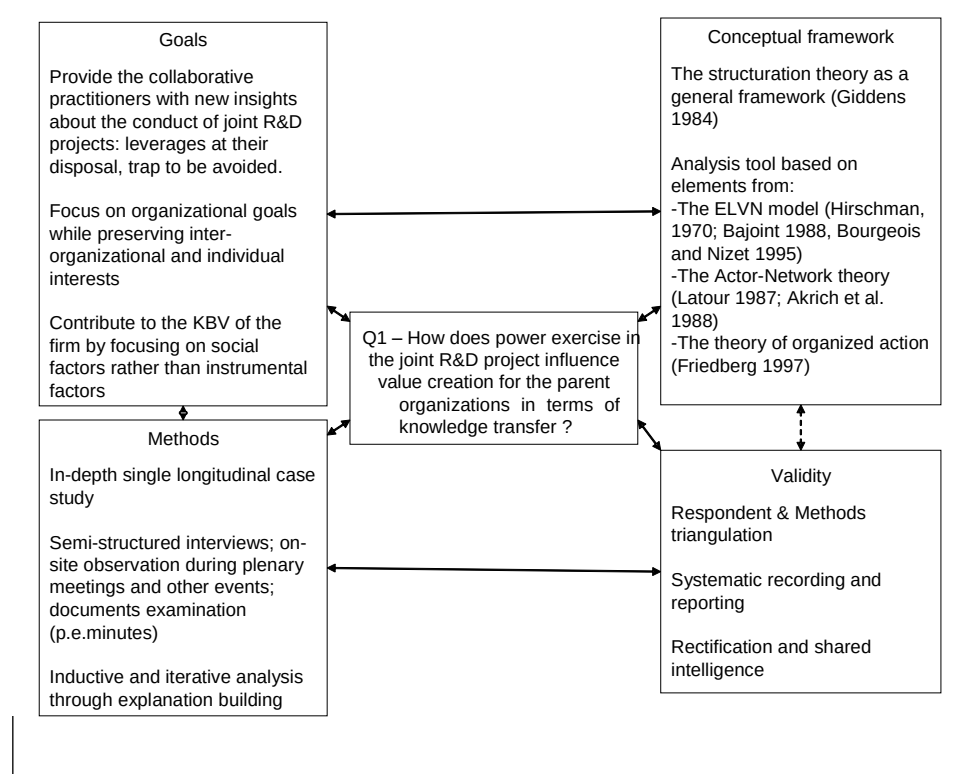
U <=> I: Exchanges between the research institutions and the industrial partners.

U => I: Sharing of academic knowledge with the Industrial partners

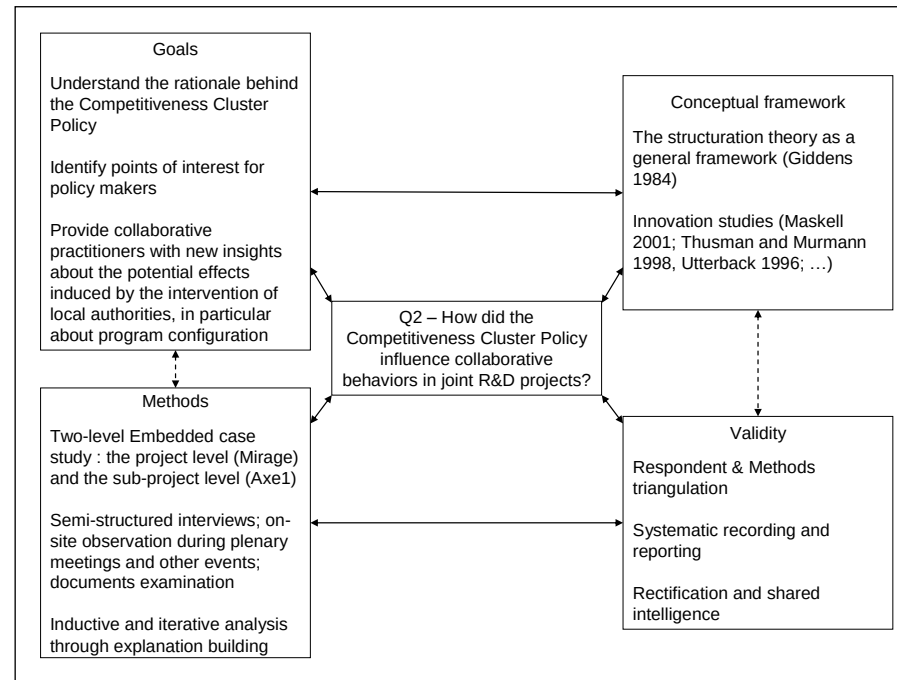
U-I: University-Industry.

UIR: University-Industry Relationships.

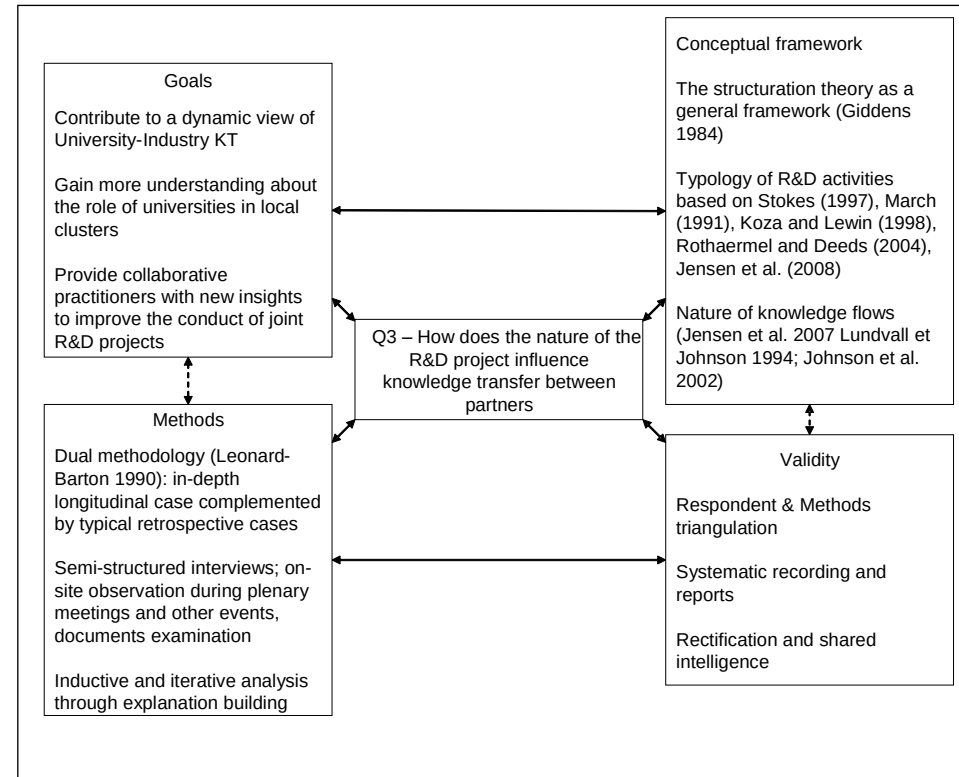
APPENDIX 2: QUALITATIVE RESEARCH DESIGN FOR Q1



APPENDIX 3: QUALITATIVE RESEARCH DESIGN FOR Q2



APPENDIX 4: QUALITATIVE RESEARCH DESIGN FOR Q3



APPENDIX 5: DATA COLLECTION METHODS AND SOURCES

Principle	Method	Source Identification	Respondent's description			Caption
Enquiry	Semi-structured interviews	Respondent	Function	Data	Level	<i>Function</i> FL : front-line researcher A : academic professors M: managers R&D: R&D coordinator TTO: technology transfer <i>Data</i> VT : Verbatim transcription WR : Written Report <i>Level</i> MEGAPROJECT SPx: Subproject x Axis-1
		IND5	R&D	VT	MEGAPROJECT	
		IND2	R&D	VT	MEGAPROJECT	
		IND4	R&D	VT	MEGAPROJECT	
		ACA1	A	WR	MEGAPROJECT	
		IND22	FL	VT	Axis-1	
		IND8	M	VT	Axis-1	
		ACA7	FL	VT	Axis-1	
		ACA6	FL	VT+WR	Axis-1	
		ACA3	A	VT	Axis-1	
		IND6	M	WR	Axis-1	
		ACA8	FL	VT	Axis-1	
		IND9	FL	VT	Axis-1	
		ACA13	FL	VT	Axis-1	
		IND7	FL	VT	Axis-1	
		IND18	M	VT	SP7	
		IND21	R&D	VT	SP10	
		TTO1	TTO	WR	MEGAPROJECT	
		IND15	R&D	VT	MEGAPROJECT	
		TTO2	TTO	WR	MEGAPROJECT	
		ACA10	FL	VT	Axis-1	
		ACA11	FL	VT	Axis-1	
		ACA12	FL	VT	SP7	
		IND19	FL	VT	SP7-SP10	
		IND20	FL	VT	SP7	
		ACA14	FL	VT	SP9	

Principle	Method	Sources Identification	Observed event's description	Caption
Experiencing	Observation	HV_10.09.08	Observation and animation during the Helicopter Views (team-building events)	EVENT_dd.mm.yy
		HV_16.10.09		
		Note_05.07.07	Observation and note taking during the plenary meetings of Axis-1	
		Note_11.09.07		
		Note_17.12.07		
		Note_01.02.08		
		Note_18.03.08		
		Note_21.04.08		
		Note_07.07.08		
		Note_11.09.08		
		Note_22.10.08		
		Note_01.12.08		
		Note_27.01.09		
		Note_01.04.09		
		Note_23.07.09		
		NoteIP_08.09.09		
		Note_10.09.09		
		Note_11.05.10		
		Note_02.08.10		
		CREAWAL_13.10.07	Observation during Creawal, in particular MecaTech sessions.	
		CREAWAL_14.10.07		
		UI_14.06.07	Observation during the University-Industry meeting organized by MecaTech	

Principle	Method	Source Identification	Document's description	Caption
Examining	Document examination	PV_27.05.07	Minutes of the plenary meetings of Axis-1	DOC_dd.mm.yy
		PV_05.07.07 + notes		
		PV_11.09.07 + notes		
		PV_13.11.07		
		PV_17.12.07 + notes		
		PV_01.02.08 + notes		
		PV_18.03.08 + notes		
		PV_21.04.08 + notes		
		PV_21.05.08		
		PV_07.07.08 + notes		
		PV_11.09.08+ notes		
		PV_22.10.08+ notes		
		PV_01.12.08+ notes		
		PV_27.01.09+ notes		
		PV_06.03.09		
		CoPil_25.03.09		
		PV_01.04.09+ notes + memo LAB5		
		PV_07.05.09		
		PV_16.06.09		
		PV_23.07.09+ notes		
		PV_10.09.09+ notes		
		PV_21.10.09		
		PV_18.11.09		
		PV_07.01.10		
		PV_10.02.10		
		PV_07.06.10		

Principle	Method	Source Identification	Document's description
Examining	Document examination	PROJET_MEGAPROJECT	Description of MEGAPROJECT (each subproject independently): description of the R&D activities, timeline, budgets, subsidies, etc.
		CA_MEGAPROJECT	Consortium agreement of MEGAPROJECT.
		DECREE	18th January 2007 Governmental Decree about Regional Clusters.
		CAPRON	Work of Prof. Henri Capron on the existing economic, technological and scientific bases of Wallonia.
		Poster1	Posters drawn by the partners of Axis-1. At the end of Axis-1, researchers from the Research Group Innovation Process proposed the “exchanger” method to capitalize on the collaborative experience of Axis-1 (see Erpicum and Chalant 2010). Partners were asked to draw the project as a journey and the resulting pictures were presented to the group during the last plenary meeting of Axis-1.
		Poster2	
		Poster3	
		Poster4	
		Poster5	
		Poster6	
		Poster7	
		Poster8	
		Poster9	
		Poster10	
		Poster11	
		Poster12	
		Poster13	
		Poster14	
		Poster15	
		Poster16	

Principles	Methods	Sources Identification	Description			Caption	
Examining	Document examination (secondary data)	Respondent	Function	Data	Level		
		IND3	R&D	WR	MEGAPROJECT		
		IND1	R&D	WR	MEGAPROJECT	<i>Function</i>	
		ACA1	A	WR	MEGAPROJECT	FL : front-line researcher	
		ACA2	A	WR	MEGAPROJECT	A : academic professors	
		IND10	M	WR	SP7	M: managers	
		IND11	M	WR	SP7	R&D: R&D coordinator	
		IND12	R&D	WR	MEGAPROJECT-	TTO:technology transfer officer	
		IND13	R&D	WR	SP7		
		IND14	R&D	WR	MEGAPROJECT-		
		CR3	R&D	WR	MEGAPROJECT	<i>Data</i>	
		IND16	R&D	WR	MEGAPROJECT	VT : Verbatim transcription	
		IND17	M	WR	MEGAPROJECT	WR : written report	
		TTO1	TTO	WR	MEGAPROJECT		
		IND18	R&D	WR	MEGAPROJECT	<i>Level</i>	
		ACA9	A	WR	MEGAPROJECT	MEGAPROJECT	
		ACA4	A	WR	MEGAPROJECT	SPx: Subproject x	
		CR4	A	WR	MEGAPROJECT		
	Interviews realized by researchers from the Research Group Innovation Process on MEGAPROJECT	SP7_10.03.08	Notes taken during the plenary meetings of SP7				
		SP7_09.06.08					
		SP7_15.09.08					
		SP9_18.03.08	Notes taken during the plenary meetings of SP9				
		SP9_17.09.08					
		SP9_30.06.09					
		SP10_07.03.08	Notes taken during the plenary meetings of SP10				
		SP10_09.10.08					
		SP10_26.01.09					

APPENDIX 6: DATA SOURCES, LONGITUDINALLY

Jan DECREE	Feb	March	April	May Kick-off MIRAGE PV_25	June U-I_14 PROJET_ MIRAGE CA_MIR AGE CAPRON	July Kick-off Axis-1 Note_5 PV_5	Aug	Sept Note_11 PV_11 IND3 IND1 IND10 CR4 ACA4 IND18	October ACA1- 2-9 TTO1-2 CREAWAL IND12 - 13-14- 16-17 CR3	Nov ACA3 IND9 PV_13	Dec Note_17 PV_17	2007
Jan	Feb Note_01 PV_01	March Note_18 PV_18 SP7_10 SP9_18 SP10_07	April IND6 Note_21 PV_21	May PV_21	June IND11 SP7_09	July IND22 ACA7 ACA6 ACA8 ACA13 Note_07 PV_07	Aug	Sept HV_10 Note_11 PV_11 SP7_15 SP9_17	October IND7 Note_22 PV_22 SP10_09	Nov	Dec Note_01 PV_01	2008

Jan	Feb	March	April	May	June	July	Aug	Sept	October	Nov	Dec	2009
Note_27 PV_27 SP10_26		PV_06 CoPil	Note_01 PV_01	PV_07	PV_16 SP9_30	IND2 Note_23 PV_23	IND5	IND8 NoteIP Note_10 PV_10	ACA10 HV_16 PV_21	PV_18	ACA11	
Jan	Feb	March	April	May	June	July	Aug	Sept	October	Nov	Dec	2010
Parental Leave PV_07	Parental Leave PV_10	Parental Leave		Closure Axis-1 Note_11 Poster1 => Poster16	PV_07	IND18 IND21 ACA12 ACA14	IND19 IND20 Note_02					

APPENDIX 7: INTERVIEW GUIDELINES

INTERVIEW GUIDELINE (1/3) – RESEARCHER

Informations propres à l'interviewé

Background scientifique:

Fonction dans le projet:

Organisation parente:

Projet :

Axe:

Sous-projet :

Phase d'introduction

Bonjour, je vous remercie de m'accueillir aujourd'hui. Comme vous le savez, je vais vous poser quelques questions au sujet de votre travail au sein du projet MEGAPROJECT.

Cet entretien fait partie d'une collecte de donnée dans le cadre de ma thèse en gestion de l'innovation. Le contenu de cette interview sera traité de façon anonyme et restera évidemment confidentiel.

J'attends de vous une information factuelle sur la façon dont le travail de recherche s'organise dans MEGAPROJECT mais également votre avis sur ce qui est mis en place pour permettre la collaboration entre les différents partenaires du projet. J'ai devant mes yeux une série de questions qui sont là pour soutenir la discussion. On ne les passera pas toutes en revue et d'autres sortiront peut être naturellement, il s'agit donc d'une discussion tout à fait ouverte.

Généralités

Pouvez-vous m'expliquer votre parcours jusqu'au ORGANISATION_PARENTE ? Vous travaillez aujourd'hui comme collaborateur scientifique sur le projet MEGAPROJECT. Est-ce la première fois que vous travaillez sur un projet de recherche incluant des laboratoires universitaire et (une ou) des entreprises ?

Selon votre expérience, qu'est-ce qui motive ces deux types d'acteurs à travailler ensemble ?

Au travers du Plan Marshall et des pôles de compétitivité, la Région Wallonne encourage ce type de rencontre. A votre avis, quels sont les objectifs de la région ?

Pensez-vous que le financement de projet multi-partenariat permettra d'atteindre ces objectifs ?

Centrage

Nous allons maintenant nous recentrer sur le projet MEGAPROJECT.

Pouvez-vous me le décrire en quelques mots ?

Vous m'avez parlé de projets université-entreprise auxquels vous avez participé. Le projet MEGAPROJECT est-il différent des projets sur lesquels vous avez travaillé ?

Vous êtes travailliez principalement sur l'axe 1 du projet MEGAPROJECT. Pouvez-vous m'expliquez les objectifs de cet axe ?

Le ORGANISATION_PARENTE n'est pas le seul laboratoire/industriel du projet, pensez-vous qu'il a un rôle spécifique à jouer dans l'axe 1 ?

Qu'est-ce que le ORGANISATION_PARENTE va apporter au projet MEGAPROJECT ?

A votre avis, que va retirer le ORGANISATION_PARENTE de cette expérience ?

Pensez-vous que les partenaires ont des attentes différentes du ORGANISATION_PARENTE vis-à-vis de MEGAPROJECT ?

Approfondissement

1. PARTAGE DU TRAVAIL AU SEIN DE L'AXE-1

Nous allons maintenant passer à l'organisation du travail de recherche au sein de l'axe 1.

Pouvez-vous me décrire les principales tâches de R&D à effectuer au sein de l'axe 1 ?

Si vous pouviez modifier cette organisation, que feriez-vous ?

Qu'est-ce que ce changement apporterait au projet ?

Le projet n'est pas figé, il évolue, ouvre des voies et en ferme. Selon vous, qu'est-ce qui détermine le choix d'une voie plutôt qu'une autre ?

2. TRANSFERT AU SEIN DE L'AXE-1

Sur base de l'organisation actuelle du travail de R&D, quelle est votre fonction dans MEGAPROJECT ?

Pouvez-vous me raconter en quelques mots une journée type de travail ?

Des partenaires sont-ils dépendants de votre travail ?

A votre avis, qu'apportez-vous au travail de ces partenaires ?

Pensez-vous que vous pourriez leur apporter plus ?

Des partenaires ont-ils un impact sur votre travail de recherche ?

Selon vous, qu'est-ce que ces partenaires apportent à votre travail de recherche ?

Est-ce que cela répond à vos attentes vis-à-vis de ces partenaires ?

Pouvez-vous me raconter une journée où vous avez vraiment eu l'impression d'avancer grâce à un partenaire ?

Dans quels autres contextes avez-vous des relations avec ces partenaires ?

Comment vous organiseriez une journée idéale partagée avec vos partenaires de l'axe 1 ?

3. TRANSFERT AU SEIN DE MEGAPROJECT

Nous avons beaucoup parlé de votre/vos partenaire(s) au sein de l'axe 1. Nous allons maintenant plutôt parler de votre relation avec les partenaires présents sur les autres axes de MEGAPROJECT.

Tout d'abord, qu'est-ce qui différencie l'axe 1 des autres axes de MEGAPROJECT ?

Est-ce que le fait d'être intégré à MEGAPROJECT apporte une valeur ajoutée par rapport à un projet qui aurait été mené de façon indépendante par l'ORGANISATION_PARENTE et ses partenaires de l'axe 1 ?

Pouvez-vous me parler d'une journée ou d'un événement partagé avec ces partenaires que vous avez trouvé enrichissant pour votre travail ?

Pensez-vous que cette journée ou événement a été aussi enrichissant pour les autres partenaires ? Pourriez-vous m'expliquer pourquoi ?

Dans quels autres contextes avez-vous des contacts avec ces partenaires ?

Pensez-vous que ces interactions sont nécessaires à votre travail ?

4. TRANSFERT AU SEIN DE L'ORGANISATION

D'autres membres du ORGANISATION_PARENTE travaillent-ils sur MEGAPROJECT ?

Travaillent-ils sur une thématique proche ?

Trouvez-vous qu'il est logique que le ORGANISATION_PARENTE soit impliqué sur ces différents axes ?

Quel type de contacts avez-vous avec eux ?

Concernant vos collègues qui ne travaillent pas sur MEGAPROJECT, ces collègues sont-ils au courant des recherches qui sont menée dans MEGAPROJECT ?

Vous aident-ils parfois sur la recherche en cours pour MEGAPROJECT ?

Quels sont vos contacts avec ces autres membres du ORGANISATION_PARENTE ?

Pensez-vous que votre travail au sein du projet MEGAPROJECT a un impact sur le travail « hors MEGAPROJECT » : le vôtre et celui de vos collègues ?

Si vous deviez quitter le projet maintenant, quelles seraient les conséquences pour ORGANISATION_PARENTE ?

Et après ? Quelles sont vos perspectives au-delà de ce projet ?

Conclusion

Pour conclure, quelles sont les conditions à remplir pour pouvoir dire « MEGAPROJECT est un succès total » ?

Si vous deviez décrire en quelques mots les aspects positifs et négatifs de MEGAPROJECT, qu'est-ce que vous citeriez ?

Notre entretien touche à sa fin, je vais essayer de résumer ce qui a été dit, si vous avez la moindre remarque à me faire, n'hésite pas à me le dire. Je vous remercie.

INTERVIEW GUIDELINE (2/3) – R&D COORDINATOR

Informations propres à l'interviewé

Background scientifique:

Fonction dans le projet:

Organisation parente:

Projet :

Axe:

Sous-projet :

Phase d'introduction

Bonjour, je vous remercie de m'accueillir aujourd'hui. Comme vous le savez, je vais vous poser quelques questions au sujet de votre travail au sein du projet MEGAPROJECT.

Cet entretien fait partie d'une collecte de donnée dans le cadre de ma thèse en gestion de l'innovation. Le contenu de cette interview sera traité de façon anonyme et restera évidemment confidentiel.

J'attends de vous une information factuelle sur la façon dont le travail de recherche s'organise dans MEGAPROJECT mais également votre avis sur ce qui est mis en place pour permettre la collaboration entre les différents partenaires du projet. J'ai devant mes yeux une série de questions qui sont là pour soutenir la discussion. On ne les passera pas toutes en revue et d'autres sortiront peut être naturellement, il s'agit donc d'une discussion tout à fait ouverte.

Généralités

Vous travaillez pour ORGANISATION_PARENTE, pouvez-vous m'expliquer votre parcours jusqu'ici ?

Pouvez-vous me décrire votre fonction chez ORGANISATION_PARENTE ?

Vous travaillez aujourd'hui sur MEGAPROJECT, un projet de R&D collaboratif incluant des laboratoires universitaire et (une ou) des entreprises. Selon votre expérience, qu'est-ce qui motive ces deux types d'acteurs à travailler ensemble ?

Au travers du Plan Marshall et des pôles de compétitivité, les autorités régionales encouragent la rencontre entre universités, centres de recherche, entreprises – grandes ou petites. A votre avis, quels sont les objectifs de la région ?

Pensez-vous que les projets de R&D collaboratifs permettront d'atteindre ces objectifs ?

Centrage

MEGAPROJECT a été lancé en 2007. Pouvez-vous me le décrire en quelques mots ?

MEGAPROJECT est-il différent des projets habituels de ORGANISATION_PARENTE?

ORGANISATION_PARENTE n'est pas la seule entreprise du projet. A votre avis, que va-t-il apporter au projet ?

A l'inverse, que va-t-il pouvoir retirer de cette expérience ?

Pensez-vous que les partenaires ont les mêmes attentes que ORGANISATION_PARENTE vis-à-vis de MEGAPROJECT ?

A votre avis, qu'est-ce qui influence ces attentes ?

Le plan Marshall et la politique des pôles de compétitivité distinguent deux types de projets : « ces projets viseront soit à concrétiser des applications industrielles sur un horizon de 3 ans au plus, soit à construire une vision prospectrice d'une thématique donnée de façon à assurer la compétitivité des entreprises du pôle ».

Pensez-vous que ces deux types de projets se rencontrent dans MEGAPROJECT ?

A votre avis, en quoi ces deux types de projets de R&D sont-ils différents ?

Cette distinction est proposée par la Région Wallonne. Est-ce que ORGANISATION_PARENTE fait une distinction entre différents types de projets de R&D ?

- Dans son porte feuille de projets
- Au sein de MEGAPROJECT

(Si oui) Quels critères sont utilisés ? (et pourquoi ?) Quels critères sont les plus importants ? (et pourquoi ?)

Approfondissement

Dans mon travail, je distingue trois types de projet de R&D collaboratifs : Les projets d'exploration, d'exploitation et de prospection (avec aide du schéma en annexe).

Exploitation en R&D ne considère pas la compréhension comme objectif principal : plus la technologie est mature, plus l'application concrète se rapproche, et plus la quête de compréhension cède la place à celle du design adéquat. Vise une application industrielle à court terme (marché ou application dans le processus de

fabrication). Le projet de R&D d'exploitation aura comme objectif de créer un produit au design adéquat, pouvant être commercialisé à très court terme ; les livrables comprendront nouveaux produits et processus de fabrication et les acteurs du projet n'encourageront pas la diffusion des résultats scientifiques même lorsqu'il y aura matière à publier.

Exploration en R&D : vise une application industrielle à court terme (marché ou application dans le processus de fabrication) mais tend à créer de nouvelles connaissances qui seront potentiellement incorporées dans un prototype,. Le projet d'exploration sera caractérisé par une quête de compréhension du phénomène, les connaissances nouvellement créées se retrouvant ainsi bien dans des publications scientifiques qu'incorporées dans un prototype avec potentialité de commercialisation à court terme.

Prospection ne vise pas d'application industrielle à court terme. Le projet de prospection visera principalement le développement de nouvelles compétences autour d'une vision commune des partenaires, avec encouragement de publications scientifiques.

Je vais vous demander d'imaginer trois projets « type », trois projets idéaux, qui représenteraient chacune de ces catégories. Ces projets de R&D collaboratifs peuvent être imaginaires ou réels si vous en avez eu l'expérience.

A partir de ces trois projets de R&D collaboratifs « idéaux », pour chaque projet :

- Quels sont les objectifs de ce projet ?
- Quels sont ses livrables ?
- Comment le projet est-il organisé pour atteindre ces objectifs et livrables ?
- En quoi ce projet est-il important pour ORGANISATION_PARENTE ?
- Quels sont les partenaires idéaux de ORGANISATION_PARENTE ?
- En quoi ces partenaires sont-ils importants ? Quels sont les apports de ces partenaires ?
- Qu'apporte ORGANISATION_PARENTE à ces partenaires au sein du projet ?
- Quelles sont les opportunités d'échange entre les partenaires ?
- En quoi ces échanges sont-ils importants pour ORGANISATION_PARENTE ?
- Quels sont les difficultés liées à ce projet ? Pour ORGANISATION_PARENTE ? Pour les partenaires ?
- Quels problèmes pourraient survenir et comment (à l'aide de quel partenaire) le résoudre ?
- A l'inverse, qu'est-ce qui facilite ce projet ?

Nous avons discuté des trois premières cases. Pensez-vous que la quatrième soit vide ?

Pourriez-vous me citer quelques exemples tirés de MEGAPROJECT pour chaque catégorie ?

En quoi ces projets sont-ils différents des projets « idéaux » dont nous avons discuté ?

J'aimerais beaucoup rencontrer des chercheurs ayant participé à ces projets. Pourriez-vous me recommander des personnes de contact pour ces projets ?

Conclusion

Pour conclure, quelles sont les conditions à remplir pour pouvoir dire « MEGAPROJECT est un succès total » ?

Si vous deviez décrire en quelques mots les aspects positifs et négatifs de MEGAPROJECT, qu'est-ce que vous citeriez ?

Notre entretien touche à sa fin, je vais essayer de résumer ce qui a été dit, si vous avez la moindre remarque à me faire, n'hésitez pas à me le dire. Je vous remercie.

Annexe

		Realization in industrial environment	
		Yes	No
Quest for fundamental understanding	Yes	Exploration	Prospect
	No	Exploitation	

INTERVIEW GUIDELINE (3/3) – INFORMANT Q3

Informations propres à l'interviewé

Background scientifique:

Fonction dans le projet:

Organisation parente:

Projet :

Axe:

Sous-projet :

Phase d'introduction

Bonjour, je vous remercie de m'accueillir aujourd'hui. Comme vous le savez, je vais vous poser quelques questions au sujet de votre travail au sein du projet MEGAPROJECT.

Cet entretien fait partie d'une collecte de donnée dans le cadre de ma thèse en gestion de l'innovation. Le contenu de cette interview sera traité de façon anonyme et restera évidemment confidentiel.

J'attends de vous une information factuelle sur la façon dont le travail de recherche s'organise dans MEGAPROJECT mais également votre avis sur ce qui est mis en place pour permettre la collaboration entre les différents partenaires du projet. J'ai devant mes yeux une série de questions qui sont là pour soutenir la discussion. On ne les passera pas toutes en revue et d'autres sortiront peut être naturellement, il s'agit donc d'une discussion tout à fait ouverte.

Généralités

Pouvez-vous m'expliquer votre parcours jusqu'au ORGANISATION_PARENTE ?

Vous travaillez aujourd'hui au ORGANISATION_PARENTE, pouvez-vous me décrire votre fonction au sein de du laboratoire ?

Vous travaillez aujourd'hui comme collaborateur scientifique sur le projet MEGAPROJECT. Est-ce la première fois que vous travaillez sur un projet de recherche incluant des laboratoires universitaire et (une ou) des entreprises ?

Selon votre expérience, qu'est-ce qui motive les firmes et les universités à travailler ensemble sur des projets de recherche ?

Au travers du Plan Marshall et des pôles de compétitivité, la Région Wallonne encourage ce type de rencontre. A votre avis, quels sont les objectifs de la Région ?

Pensez-vous que le financement de projet multi-partenariat permettra d'atteindre ces objectifs ?

Centrage

Nous allons maintenant nous recentrer sur le projet MEGAPROJECT et plus précisément sur SPx.

Pourriez-vous me décrire le projet en quelques mots ?

Vous m'avez parlé de projets université-entreprise auxquels vous avez participé. Ce projet est-il différent des projets sur lesquels vous avez travaillé ?

Pouvez-vous m'expliquer les objectifs de cet SP ? Quels sont ses livrables ?

ORGANISATION_PARENTE n'est pas le seul industriel, mais pensez-vous qu'il a un rôle spécifique à jouer dans SPx ? Qu'est-ce que ORGANISATION_PARENTE va apporter au projet ?

A l'inverse, que va-t-il pouvoir retirer de cette expérience ? Pourquoi est-ce un projet important pour ORGANISATION_PARENTE ?

Pensez-vous que les partenaires ont des attentes différentes de ORGANISATION_PARENTE ?

Le plan Marshall et la politique des pôles de compétitivité distinguent deux types de projets : « ces projets viseront soit à concrétiser des applications industrielles sur un horizon de 3 ans au plus, soit à construire une vision prospectrice d'une thématique donnée de façon à assurer la compétitivité des entreprises du pôle ».

A votre avis, à quelle catégorie appartient SPx ? Pourquoi ?

Approfondissement

1. PARTAGE DU TRAVAIL AU SEIN DU SPx

Nous allons maintenant passer à l'organisation du travail de recherche au sein de SPx.

Pouvez-vous me décrire les principales tâches de R&D à effectuer au sein de l'axe 1 ?

Pouvez-vous m'expliquer comment s'effectue le partage du travail ? Qui fait quoi ?

Si vous pouviez modifier cette organisation, que feriez-vous ?

Qu'est-ce que ce changement apporterait au projet ?

Le projet n'est pas figé, il évolue, ouvre des voies et en ferme. Selon vous, qu'est-ce qui détermine le choix d'une voie plutôt qu'une autre ?

2. TRANSFERT AU SEIN DE SPx

Pouvez-vous me raconter en quelques mots une journée type de travail au sein de SPx ?

Des partenaires sont-ils dépendants de votre travail ?

A votre avis, qu'apportez-vous au travail de ces partenaires ?

Pensez-vous que vous pourriez leur apporter plus ?

Des partenaires ont-ils un impact sur votre travail de recherche ?

Selon vous, qu'est-ce que ces partenaires apportent à votre travail de recherche ?

Est-ce que cela répond à vos attentes vis-à-vis de ces partenaires ?

Quelles sont les opportunités d'échange entre les partenaires ?

En quoi ces échanges sont-ils importants pour ORGANISATION_PARENTE ?

Est-ce que vous pouvez me parler d'un problème que vous avez surmonté grâce à un autre partenaire ?

Quels sont les difficultés liées à ce projet ? Pour ORGANISATION_PARENTE ? Pour les partenaires ?

3. TRANSFERT AU SEIN DE MEGAPROJECT

Nous avons beaucoup parlé de vos partenaires au sein de SPx. Nous allons maintenant plutôt parler de votre relation avec les partenaires présents sur les autres SP de MEGAPROJECT.

Tout d'abord, qu'est-ce qui différencie SPx des autres SP de MEGAPROJECT ?

Est-ce que le fait d'être intégré à MEGAPROJECT apporte une valeur ajoutée par rapport à un projet « SPx » qui aurait été mené de façon indépendante par le ORGANISATION_PARENTE et ses partenaires de SPx ?

Pouvez-vous me parler d'une journée ou d'un événement partagé avec ces partenaires que vous avez trouvé enrichissant pour votre travail ?

Pensez-vous que cette journée ou événement a été aussi enrichissant pour les autres partenaires ? Pourriez-vous m'expliquer pourquoi ?

4. TRANSFERT AU SEIN DE L'ORGANISATION

D'autres membres du ORGANISATION_PARENTE travaillent-ils sur MEGAPROJECT ?

Travaillent-ils sur une thématique proche ?

Trouvez-vous qu'il est logique que le ORGANISATION_PARENTE soit impliqué sur ces différents axes ?

Quel type de contacts avez-vous avec eux ?

Concernant vos collègues qui ne travaillent pas sur MEGAPROJECT, ces collègues sont-ils au courant des recherches qui sont menée dans MEGAPROJECT ?

Vous aident-ils parfois sur la recherche en cours pour MEGAPROJECT ?

Quels sont vos contacts avec ces autres membres du ORGANISATION_PARENTE ?

Pensez-vous que votre travail au sein du projet MEGAPROJECT a un impact sur le travail « hors MEGAPROJECT » : le vôtre ou celui de vos collègues ?

Si vous deviez quitter le projet maintenant, quelles seraient les conséquences pour ORGANISATION_PARENTE ?

Et après ? Quelles sont vos perspectives au-delà de ce projet ?

Conclusion

Pour conclure, quelles sont les conditions à remplir pour pouvoir dire « MEGAPROJECT est un succès total » ?

Si vous deviez décrire en quelques mots les aspects positifs et négatifs de MEGAPROJECT, qu'est-ce que vous citeriez ?

Notre entretien touche à sa fin, je vais essayer de résumer ce qui a été dit, si vous avez la moindre remarque à me faire, n'hésitez pas à me le dire. Je vous remercie.

