The role of organizational and social capital in the firm's absorptive capacity

Amal Aribi and Olivier Dupouët

Amal Aribi is based at the University of Angers, Angers, France.
Olivier Dupouët is based at the Department of Operations Management, Kedge Business School, Talence, France.

Abstract

Purpose – *This paper aims to ask the question of the contingency of a firm's absorptive capacity upon the type of expected outcome. Thus, this paper looks at different expected outputs in terms of more or less radical innovations and sees if there are consequences on the absorptive process underpinning cognitive structures and processes, as embodied in its organizational and social capital.*

Design/methodology/approach – *To do so, a qualitative study was conducted. In total, 23 persons in three French industrial firms were interviewed about their firm's absorptive capacity. One of these firms aims at "new-to-the-firm" innovations, while the other two aim at "new-to-the-world" innovations.*

Findings – *Results suggest that while "new-to-the-firm" innovations tend to favor the use of social capital, "new-to-the-world" innovations tend to rely more on organizational capital. These rather counterintuitive results are interpreted by the necessity to take into account other variables than knowledge distance in the absorption of new knowledge. In particular, complexity and time-length would call for greater use of organizational capital, while speed and reactivity would instead require greater use of social capital.*

Originality/value – *This is to the best of the authors' knowledge that one of the first study evidencing the contingent nature of the absorptive process. Further, results tend to show the form absorptive capacity takes depends not only on cognitive aspects but also on the particular environment the firm evolves in.*

Keywords *Social capital, Absorptive capacity, Organizational capital*

Paper type *Research paper*

Introduction

Since it has been first identified by Cohen and Levinthal (1989, 1990, 1994), absorptive capacity is seen as an important capacity for firm's performance and long-term survival. Cohen and Levinthal (1990, p. 128) define absorptive capacity as "[. . .] an ability to recognize the value of new information, to assimilate it, and apply it to commercial ends". As such, it is arguably one of the key mechanisms for organizational learning, innovation and, more broadly, adaptation and change (Hill and Rothaermel, 2003; Lavie, 2006; Van den Bosch *et al.*, 1999; Volberda *et al.*, 2010).

This definition implies that an obvious necessary condition to the success of knowledge absorption is the mechanisms and structures firms set to make knowledge circulating across its internal and external boundaries. Absorptive capacity "depends on the organization's ability to share knowledge and communicate internally" (Lane *et al.*, 2006, p. 838). Absorptive capacity is thus a critical capacity that spans the entire organizations as the absorptive process unfolds.

However, despite the importance of the concept, surprisingly little is known about the details of the process and the underlying mechanisms enabling knowledge transfer and modification along the different stages of the absorptive process (Volberda *et al.*, 2010).

Received 3 May 2015
Revised 3 May 2015
Accepted 5 May 2015

Intellectual capital made of human, organizational and social capitals, the set of cognitive structures and processes upon which firms build their performance (Subramaniam and Youndt, 2005), has always been recognized as an important antecedent of absorptive capacity. Intellectual capital is the set of resources that permits the firm to learn further knowledge, that is identifying it in the environment, bring it into the firms boundaries and combine it with already possessed knowledge to come up with new products and processes (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Zahra and George, 2002; Todorova and Durisin, 2007; Volberda *et al.*, 2010).

However, the interplay between the different dimensions of intellectual capital and the absorptive capacity is still under-investigated. Specifically, to our knowledge, studies investigating the role of intellectual capital in the absorptive process tend to consider the absorptive capacity as being universal, i.e. the absorptive process is viewed as uniform, whatever the industry, the kind of knowledge processed or the purposes of the knowledge absorption (Van den Bosch *et al.*, 1999; Chang *et al.*, 2013).

Yet, literature on innovation and knowledge management suggest that, depending on the objectives pursued by the firm and on the type of necessary knowledge, the structures, methods, practices and processes used by the firm should differ (March, 1991; Tushman and O'Reilly, 1996; Kusunoki *et al.*, 1998). It thus seems reasonable that absorptive capacity, as a key driver of innovation, should display similar differences.

Hence, the question we ask in this article is: do different objectives and expected outcomes lead firms to adopt different forms of absorptive capacity and of the underlying intellectual capital?

The aim of this article is thus to clarify the role of organizational and social capital of a firm when absorbing knowledge for a targeted output. We will more particularly focus on organizational and social capital as they are collective, and therefore, more specifically apt at knowledge diffusion and sharing. To do so, we rely on data gathered during a qualitative study consisting of 23 interviews conducted in three French industrial firms, making this research one of the few empirical investigations of the actual functioning of absorptive capacity.

Theoretical framework

There is a wide agreement that absorptive capacity is instrumental to a firm's innovation aptitude (Hill and Rothaermel, 2003; Lavie, 2006). Absorptive capacity can be conceptualized as a process made of successive phases. Although several different decompositions have been proposed over time (Cohen and Levinthal, 1990; Lane *et al.*, 2006; Todorova and Durisin, 2007; Zahra and George, 2002; Van Den Bosch *et al.* 1999), all authors agree that absorptive capacity include three broad phases:

1. Exploration, that is, the ability to scan the environment and to bring new ideas and knowledge back into the firm.
2. Transformation, which consist in transforming the newly acquired knowledge, and also possibly the existing knowledge base to come up with novel combinations.
3. Exploitation, which turns these new knowledge combinations into marketable goods and services (Lane *et al.*, 2006).

As each of these phases is carried out by different actors in different organizational spaces, absorptive capacity requires that knowledge flows across the firm's external and internal boundaries. Knowledge is acquired and transformed in each phase and passed on to the next phase. To efficiently absorb knowledge, firms need an appropriate underlying structure that enables this knowledge circulation and processing. They, therefore, need suitable knowledge architecture and processing systems (Lane and Lubatkin, 1998; Van den Bosch *et al.*, 1999). In other words, firms must shape their intellectual capital in a way that enables them to further absorb new knowledge.

Intellectual capital, understood as "the sum of all knowledge firms utilize for competitive advantage" (Subramaniam and Youndt, 2005, p. 450), includes three distinct dimensions:

1. the human capital, that is, the knowledge possessed at the individual level;
2. the organizational capital that lies in the structure and formal rules of firms; and
3. social capital that represents informal networks of interrelationships and the knowledge that can be accessed through these (Subramaniam and Youndt, 2005; Youndt *et al.*, 2004).

Identifying, acquiring, transforming and exploiting knowledge can only be done on the basis of the knowledge and learning processes already mastered by the firm. As such, and as mentioned by Cohen and Levinthal (1990), intellectual capital is an essential pillar of absorptive capacity. In particular, the two last dimensions, organizational capital and social capital, span the entire organization and play a significant role in knowledge circulation throughout the firm. We will therefore focus on these two dimensions in the remaining of this study.

Organizational capital rests in the patents, databases, processes, systems and structures of the firm. As Youndt *et al.* (2004) put it, organizational capital is the knowledge that stays behind when people go home at night. Organizational capital is very often defined as established standards and practices (Spender, 1996) and "represents the shared corpus of knowledge" (Nahapiet and Ghoshal, 1998, p. 247). Organizational capital is specified and set by the management. They are made of precise and detailed rules, and drafted standard operating procedures that inform the way coordination and cooperation should be achieved within the firm. Further, these rules and procedures can be measured, controlled and monitored by the management that can change them if necessary. Information and knowledge circulation within the firm is ensured by procedures, knowledge codification and formal languages and the use of information systems (Moos *et al.*, 2013). Organizational capital is thus defined as formalized, explicit and monitored by the management (Subramaniam and Youndt, 2005).

Organizational capital is a powerful tool to achieve cooperation and coordination among different and heterogeneous groups or communities. Because organizational capital creates a stable cognitive platform known to everyone, it provides general rules and guidelines to which anyone can refer to (Brusoni *et al.*, 2001). These clear procedures and rules specify how knowledge should be used, shared and utilized by specifying the different interfaces between knowledge domains, in addition to providing guidelines for conflict resolution (Subramaniam and Youndt, 2005). In addition, organizational capital also facilitates the synchronization or temporal coordination of the different cognitive endeavors within the firm by enabling the use of tools such as PERT for instance (Yakura, 2002). Thus, the distinctive trait of organizational capital, as compared to other forms of intellectual capital, is the ability it gives to firms to deploy coordination and cooperation mechanisms that can be used by the hierarchy for aligning the different knowledge processes at play (Tushman and Rosenkopf, 1992).

Social capital is the network of interrelationships that develops over time between individuals (Adler and Kwon, 2002; Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998). This capital represents both the network and the knowledge that can be accessed through it. These networks are typically not monitored by the management but resort to a set of shared norms and mutual adjustment (Ouchi, 1981). The development of social capital supposes a great autonomy of actors and favors joint interpersonal decision-making over formalized decision procedures. It also favors lateral communications that cut across functions and lines of authority (Blackler, 1995; Wenger, 1998). Social capital is thus characterized by informality, mutual adjustment and little managerial intervention.

The greatest strength of social capital lies in the possibility for knowledge accumulation, maintenance and circulation it offers. Social capital first eases collaboration, interaction

and the sharing of ideas (Subramaniam and Youndt, 2005). Because it spans the formal organizational frontiers, the informal networks constituting the social capital infrastructure allow knowledge to flow freely, unbounded by the organizational chart (Tsai and Ghoshal, 1998). In addition, because knowledge embedded in social capital is built out of interactions among individuals and in a specific context, it evolves and is updated with the needs and requirements of the tasks at hand. Social capital enables a flexible and versatile sharing, accumulation and use of knowledge (Brown and Duguid, 2002).

Note that from these descriptions, the term "capital" is misleading. Organizational and social capital are described in terms of content (codified knowledge in the case of organizational capital, tacit knowledge in the case of social capital) but also in terms of methods and processes used to access, diffuse and make use of that content. Hence, organizational and social capital incorporates a dynamic dimension, and these concepts are consistent with a view of knowledge as practice and communication (Cook and Brown, 1999; Tsoukas and Chia, 2002).

The idea that intellectual capital is crucial for the performance of the absorptive process is by no means new. Indeed, among antecedents identified in the literature, prior knowledge has since long been recognized as being of paramount importance (Cohen and Levinthal, 1990). The knowledge already possessed by the firm, upon which new knowledge can be aggregated, has been identified as one of the key drivers of absorptive capacity since the very introduction of the concept.

Later works further investigated the importance of social capital and organizational capital for the absorption process. At a theoretical level, different studies stress that social capital should play a key role in moving knowledge from one stage to the other in the absorptive process (Lane *et al.*, 2006; Todorova and Durisin, 2007; Zahra and George, 2002). Social networks facilitate the building of shared interpretations and languages, thereby lowering the different internal barriers that hinder knowledge circulation within the firm. Further, external social networks increase the search ability of agents and enhance their ability at detecting useful external knowledge. Recently, Chang *et al.* (2013) formally tested the role of social capital and evidenced that the quality of the absorptive process was significantly higher in firms nurturing and fostering social capital through adapted human resources management. Similarly, organizational capital has been shown to have a positive influence on absorptive capacity. Van den Bosch *et al.* (1999) and Jansen *et al.* (2005) provide evidence that properly designed rules and procedures enhance the upfront part of the process by facilitating the acceptance of new useful ideas through the implementation of cross-functional interfaces and appropriate decision making procedures, along with aligned human resources practices. Moos *et al.* (2013) studied more specifically the role of knowledge management systems in the absorptive process. They show that knowledge codification and use of information systems facilitate knowledge circulation and manipulation and, ultimately, knowledge absorption.

Nonetheless, all these studies assume an undifferentiated absorptive process: every firm uses the same absorptive process for every kind of objective and purpose. None of the works we are aware of hypothesizes that different environments and objectives should lead to the setting of different absorptive processes sustained by different cognitive architectures and processing capabilities. Yet, literature on innovation has long established that different sorts of innovations call for different knowledge settings and processing (Burns and Stalker, 1961). In particular, following the well-established distinction, it is usually asserted that incremental innovation rather relies on organizational capital, whereas radical innovation rests on social capital (Subramaniam and Youndt, 2005). We would thus expect similar differences regarding absorptive capacity. Depending on the nature of the expected outcomes (i.e. more or less radical innovation), the absorptive process and the underlying cognitive mechanisms should differ.

Firms tend to specialize in one kind of innovation. This is due to their specific economic and competitive environment that informs the desirable outcome for a firm. Moreover, path dependency and specialization push firms to accumulate experience and know-how in one specific kind of innovation. As absorptive capacity is one dimension of innovation, this also holds for absorptive processes (Lane and Lubatkin, 1998). Firms thus set enduring cognitive architectures and processes to sustain an absorptive process specifically suited for their innovation purposes and objectives.

Depending on the more or less great innovation radicalness sought, firms should set different combinations of organizational and social capital. To our knowledge, however, this has not been investigated so far. In order to shed light on this issue, we resort to a qualitative study conducted in three French industrial firms.

Empirical study

Our aim is to better understand the way firms actually combine organizational and social capital to sustain their absorptive capacity. Given the relative scarcity of data related to this phenomenon and the need to first have a detailed understanding of the different knowledge infrastructures, we choose to use a qualitative study. We will deal with the gathered data in an inductive way, seeking to generate theoretical propositions from the field (Eisenhardt, 1989; Miles and Huberman, 1994).

Case selection

We selected the studied firms according to three main criteria. First, as the literature repeatedly argues, absorptive capacity is to be found in firms in which success depends on the ability to introduce new products to the market on a regular basis (Lavie, 2006). Accordingly, we sought firms that based their strategy on innovations. Second, because, by definition, absorptive capacity implies the ability to acquire knowledge from the outside, incorporate that knowledge into new products and deliver these new products on the market, we looked for firms that were designed for carrying out all these tasks (Cohen and Levinthal, 1990, 1994). We thus selected firms that possessed internal R&D, production facilities and sales and marketing departments. Last, because we expect the kind of innovation pursued to have an impact on the intellectual capital underlying the absorptive process, we sought firms with different objectives and constraints in terms of innovation (Van den Bosch *et al.*, 1999; Jansen *et al.*, 2005; Volberda *et al.*, 2010).

With these criteria in mind, we approached three firms likely to suit our research objectives (Eisenhardt, 1989; Miles and Huberman, 1994). Firm 1 employs about 3,000 persons and operates in the defense market for which it builds high-frequency electronic devices. Firm 2 has about 1,200 employees and develops engines for the aeronautic and spatial sector. Firm 3 employs 700 persons and provides equipment and consumables for dental treatments and medical imagery. All these firms are subsidiaries of larger holdings. We present our findings on each of these firms in light of our three selection criteria.

The three firms base their strategy explicitly on innovation, presented as one of the firms' core values. Accordingly, each of these firms spends 20 per cent of its annual sales in R&D. Further, each of these firms is characterized by the number of engineers among their employees, about 40 per cent in all of them. The parent company to which Firm 1 belongs published 341 patents in 2011, Firm 2 published 573 patents that same year, while Firm 3 publishes 15 patents and 20 registered designs per year on average. It should be noted that each of these firms is very successful in its respective sector. Firm 1 is the leader at the European level and ranks three at the world level. Firm 2 is the world leader in one of its market segments (aeronautic engine propulsion) and world number two on the other (spatial engine propulsion). Firm 3 also is a world leader in its three markets (equipment, dental care consumables and medical imagery).

In terms of organizational structure, all three firms possess a marketing department, several R&D departments, production plants and sales departments. For all three firms, both R&D departments and production sites are located in Europe. The reason invoked is that it is important to maintain tight links between R&D and production to ease knowledge transfer. For Firms 1 and 2, sales and business development is located in France. Firm 3 has a dozen sales offices scattered around the world. The difference stems from the nature and size of the firms' markets. Whereas Firms 1 and 2 address a very specific and relatively small market in terms of number of actors, firm 3, though operating in the business-to-business segment, enjoys a larger market, which necessitates the physical presence of the firm in the different geographical areas in which it is active.

One can draw a distinction between Firms 1 and 2 on the one hand and Firm 3 on the other in terms of kind of innovation pursued. Firms 1 and 2 are required by their customers (aeronautics and space manufacturers) to provide products that do not yet exist. In other words, these firms draw most of their incomes and *raison d'être* from the ability to achieve disruptive, "new-to-the-world" innovations. Their product development cycles are typically long, lasting between 5 and 10 years. Firm 3 also builds its success on its innovation capacities. However, the exigencies of its customers are not as high as those of Firms 1 and 2. Consequently, this firm aims at radical, "new-to-the-firm" innovations. Contrary to Firms 1 and 2, which must develop new bodies of knowledge, Firm 3 can borrow already mastered technologies and knowledge from other sectors to adapt them to its products and customer needs. Accordingly, development cycles last between one and a half and two years.

Table I summarizes the key features of the three studied firms.

Data collection

We selected interviewees according to two main criteria:

1. We ensured that all the main functional areas where organizational learning and knowledge management were likely to play a key role were covered.
2. We selected respondents from different hierarchical levels to have an overall view of functional areas, as well as of the interactions and interdependencies with other functions.

Incidentally, all of our interviewees have held different positions at headquarters and in several subsidiaries at different points in time. Utilizing these two criteria allowed us to have a good global vision of the way this firm handles exploration and exploitation at the organizational level. This variety of viewpoints gave us a global overview of the firm's functioning.

Table I Key figures of the studied firms

Firm	*Sector*	*Date of the firm's creation*	*No. of employees*	*2012 turnover (€)*	*Products*
Firm 1	Military aeronautic	1975	3,035	722 million (20% for R&D)	Fire radars for fight aircrafts and radars for navy applications
Firm 2	Spatial propulsion Defense and aeronautic	1945	1,200	300 million (20% for R&D)	Solid propergol engines and composite material
Firm 3	Medical imagery Dental instrumentation	1946	700	126 million (20% for R&D)	Small electronic appliances, pharmaceuticals products, oral cameras and imagery equipment, radiology, endoscopes

We used an interview schedule specifically developed for this study, focused directly on the absorptive process and its underlying structure. Specifically, we asked the interviewees about the company's overall approach to knowledge absorption, their approach to managing it, the interviewee's role in managing this process, how the process unfolded, who or what they saw as major contributors or critical elements of this process, the role of organizational structure/design in this process and their overall evaluation of the success of these efforts. We triangulated data from the interviews with our database of different archival sources.

We conducted 23 interviews in total. Interviews lasted 1 hour and 45 minutes on average and were tape-recorded before transcription. As our work progressed, we regularly went back to our interviewees to validate our constructs and to ask them for clarifications and further details.

In addition to these interviews, we also gathered secondary sources relevant to our research. These documents include internal documents given to us by interviewees, publicly released written documents and videos, as well as search results from specialized databases. In total, we consulted about 87 such documents.

Table II presents the raw material we gathered for each firm.

Data analysis

We followed the four steps of the data analysis process, as proposed by Miles and Huberman (1994).

Identifying initial categories within each case. We compiled the data from transcribed interviews and made an initial categorization for each case. Following Gioia *et al.* (2013), we remained as close as possible of the wording of our interviewees to start to build first-order concepts. We resorted to the NVivo software to identify similarities and differences between statements of our different informants and build a first pattern. This first categorization offers a general vision of the different phases composing the absorptive process and the procedures and systems in place to sustain the process, as described by respondents. To assess the reliability of this categorization, we asked a second coder to code the data. We then compared the two codes and obtained a satisfying $\kappa = 0.81$ (Cohen, 1960).

Linking related concepts within each case. We then sought to establish links among the different first-order concepts to group them in second-order themes. Because our objective is to study the links between the different already identified phases of the absorptive process and the different known components of the underlying knowledge structure, we rather relied on Eisenhardt (1989) who advocates taking categories from the existing literature. Our objective being to link the output of the absorptive process and its underlying knowledge systems, we wanted to use existing theoretical concepts as provided by the description of the different absorptive capacity phases and the organizational and social capitals. We did so both for the different phases of the absorptive process and for the descriptors of the two kinds of capital. To avoid over-interpretation, however, we shared our categorizations with members of the studied firms to make sure that our representation and theirs were consistent.

Conducting cross-case comparisons. Using cross-case analysis techniques (Eisenhardt, 1989; Miles and Huberman, 1994), we observed similarities and differences between transcripts, comparing the themes produced in the second stage but also verifying the similarities and differences between the first-order concepts across the different cases. Similar themes were gathered in aggregate dimensions, once again relying on existing concepts (Eisenhardt, 1989). We however pay special attention to the consistency between data and existing conceptual categories to avoid misclassification or over interpretation. Toward this end, we there again asked for the help of an external coder. All differences were discussed with the second coder and discrepancies were resolved by discussion until there was complete agreement.

Table II Data sources (interviews and archival data)

Firm	*Interviews*	*Experience (years)*	*Archival material (87) Public sources*	*Private sources*
Firm 1	CEO	30	Company websites	Presentation of companies (brochures provided by the companies)
	Government sector products	25	Theses and course papers	
	Marketing director	20	Dissertation	Internal communication (latest technologies, new programs, new organizations, new directions, new strategies, new partnerships, information on subsidiaries and human resources)
	Industrial designer	31	Master's theses	
	Product designer	20	Annual reports	
	Director	20	Scientific journals reports	
	Product designer	10	Industrial reports	
	Innovative cockpit design	4	Newspaper articles	
	Engineers	15	Press releases	Company handbook, publications
			National articles	Surveys of students
			Presentations at national and international conferences	
			Videos	
			Description of products	
			Statistical studies	
			Surveys regarding academic integrity	
			Academic integrity policies	
			Strategic plans	
			Economic and financial annual reports	
			Some websites (INPI ranking (past five years), innovation management	
			Regional reports (pole of competitiveness)	
			Organizational charts	
Firm 2	CEO	25	IDEM	Company handbook publications, internal communication, product description
	Design research	20		
	Engineers	5		
	Human factors consultant	20		Surveys of students
	Engineers	5		
	Operational pilot innovation	12		
	Engineers	5		
Firm 3	Quality manager	23	IDEM	Company handbook publications, internal communication, product description
	Product range director	10		
	R&D director	30		
	Marketing and product policy director	20		Surveys of students
				Clinical studies
	Communication and event manager	7		Evaluation for employees
				Price ADF 2012 (Intraoral Camera
	CEO	10		Soprocare) innovation, Red Dot
	Director of studies	8		Design Award 2011

In this stage, we found that Firms 1 and 2 shared many similarities in their implementation of the absorptive process. Thus, not only were their objectives in terms of kind of innovation pursued identical but they also had similar approaches to the absorption of knowledge and made similar use of organizational and social capitals. This leads us in the remaining of the paper to treat Firms 1 and 2 on the one hand and Firm 3 on the other.

Building a theoretical framework. In this last stage, we sought to identify the relationships between the different categories we built associating data and existing theoretical categories. Following Eisenhardt (1989), and Gioia *et al.* (2013), our focus and the contribution we intend to make lie more on the links between the different categories than on the possible emergence of new categories. We focused only on the most robust findings. Figures 1-3 depict data structures for the absorptive process and for the two kinds of capitals.

Figure 1 Data structure: the absorptive process

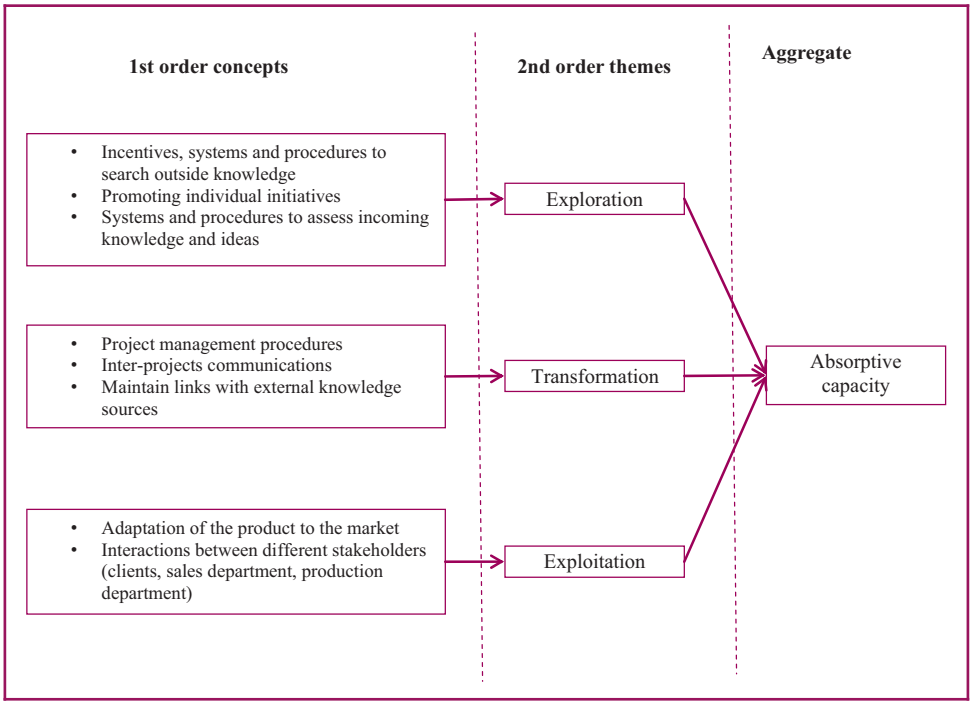
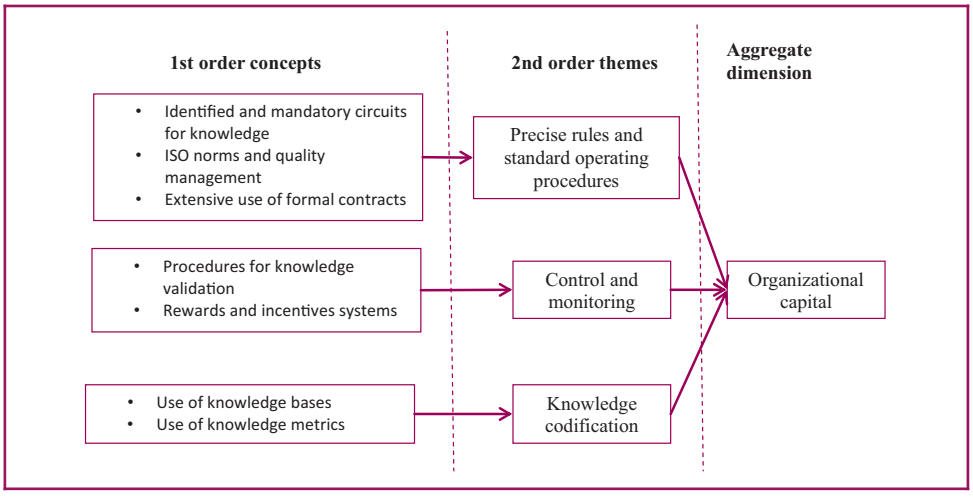


Figure 2 Data structure: systems capabilities



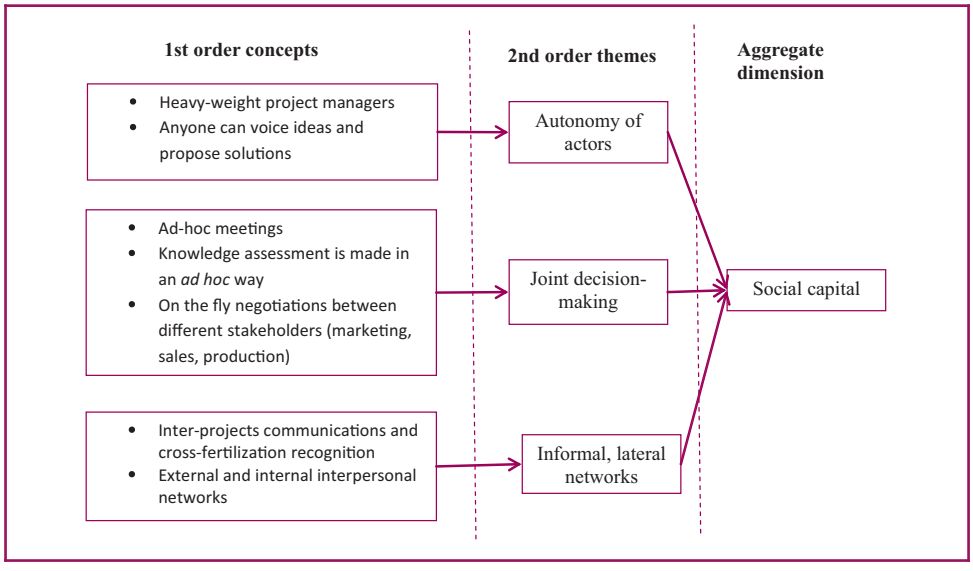
Results

This section is organized along the main phases of the absorptive process: exploration – transformation – exploitation. For each of these phases, we describe how organizational and social capitals come into play. We distinguish where necessary between Firms 1 and 2 on the one hand and Firm 3 on the other. Informative quotes are listed in Table III.

Exploration

In the exploration phase, firms gather pieces of knowledge from their external environment, bring them into the firm, and assess them to decide whether to pursue the absorptive process or not. For all firms, external knowledge can come from a wide a variety of sources: primarily customers, but also suppliers and business and academic partners. The means

Figure 3 Data structure: coordination capabilities



to access that knowledge also varies greatly, and may include joint projects, conferences, meetings, professional exhibitions, commercial meetings, etc. Firms however differ in the way they process and assess the knowledge coming from the outside world.

For firms 1 and 2. Firms 1 and 2 have developed formal means for scanning their environment. They devote a lot of efforts and resources to rationalize and centralize the various knowledge flows. The most salient feature is a strategic intelligence department that nurtures the rest of the organization with novel ideas for future developments. This department is in charge of gathering knowledge about technologies, competitors, customers and the broader economic and institutional environment. The reason invoked for the existence of such a department is the complexity of the environment they have to make sense of, as well as the necessity to have an historical perspective on their environment's evolution.

However, despite the importance of this department, the primary driver for Firms 1 and 2 to engage in new knowledge and products development is demand from a customer. At these firms, our respondents explained this by the resources entailed, the length of the project, and the risk inherent to a "new-to-the-world" innovation. These firms seek to secure their outcomes prior to engaging in the next phases of the absorptive process. Knowledge and understanding gathered by the strategic intelligence department nurture the initial discussions with the customer about the exact objectives to be reached, both from an operational and technological standpoint.

Further, from this point on, the customer will be deeply involved throughout the absorptive process to ensure that the project stays in line with the specifications agreed upon at the start. This means going back to customers, inviting them to internal meetings and setting regular check points. It may even entail the hiring of customers to guide the transformation process.

It is worth noting that, in addition to these intelligence departments, the firms also seek to encourage what they call "spontaneous innovation", i.e. innovative initiatives from every members of the organization. Thus, any person can propose an idea that could potentially lead to further developments. However, this bottom-up approach is a thoroughly controlled process steered by the management (there is a head of "spontaneous innovation") and each idea must be assessed by a commission that states on the quality of the proposed

Table III Selected quotes

Absorptive capacity phase	*Intellectual capital*	*Firms 1 and 2*	*Firm 3*
Exploration	Organizational capital	We have an economic intelligence department [attached to the marketing department] that conducts market studies and defines offers and how to position our disruptive technologies with respect to our competitors, which forces us to study our competitors' offers We set a tool, a kind of internal Google which allows us to access to information with a simple query. We have a data-base, a huge data-base we enrich continually that enables us to connect information we receive and raw information to more refined information and that makes the link between the information and the broader picture in terms of quantity, date, price, etc. This enables us to carry out rather relevant market studies	[New ideas] can be a reaction from users or sales persons who express dissatisfaction and present us solutions existing at our competitors. We invite them to present their solutions in front of people from marketing, R&D, but also engineering and design departments . . . . If the information we gather from our distribution channel say yes there is something interesting, then we enter the specification process
	Social capital	We have an HR policy that says that anybody working in the firm can voice innovative ideas. We push people to submit new ideas, there is a commission that assesses whether the idea is truly innovative or not	There are external channels, we have customers who call us 'here, I've got an idea on such topic', we have a kind of internal validation committee, we're not much, three or four, we are going to decide whether the idea is relevant or not, and decide whether to go a bit further or not
Transformation	Organizational capital	The enterprise of course follows the process for which it has been ISO 9000 certified. It concerns the process end-to-end, from the launch to the market entry Hence, the shift from a knowledge to a product is typically a matter of design, and these are things rather well modeled today . . . We have a model for conception. How we mobilize a piece of knowledge in elaborating a design is a canonical problem of scientific management and is already modeled We think in terms of TRL (Technology Readyness Level). We assess the maturity of our topics with a scale we call TRL. It is a way to evaluate our capacity to produce a new product or implement a new technology. That is, we ask ourselves "do we understand well how this new technology works?"	We are in an ISO process. So, coming to that, we have procedures and there are a certain number of things that are well normed It is going to be much formalized anyway. Because since [project management] is in the hands of specialists and that they are methodic people, they won't move on to the next stage without having checked the current one
	Social capital	Intranet forums, shared spaces, shared work spaces, etc. there is a whole lot of micro-communities that facilitate information circulation and sharing on topics, common work, on-going projects, etc	We regularly attend meetings that enable us to share. Even if it's not my area of expertise, I have an idea in your domain, we share it, we discuss, we are going to see whether it's a good idea. We see how we can implement it. We are in the exchange and sharing of best practices After a while, each project manager has her own little network of experts. I encourage them to do so. Product managers have very very strong ties with these experts who are very upstream in the process
Exploitation	Organizational capital	Then, the equipment is going to be test in flight, we are not going to be in trial and error mode here, but we are going to check that the product will have the same performance in real conditions of use than in our facilities	Usually we ask for feedbacks after two to three tests or two to three surgeries for them to tell us "yep it works perfectly 'or' no, it doesn't work". If it works well, we start to launch the marketing package: brochures, technical documents, web sites, training sessions, journal articles, etc.
	Social capital		When we arrive towards the end of the process it's different because I am going to send products to the US, to Germany. I will handle it to the local team. We are focused on product development and validation. They are focused on selling the product. So, to avoid mistakes we made in the past, we have exchanges with local team members to make sure that we are well in a validation phase

idea. In addition, an incentive system has been set, people being rewarded according to the quality of their inputs.

For firm 3. Listening to our respondents, the assessment of incoming ideas at Firm 3 is made in a relatively less formal way than in the other firms. A process exists but is much more flexible and loosely defined than in Firms 1 and 2. At this, firm, the assessment of potential innovations takes the form of a series of *ad hoc* meetings. The first meeting always involves the head of R&D, the head of marketing and the person proposing the idea. If the idea is deemed interesting, several other meetings will follow, set in a rather *ad hoc* way and soliciting various internal experts who have sufficient knowledge of the technological state of the art and the portfolio of current products of the firm. If the idea successfully goes through this process, the transformation phase begins. Contrary to Firms 1 and 2, Firm 3 can engage in the transformation phase without having secured a particular customer.

Transformation

During the transformation phase, firms further elaborate on the knowledge they need to build the targeted product. The knowledge handled becomes less and less conceptual and increasingly practical and applied. In the studied firms, this knowledge is mostly technological and firms aim to create connections between the newly acquired knowledge and existing knowledge.

The transformation phase lasts about four months in Firm 3, whereas it may last up to five years in the two other firms. The difference is due to the complexity of the product developed in these two firms, as well as the nature of the innovation pursued. As mentioned previously, because Firms 1 and 2 pursue "new-to-the-world" innovations in areas of high technologies, the greater complexity of products and the greater uncertainty regarding what knowledge is necessary to complete the project lead to a longer transformation phase.

During transformation, firms continue to enrich, add to and enhance their knowledge over time. In addition to internal development, it may be necessary to acquire additional knowledge in the environment. The necessary knowledge cannot be completely determined ex ante and need to be completed as the project evolves. Hence, firms must set specific channels to external knowledge sources. We present the way firms handle internal developments and external channels for each kind of firms in the remaining of this section.

Internal developments. Within all these firms, transformation takes the form of management by projects. Every selected idea is developed by project teams. The project management is taken very seriously in all firms. They are all ISO certified for project management, and consistently rely on the project management toolbox, such as sequencing, scheduling, definition of milestones, formal projects review, etc.

Note, however, that Firms 1 and 2 push formalization and the use of formal procedures and controls further than Firm 3, especially regarding knowledge contents. Both of these firms developed a knowledge base that includes repositories, keywords and a search engine to help retrieve relevant pieces of knowledge. They have thus developed a sophisticated codification process to store all relevant technical concepts, reports and known solutions that can be tapped by members of project teams. In addition, these firms have developed formalized design procedures and technological maturity measurement scales to map the concepts and knowledge mobilized in the project and to gauge their evolution. Lastly, these firms resort to quality management techniques, such as lean Six Sigma, lean office and standardized inter-service interfaces, thereby adding another layer of control over project management.

Along with the organizational capital features described above, all firms promote the development and use of social capital for inter-projects communication and knowledge spillover and cross-fertilization. Different means have been established to this end. In

particular, in every project, meetings with people identified as generalists (expert marketing or salespeople, R&D people with a broad experience, etc.) take place. Another common means is the inter-project meeting, at which the different groups share their experience and achievements. Last, in every firm, information and communication tools such as groupware, collaborative tools and enterprise social networks are put at the teams' disposal to facilitate information and experience sharing throughout firms. All these processes ensure that new and old knowledge are shared and blended beyond the project team.

External channels maintenance. Differences between the two kinds of firms are more marked regarding the external links they maintain during the transformation phase. We present each case in turn (for Firms 1 and 2).

For firms engaged in very radical innovation process, technological and scientific knowledge needed for the development of the new product cannot be fully specified *ex ante*. The ability to go back to a more conceptual level is thus crucial. Consequently, Firms 1 and 2 maintain ties with external research centers during transformation because uncertainty is high and the number of issues to be dealt with is important. These firms tend to develop long-lasting ties with external parties. These ties usually take the form of formal partnerships and imply a continual involvement of the external partner until conceptual aspects of the new knowledge area are fully understood. Hence, ties can be found in partnerships with public laboratories and universities. Partners can be offered research funding or merely note that the subject can be of scientific interest to the public research center. Additionally, several of these firms' employees also belong to research centers. These firms also typically recruit PhD students to work on their projects. This dual affiliation ensures a continuous flow of knowledge between the two organizations throughout the lifetime of the project.

Firms 1 and 2 extensively use formal agreement and employment contracts for establishing links with external parties. The reasons invoked by our respondents are the complexity and duration of projects. According to them, formal ties are the best way to make sure that the knowledge resources will be available when needed. Moreover, as this knowledge typically is not stabilized at the start of the project, Firms 1 and 2 seek to be as involved as possible in its elaboration to be sure that it will meet their needs and industrial constraints.

For Firm 3. For Firm 3, the access to external knowledge takes the form of punctual contacts with identified individual experts. Firm 3 maintains an important network of external experts who can be solicited when needed. At this company, every project manager is required to grow and maintain a network of experts from universities and businesses. They are encouraged to develop strong ties, based on dyadic trust, with these experts. When necessary, experts can be called in for short periods of time to solve specific problems. It is also common to train project team members on the fly, whenever the need is felt to acquire a new technique or some specific knowledge on a particular technical aspect. Training is ensured by partners or even customers, depending on the competency sought.

Firm 3 thus relies on social rather than organizational capital to access external knowledge during the transformation phase. Contrary to Firms 1 and 2, Firm 3 uses "off-the-shelf" external technologies. This kind of knowledge is more easily accessible and requires less customization than the kind of knowledge needed by Firms 1 and 2. Accordingly, the firm favors flexibility over security in the building and maintenance of its external knowledge network.

Exploitation

During the exploitation phase, firms seek to refine and adapt their knowledge about the environment in which the product is to be sold and used. People within firms thus develop an understanding of the way the organization will incorporate the existing product in production plants and sales service product portfolios for the market, reflecting effective conditions of functioning and customer expectations. The focus is not on the product *per*

se, but on the interactions between the product and the different environments, both within and outside the firm's boundaries. There again, this phase differs according to the kind of firms considered.

For Firms 1 and 2. Given the complexity of projects, Firms 1 and 2 try to solve all possible problems before completing the transformation phase. Moreover, with the intensive use of software and computer-aided design systems, the firms can now skip the prototyping phase and directly starts production. Our respondents pointed to the appearance of a problem at this stage as a serious threat because of the delays and additional costs involved. As a result, firms try to anticipate market changes and, as mentioned previously, involve as much as possible customers and salespeople in the transformation process to anticipate possible gaps and misfits that may occur so they can correct them as soon as possible.

At these firms, the products will be directly delivered to these customers who will then incorporate them into their own products and systems. Tests are then carried out jointly with the customers to check that the different expected functionalities are present in the product and work well. If the product does not correspond exactly to their specifications or if a default or malfunction is detected, the customer will ask the firm to make modifications. As one may expect in defense and aerospace industries, these tests are very rigorous and follow pre-established protocols and are validated with a check list of pre-defined indicators.

For firm 3. In Firm 3, the product is destined for a large customer base and is thus produced at an industrial scale and delivered to the market via a sales force. According to our respondents, at this firm, exploitation (mostly production and sales) is not completely formalized and is adapted to each situation. More precisely, this phase is characterized by numerous communications, discussions and negotiations among the different actors involved (marketing production and sales departments). Salespersons, in particular, have to be convinced of the value of the newly introduced product. They have to understand it to incorporate it into their product portfolios. A negotiation thus takes place, and, if salespersons are not convinced by the new product, they may ask for major changes. This dialogue enables the firm to fine tune the product and the definition of the market segment to be targeted.

Because the market segments addressed by the firm are large and diversified, there is no need to define *ex ante* the targeted market as thoroughly as in Firms 1 and 2. The firm retains some flexibility in this last stage of the process to adapt product–market couples. If the initial target does not seem adequate to sales persons, who are the most knowledgeable people regarding the market within the firm, it is still possible to modify it as the firm enjoys enough diversity in its customers base.

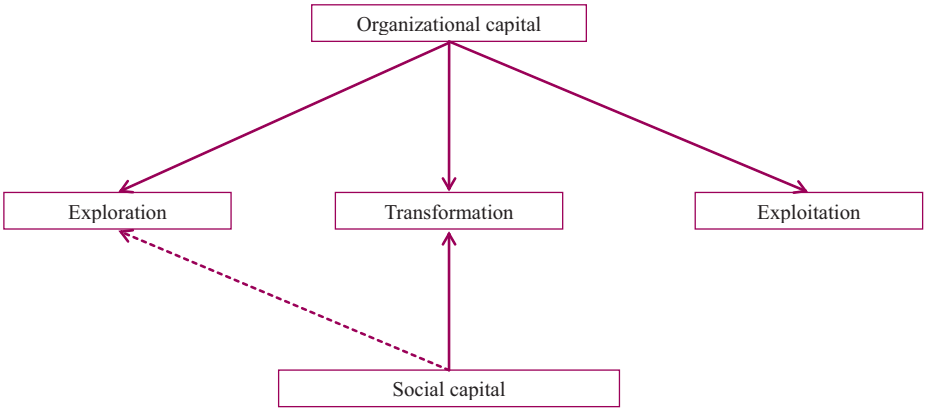
Results summary

To sum up, our data reveal the nature of the linkages between the different concepts presented in our "data analysis" section. Our results indicate that the linkages between the phases of the absorptive process and the underlying intellectual capital differ between Firms 1 and 2 on the one hand and Firm 3 on the other hand.

For Firms 1 and 2, as described in Figure 4, organizational capital is primarily or exclusively used in all three phases of the absorptive process. Social capital is used extensively in the transformation phase and in complement to systems capabilities. It is absent in the exploitation phase.

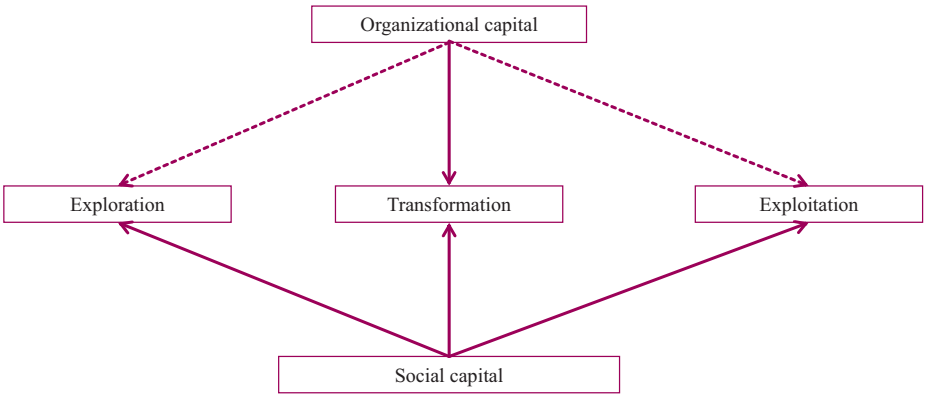
At Firm 3, as shown in Figure 5, social capital constitutes the one that is mostly used during the absorptive process. Social capital is used predominantly in all three phases of the absorptive process. Organizational capital plays an important role in the transformation phase and complements social capital in the exploration and exploitation phases.

Figure 4 Firms 1 and 2 knowledge processing system



Notes: Plain arrows represent the primary (or dominant) mechanism, dashed arrow represent the secondary (or complementary) mechanism

Figure 5 Firm 3 knowledge processing system



Notes: Plain arrows represent the primary (or dominant) mechanism; dashed arrow represent the secondary (or complementary) mechanism

Discussion

From our results, organizational and social capital both play a role in the absorptive process in all three studied firms. Consistent with previous findings, the firm must resort to its intellectual capital in its entirety to absorb knowledge and incorporate it in its future products (Chang *et al.*, 2013). Further, we observe a different mix of the different types of capital in each phase, lending support to the idea that the nature of knowledge that needs to be handled and the sub-objectives pursued inform the infrastructure set forth (Jansen *et al.*, 2005; Nonaka, 1994). As the process evolves, the knowledge progressively evolves from relatively unrelated pieces of knowledge to a progressively more articulated and structured knowledge architecture. In parallel, the objectives evolve progressively from discovering an opportunity to releasing a finalized product on the market. Accordingly, the firm mobilize the most relevant tools and procedures in terms of intellectual capital to meet the requirements of each phase (Turner and Makhija, 2006; Lane *et al.*, 2006). It is interesting to note that, for all firms, transformation is the phase during which both types of capital are intensively used. This may not be

surprising as it is the phase that is the more knowledge intensive, as exploration and exploitation need to be reconciled here.

However, it seems to us that the most interesting finding in this study is that Firms 1 and 2 use preferentially organizational capital throughout the absorptive process, whereas Firm 3 mostly relies on social capital to carry out knowledge absorption. How can this be explained?

According to us, the properties of each kind of capital, together with the different strategic requirements of the two types of firms, help explain our findings. The absorptive capacity, and hence its underlying intellectual capital, is adapted to the firm broader innovation policy, which, in turn, is dictated by the specific market position occupied by the firm. We think that the key argument is that social capital is best suited for knowledge accumulation, maintenance and circulation, whereas organizational capital is a tool for coordination and cooperation. Let us develop our argument by considering each case in turn.

Firm 3 enjoys a relatively wide market, made of different niches and categories of customers. However, this market is fairly competitive and requires from the firm very frequent innovations. Nonetheless, these innovations are (comparatively) simple, as they often involve the mere combination of different technological bricks that can be found off-the-shelf. Thus, to maintain its position, what is important for the firm is to quickly detect new ideas, launch a project and deliver a product on the market. Accordingly, at this firm, the flexibility and versatility of the absorptive process is critical. Of course, each project must be conducted thoroughly, but what is important is the ability to quickly move competencies, knowledge and skills from one project to another and to quickly build competencies and knowledge around specific projects/products. In other words, flexible knowledge accumulation and circulation is more important than strong coordination and cooperation in this setting (Brown and Eisenhardt, 1998).

To fulfill these different needs, social capital appears to be better suited than organizational capital. As mentioned earlier, social capital is especially apt at facilitating a smooth adaptation and an efficient circulation of knowledge throughout an organization through contextualized interactions, inter-individuals relationships and collaborations. Therefore, an absorptive process relying heavily on this kind of capital will have the attributes of knowledge flexibility and versatility (Nahapiet and Ghoshal, 1998; Tsai, 2002). An absorptive process extensively relying on social capital favors the evolvability of knowledge domains and smooth reorientations of knowledge flows according to the different opportunities identified by the firm (Cohendet and Simon, 2007). Moreover, while less enduring than organizational capital, social capital nonetheless does not disappear as individuals change position in the organization (Subramaniam and Youndt, 2005). On the contrary, individuals bring their networks with them when moving around the organization, thus allowing for re-use of existing knowledge, which facilitates the quick building of competencies required for a specific new product. The need for coordination is of course always present and explains the presence of organizational capital, but the firm's strategy calls for a strong emphasis on social capital.

Firms 1 and 2 face different environmental conditions. Their market is smaller and their customers ask for truly radical innovations. Consequently, these firms conduct (relatively) fewer projects, but these are much more complex than those conducted at firm 3. They include more components with much more uncertainty attached to each component. In addition, there are numerous interdependencies to manage between these different components. Consequently, the absorptive process is much longer and there are possibly different time horizons for each component that need to be reconciled (Brusoni *et al.*, 2001). Thus, in contrast to what takes place at Firm 3, the stake for Firms 1 and 2 is not to be able to swiftly reorient the absorptive process, but

rather to make it stable enough to guarantee both the accumulation of knowledge over specific domains and architectural and temporal coordination for the duration of a given project (Brusoni *et al.*, 2001). In this situation, knowledge building is important, but equally important is the handling of interdependencies existing between the different bodies of knowledge. The strategic requirements thus imply not to be able to swiftly reorient the absorptive process, but to make sure that it will remain stable for the duration of the product development.

To fulfill these requirements, organizational capital appears as a better tool than social capital. Codification ensures the accumulation of knowledge and the building of a collective memory about specific and sophisticated knowledge over long period of times, until uncertainty is completely resolved. Codification is better suited for complex knowledge as the elaboration thereof requires a traceability of the different steps taken and a protection against the risk of seeing the process disrupted, for instance by the departure of a key expert (Zollo and Winter, 2002). Moreover, organizational capital also permits to specify the global architecture of the product and thereby to define the different interfaces between components. It is then possible to coordinate the work on the different components (Brusoni *et al.*, 2001; Tushman and Rosenkopf, 1992; Hoopes and Postrel, 1999). In turn, the definition of the global architecture permits to synchronize and organize processes over time. Organizational capital provides an established cognitive platform available to everyone and enduring over time to cope with the long-term duration of the process at these firms. As such, it can be seen as a set of tools that enables the coordination and cooperation during the entire absorptive process (Cohendet and Simon, 2007).

Absorptive capacity is, by nature, a process that spans the internal and external frontiers of the firm. Actually, at the firm level, absorptive capacity is very often presented as an important capability for inter- and intra-organizational knowledge transfer (Van Wijk *et al.*, 2008). A closer look at the absorptive process and its associated cognitive infrastructure reveals that absorptive capacities depend on the firm's knowledge basis and organizational structures, which in turn is likely to influence the kind of knowledge and the kind of inter-organizational relationships that can be established. In other words, the absorptive capacity is much more contingent than usually stated. In particular, the market position seems to be an important determinant of the attributes of the absorptive process and, consequently, of the knowledge transfers taking place within the firm (Lane and Lubatkin, 1998). The nature of the knowledge transferred, and the way by which it is transferred, will depend on the overall innovative objective of the firm. Future research on knowledge transfer should thus go beyond general conditions for effective knowledge transfer (Szulanski, 1996), and should consider the reasons for transferring knowledge, both within and between organizations.

This work suffers a number of limitations. First, although our qualitative approach enabled us to access relevant data about the way the different phases are actually carried out, we are aware that we can only pretend to limited generalizability of our results. In addition to the small size of our sample, another limit is that all interviewees belonged to industrial firms. It would be interesting to extend this research by including firms from the service sector, where absorptive capacity could rely on more diffuse social interactions and where the knowledge dealt with could be more diverse in nature.

Further, especially in Firms 1 and 2, engineers and researchers share scientific professional norms that already integrates a good deal of codification, formalization and standardized procedures. Hence, the firm organizational capital is already well-tuned with the norms of the scientific culture of the workers (Adler and Borys, 1996; Cardinal, 2001). Hence, our results could be different in cases where professional identity and organizational capital do not fit so closely. Nonetheless, we believe this study retains some value in pointing some interesting results worth further investigations.

Conclusion

The overall aim of this article is to contribute to finer-grained understanding of how the absorptive capacity actually takes place in firms, crossing internal and external frontiers. Our core result is that absorptive capacity relies on organizational and social capitals. The exact combination of these two dimensions is contingent on the kind of output expected, which itself is informed by the specific environment in which firms evolve. More precisely, we find that more radical innovations call for formalized and managed knowledge infrastructures, while less radical ones rely on more informal and emergent knowledge networks.

This somewhat counterintuitive result is an invitation to further study the absorptive capacity process and its underpinning structures and processes at a micro-level of analysis. It also calls for deepening our understanding of the relationship between types of knowledge, knowledge management and the kind of innovation pursued.

References

Adler, P.S. and Borys, B. (1996), "Two types of bureaucracy: enabling and coercive", *Administrative Science Quarterly*, Vol. 41 No. 1, pp. 61-89.

Adler, P.S. and Kwon, S.W. (2002), "Social capital: prospects for a new concept", *Academy of Management Review*, Vol. 27 No. 1, pp. 17-40.

Blackler, F. (1995), "Knowledge, knowledge work and organizations: an overview and interpretation", *Organization Studies*, Vol. 16 No. 6, pp. 1021-1046.

Brown, J.S. and Duguid, P. (2002), *The Social Life of Information*, Harvard Business Press, Boston, MA.

Brown, S. and Eisenhardt, K. (1998), *Competing on the Edge*, Harvard Business School Press, Boston, MA.

Brusoni, S., Prencipe, A. and Pavitt, K. (2001), "Knowledge specialization, organizational coupling, and the boundaries of the firm: why do firms know more than they make?", *Administrative Science Quarterly*, Vol. 46 No. 4, pp. 597-621.

Burns, T. and Stalker, G.M. (1961), *The Management of Innovation*, Tavistock, London.

Cardinal, L.B. (2001), "Technological innovation in the pharmaceutical industry: the use of organizational control in managing research and development", *Organization Science*, Vol. 12 No. 1, pp. 19-36.

Chang, S., Gong, Y., Way, S.A. and Jia, L. (2013), "Flexibility-oriented HRM systems, absorptive capacity and market responsiveness and firm innovativeness", *Journal of Management*, Vol. 39 No. 7, pp. 1924-1951.

Cohen, J.A. (1960), "Coefficient of agreement for nominal scales", *Educational and Psychological Measurement*, Vol. 20 No. 1, pp. 37-46.

Cohen, W.M. and Levinthal, D.A. (1989), "Innovation and learning: the two faces of R&D", *The Economic Journal*, Vol. 99 No. 397, pp. 569-596.

Cohen, W. and Levinthal, D. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quaterly*, Vol. 35 No. 1, pp. 128-152.

Cohen, W.M. and Levinthal, D.A. (1994), "Fortune favors the prepared firm", *Management Science*, Vol. 40 No. 2, pp. 227-251.

Cohendet, P. and Simon, L. (2007), "Playing across the playground: paradoxes of knowledge creation in the videogame firm", *Journal of Organizational Behavior*, Vol. 28 No. 5, pp. 587-605.

Cook, S.D.N. and Brown, J.S. (1999), "Bridging epistemologies: between organizational knowledge and organizational knowing", *Organization Science*, Vol. 10 No. 4, pp. 381-400.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013), "Seeking qualitative rigor in inductive research notes on the Gioia methodology", *Organizational Research Methods*, Vol. 16 No. 1, pp. 15-31.

Hill, C.W.L. and Rothaermel, F.T. (2003), "The performance of incumbent firms in the face of radical technological innovation", *Academy of Management Review*, Vol. 28 No. 2, pp. 257-274.

Hoopes, D.G. and Postrel, S. (1999), "Shared knowledge,"glitches," and product development performance", *Strategic management journal*, Vol. 20 No. 9, pp. 837-865.

Jansen, J.J., Van den Bosch, F.A. and Volberda, H.W. (2005), "Managing potential and realized absorptive capacity: how do organizations antecedents matter?", *Academy of Management Journal*, Vol. 48 No. 6, pp. 999-1015.

Kusunoki, K., Nonaka, I. and Nagata, A. (1998), "Organizational capabilities in product development of Japanese firms: a conceptual framework and empirical findings", *Organization Science*, Vol. 6, pp. 699-719.

Lane, L.P., Koka, B. and Pathak, S. (2006), "The reification of absorptive capacity: a critical review and rejuvenation of the construct", *Academy of Management Review*, Vol. 31 No. 4, pp. 833-863.

Lane, P.J. and Lubatkin, M. (1998), "Relative absorptive capacity and inter-organizational learning", *Strategic Management Journal*, Vol. 19 No. 5, pp. 461-477.

Lavie, D. (2006), "Capability reconfiguration: an analysis of incumbent responses to technological change", *Academy of Management Review*, Vol. 31 No. 1, pp. 153-174.

March, J.G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2 No. 1, pp. 71-87.

Miles, M.B. and Huberman, A.M. (1994), *Analyse des données qualitatives*, De Boeck Université, Thousand Oaks, CA.

Moos, B., Beimborn, D., Heinz-Theo, W. and Weitzel, T. (2013), "The role of knowledge management systems for innovation: an absorptive capacity perspective", *International Journal of Innovation Management*, Vol. 17 No. 5, pp. 1350019-1350050.

Nahapiet, J. and Ghoshal, S. (1998), "Social capital, intellectual capital, and the organizational advantage", *Academy of Management Review*, Vol. 23 No. 2, pp. 242-266.

Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization science*, Vol. 5 No. 1, pp. 14-37.

Ouchi, W.G. (1981), *Theory Z: How American Business Can Meet the Japanese Challenge*, Addison-Wesley, Reading, MA.

Spender, J.C. (1996), "Making knowledge the basis of a dynamic theory of the firm", *Strategic Management Journal*, Vol. 17 No. 2, pp. 45-62.

Subramaniam, M. and Youndt, M.A. (2005), "The influence of intellectual capital on the types of innovative capabilities", *Academy of Management Journal*, Vol. 48 No. 3, pp. 450-463.

Szulanski, G. (1996), "Exploring internal stickiness: impediments to the transfer of best practice within the firm", *Strategic Management Journal*, Vol. 17 No. S2, pp. 27-43.

Todorova, G. and Durisin, B. (2007), "Absorptive capacity: valuing a re-conceptualization", *Academy of Management Review*, Vol. 32 No. 3, pp. 774-786.

Tsai, W. (2002), "Social structure of coopetition within a multiunit organization: coordination, competition, and intraorganizational knowledge sharing", *Organization Science*, Vol. 13 No. 2, pp. 179-190.

Tsai, W. and Ghoshal, S. (1998), "Social capital and value creation", *Academy of Management Journal*, Vol. 41 No. 4, pp. 464-476.

Tsoukas, H. and Chia, R. (2002), "On organizational becoming: rethinking organizational change", *Organization Science*, Vol. 13 No. 5, pp. 567-582.

Turner, K.L. and Makhija, M.V. (2006), "The role of organizational controls in managing knowledge", *Academy of Management Review*, Vol. 31 No. 1, pp. 197-217.

Tushman, M.L. and O'Reilly, C.A., III. (1996), "Ambidextrous organizations: managing evolutionary and revolutionary change", *California Management Review*, Vol. 38 No. 4, pp. 8-29.

Tushman, M.L. and Rosenkopf, L. (1992), "On the organizational determinants of technological change: toward a sociology of technological evolution", in Staw, B. and Cummings, L. (Eds), *Research in Organizational Behavior*, Jai Press, Greenwich, CT, Vol. 14, pp. 311-347.

Van den Bosch, F. Volberda, H. and de Boer, M. (1999), "Co-evolution of firm absorptive capacity and knowledge environment: organizational forms and combinative capabilities", *Organization Science*, Vol. 10 No. 5, pp. 551-568.

Van Wijk, R., Jansen, J.J. and Lyles, M.A. (2008), "Inter and intra-organizational knowledge transfer: a meta-analytic review and assessment of its antecedents and consequences", *Journal of Management Studies*, Vol. 45 No. 4, pp. 830-853.

Volberda, H.W., Foss, N.J. and Lyles, M.A. (2010), "Perspective-absorbing the concept of absorptive capacity: how to realize its potential in the organization field", *Organization Science*, Vol. 21 No. 4, pp. 931-951.

Wenger, E. (1998), *Communities of Practice; Learning as a Social System*, Systems Thinker, New York, NY.

Yakura, E.K. (2002), "Charting time: timelines as temporal boundary objects", *Academy of Management Journal*, Vol. 45 No. 5, pp. 956-970.

Youndt, M.A., Subramaniam, M. and Snell, S.A. (2004), "Intellectual capital profiles: an examination of investments and returns", *Journal of Management Studies*, Vol. 41 No. 2, pp. 335-362.

Zahra, S.A. and George, G. (2002), "Absorptive capacity: a review, re-conceptualization and extension", *Academy of Management Review*, Vol. 27 No. 2, pp. 185-203.

Zollo, M. and Winter, S.G. (2002), "Deliberate learning and the evolution of dynamic capabilities", *Organization Science*, Vol. 13 No. 3, pp. 339-353.

Corresponding author

Olivier Dupouët can be contacted at: olivier.dupouet@kedgebs.com