The knowledge capital of SMEs: The French paradox

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DANS JOURNAL OF INNOVATION ECONOMICS & MANAGEMENT 2015/2 (N°17), PAGES 27 À 48
ÉDITIONS DE BOECK SUPÉRIEUR

DOI 10.3917/jie.017.0027
Empirical and theoretical research shows that for SMEs as for big firms, firm-level innovation activities are positively related to their growth in terms of sales (Coad, 2009) or productivity (Crepon et al., 1998; Ortega-Argilés et al., 2011). Indeed, innovation activities are crucial in a context of global competition and market uncertainty; they are an essential means not only to maintain or increase the firms’ competitiveness but also to survive (Porter, 1990; RRI, 2014). However, the measure of innovation activities is not an easy task. Traditional indicators of innovation (like the amount of R&D expenses or the number of patents) have been criticized since they only capture (moreover not perfectly) technological innovation and neglect organizational or commercial innovation. While the most recent studies include new indicators (see OECD, 2005; OECD, 2013a), it is now recognized that innovation resources are not only developed internally but strongly depend on external partnerships that enrich the firm’s knowledge stock and contribute to the diffusion of innovation. In other words, the measurement of innovation activities should integrate both absorptive capacity (Cohen, Levinthal, 1990) and open innovation strategy (Chesbrough, 2003).

In this paper, we build a theoretical framework aimed to assess innovation activities of firms, using the concept of “Knowledge Capital” (KC) (Laperche, 2007, 2013), which aims to provide a better understanding of the ways by which firms develop and use new knowledge in the innovation process. It gathers the two concepts of absorptive capacity and open innovation, also used as assessment tools. Through a review of literature, we apply
this framework to small and medium-sized enterprises (SMEs) in order to capture their main characteristics regarding innovation activities. Our interest in SMEs may be justified by the idea that innovation mostly stems from the small flexible organization (or even from the entrepreneur) rather than from the bureaucratic large company (Schumpeter, 1942; Acs, Audretsch, 1988; Baumol, 2002). But does this common idea reflect the reality? We use the case of French SMEs to answer this question. The study of the French context rapidly shows the existence of a paradox – we call it a “French paradox” – expressed by a quite important effort of SMEs in terms of R&D investments and poor results in terms of innovation as measured by traditional indicators. To explain this paradox, we study their strategy of KC building and valorization (through absorptive capacity and open innovation).

In the first part, we firstly present our analytical framework based on the definition of KC and the main characteristics of SMEs and we secondly define our research method characterized by the analysis of French case. The second part gives explanations for the French paradox, based on the study of how French SMEs build and use their KC. It particularly stresses the place of SMEs within innovation networks.

THEORETICAL FRAMEWORK
AND RESEARCH METHOD

Studying the innovation capacity of SMEs through KC formation and use

An analytical framework to study innovation activities of SMEs

To study the innovation capacity of SMEs, usually considered as the main drivers of innovation, due to their flexibility and creativity, we use the concept of KC; It has the advantage, as explained below, to link two important current concepts in innovation management: absorptive capacity (AC) and open innovation (OI) strategy. These concepts are often studied separately in theoretical and empirical papers (see for example Muscio, 2007; Kodama, 2008; Spithoven et al., 2011; etc. for AC; Gassmann, Enkel, 2004; Vanhaverbeke et al., 2012; Parida et al., 2012; etc. for OI). However, we consider that, to be able to understand the whole innovation process, it is necessary not only to study the way firms acquire, assimilate, transform and exploit knowledge (which refers to AC) but also the type of partnerships implemented to develop and/or diffuse innovations (which refers to OI). By the way of a literature review achieved in international journals of
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economics and management on innovation, we are thus able to draw the
main characteristics of SMEs regarding KC, distinguishing the performances
in terms of AC and of OI.

The concept of KC was proposed to provide a better understanding of
the ways by which firms develop and use their knowledge in the innovation
process. It is defined as the set of scientific and technical knowledge and
information produced, acquired, combined and systematized by one or seve-
rnal firms for productive purposes (Laperche, 2007, 2013). It (see Figure 1)
refers to the accumulated knowledge of one or several linked firms (embed-
ded in the individuals – know-how – machines, technologies and routines
of the firm), which is continuously enriched by information flows and which
is used in the production process or more globally in the value creation pro-
cess. Thus, it is a dynamic concept – a process – that defines the know-
ledge accumulated by one or several firms and continuously enriched and
combined in different ways, and eventually used or commercialized. This
productive aim – to create value – is the main characteristic, which turns
knowledge into “capital”\(^1\).

Studying the KC of enterprises gives the possibility to understand how
they generate new knowledge and how they transform this knowledge into
(technological, organizational and commercial) innovation. As a matter of
fact, the information collected on markets (through intelligence strategy,
patent information, purchase of technology, partnerships and licensing con-
tracts…) is integrated into the knowledge stock through learning processes
which are basic in the transformation of information (flow) into knowledge
(stock) (Nelson, Winter, 1982). The use of the knowledge stock depends on
market and production opportunities and on the degree of maturity of the
existing technologies. Regarding the analysis and assessment of the gene-
ration and use of new knowledge, two concepts are thus useful: absorptive
capacity and open innovation.

\(^1\) The concept of Knowledge Capital is mainly analytical and aims to go deeper in the under-
standing of the content of the “black box” of firms’ innovation processes. It thus complements
but also differs from the “Knowledge-based capital (KBC)” recently developed by the OECD
(2013a) which aims to list and better measure the intangible assets into which firms invest, such
as data, software, patents, designs, new organization processes and firm specific skills (divided in
three groups: computerized information, innovative property and economic competency, see also
Corrado et al., 2005). The ultimate goal of KBC is to provide evidence of the economic value
of KBC (impact on growth and productivity, competitiveness of firms, innovation) in order to
promote policy measures adapted to a broad vision of innovation. Moreover, although these ele-
ments are crucial to the firm’s innovation processes, tangible assets (included in our concept of
KC) also contain the knowledge (dead labor) essential to innovation processes.
“Absorptive capacity”, which is a dynamic capability (Teece et al., 1997), can be considered as a prerequisite for KC formation. AC was firstly defined by Cohen and Levinthal (1990) as the ability of a firm to recognize the value of new and external information, assimilate it and apply it to commercial ends. Four dimensions of AC are usually identified: acquire, assimilate, transform and exploit (Zahra, George, 2002) and are considered as essential to building competitive advantage over competitors in a context of growing open innovation.

The concept of “open innovation” suggests that the management of innovation activities by the firm has been changing over time, from a “closed” to an “open” process through which “valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well” (Chesbrough, 2003, p. 47). According to this model, firms collaborate at all stages of the interactive innovation process (design, production and commercialization) and with multiple partners. The analysis of collaborative innovation with an “open” approach defines three processes of OI (Chesbrough 2003; Gassmann, Enkel, 2004; Chesbrough, Crowther 2006; Lichtenthaler, 2008; Van De Vrande et al., 2009).

The first is known as inbound or outside-in OI which refers to the exploration and integration of external resources for internal knowledge
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development (Parida et al., 2012). The second is known as outbound or inside-out OI that exploits externally the technology capacities through various paths of commercialization, IP licensing, technology multiplying, or spin-offs. It is often accompanied by the development of a corporate innovation ecosystem (See for example the analysis of Rohrbeck et al., 2009 on the innovation ecosystem of Deutsche Telekom or the case of IBM Corporate Venture Capital). The third is a coupled process which mixes the outside-in and inside-out processes while dealing with different partners engaged in the same R&D project.

OI puts forward the growing importance of networks, within which KC is built. The tendency towards the collective constitution of KC is gaining ground in the context of the economic crisis, and particularly in large companies (Laperche et al., 2011). Indeed, collaborative research gives firms the possibility to reduce the cost and risk of innovation development. At the same time, it provides new opportunities for them to renew their supply, finding new technological paths and thus opening new markets.

The knowledge capital of SMEs: some characteristics

Main characteristics of SMEs presented in table 1 stem from our review of literature. AC and OI are two interrelated elements that contribute to SMEs’ KC development. On the one hand, the structural characteristics inherent to their smallness and their knowledge management practices (transformational and configurational capabilities) influence the assessment of their AC and innovation strategy. On the other hand, the integration into innovation networks provide SMEs not only new knowledge to enrich their knowledge stock and to reinforce their AC, but also new channels to valorize their capital through innovation collaboration.

Table 1 – Characteristics of SMEs’ absorptive capacity and open innovation strategies

<table>
<thead>
<tr>
<th>Absorptive capacity</th>
<th>Open innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Measurement issue • Indicators not well adapted to SMEs • SMEs less effective in terms of AC as measured by traditional indicators</td>
<td>1) Choice of OI strategies • Preferring inbound OI process • Relying on collaboration with market sources • IPR practices limiting usage of outbound OI</td>
</tr>
<tr>
<td>2) SMEs’ knowledge management capacities • Transformational capabilities requiring skills and experience limited by a small R&amp;D personnel • Configurational capabilities linked to their ability to benefit from outside sources conditioned by their smallness</td>
<td>2) Role of innovation networks • Integrating in innovation networks in order to overcome their limits • Sources of new knowledge to enrich existing stocks of knowledge • Source of market information: new channels for commercialization/valorization</td>
</tr>
</tbody>
</table>

Source: authors, based on the review of literature
Regarding AC, a first element to put forward is that the empirical research on SMEs and AC does not generally focus on the distribution of AC according to the firm’s size but rather on its role in the enhancement of performances (e.g., Pavitt, 1998; Laursen, Salter, 2006; Schmidt, 2005). Moreover the indicators of AC are a subject of debate. While being a multidimensional concept, the measure of AC has remained mainly based on R&D proxies, that is to say R&D inputs (notably R&D intensity) and outputs (especially patents) even if some recent works try to improve this measure by including new criteria (like non-R&D investments linked to innovation, collaborations and knowledge management tools) (Liao et al., 2003; Flatten et al., 2011; Courvisanos, 2012; Som et al., 2013). However, these indicators that build upon the model of innovation of large corporations are not well adapted to the practices of SMEs (Bougrain, Haudeville, 2002; Huet, Lazaric, 2008; Gallié, Legros, 2012). Due to their weaker human and financial resources, compared with larger firms, SMEs appear to be less effective in terms of AC as measured by traditional indicators. SMEs (with less than 250 employees) of OECD countries performed on average 32.6% of total business R&D while the other 67.4% was performed by larger firms in 2011. Although they may file more total number of patents than big firms, they have lower grant rates and a higher withdrawal rates (Frietsch et al., 2013).

A second issue deals with the knowledge management capacities of SMEs. As a matter of fact, small firms are qualitatively different from big companies in terms of management systems, internal resources and behaviors. In particular, they are characterized by a specific “small business mindset” (remain small to be flexible and independent) which contributes to their survival, but also limits the growth of their AC (Anderson, Ullah, 2014). The number and the quality of R&D personnel can have a direct impact on SMEs’ internal capacity to absorb the knowledge acquired and to create new ones. Thus, in order to access and to exploit the knowledge of outside partners, SMEs need to have qualified R&D personnel and to continuously invest in human resources (Muscio, 2007). The small size of the R&D team will limit their “transformational capacities” which define their ability to transform available general knowledge into locally specific knowledge. This will also limit their “configurational capabilities”, which emphasize the firms’ aptitude to efficiently identify and access knowledge and to reconfigure and redistribute the repositories of knowledge (Bender, 2008). This explains the weakness of SMEs (in particular those in traditional sectors) in exploiting external sources due to the lack of proficiency in networking or in other forms of trans-organizational interactions (ibid.).

Concerning OI strategies, the small size of SMEs may indeed be an advantage as they are more flexible than big corporations to mobilize and
exploit external resources (Narula, 2004, Nooteboom, 1994, Rothwell andDodgson, 1991). On the contrary, their smallness also limits the developmentof AC and thus their capabilities to exploit external resources, which conditiontheir KC development. Since SMEs are often specialized in one family ofknowledge and use less structured innovation strategies, they use morefrequently collaboration and inbound OI processes while large companies have morecollaborative partners and different channels of diffusion (Vanhaverbeke et al., 2012; Parida et al., 2012). Technology intermediaries are essential to help SMEs in searching and exploiting knowledge (Kodama, 2008; Spithoven et al., 2011). Moreover, compared with large corporations, SMEs prefer cooperating with market sources (clients, suppliers, customers) than with horizontal partners which are mainly universities, public research centers or government agencies (Diez, 2000; Zeng et al., 2010; OECD, 2013b) and with international partners (Zeng et al., 2010; OECD, 2013b). Finally, their capacity to be involved in outbound OI is constrained by their practice of intellectual assets management. The most innovative SMEs implement sophisticated OI strategies, as it is the case in biotechnology (Gassman, Keupp, 2007). For them, commercializing their technologies is one of their core competencies and provides a means of rapid growth. However, the use of outbound OI – which is largely built upon the exploitation of IPRs – is restricted by their general lack of IPR awareness and strategies (OECD, 2011) and their preference for non-statutory methods (mainly trade secrets) (Gallié, Legros, 2012; Ollivier, Simon, 2013).

To cope with their disadvantages, SMEs need to look out for new resources and opportunities, which they usually find within innovation networks. Being part of innovation networks provides SMEs not only new knowledge for product development but also channels of commercialization. By joining a business group for example, SMEs can overcome their natural constraints on financial and human resources and lack of economies of scale and scope inherent to their small size (Guzzini, Iacobucci, 2014). SMEs that belong to an innovation network especially those that cooperate with large companies practice more actively outbound OI (Vanhaverbeke et al., 2012). Through the collaboration with large firms, SMEs can not only reinforce their own KC but also contribute to the formation of large companies’ ones.

An illustrative case: the French paradox

The interest of taking into account the two concepts of AC and OI in the analysis of innovation activities is illustrated by the case of French SMEs. When studying European and notably French innovation results, it has been current to present a paradox between the quite important efforts and results
in term of R&D and scientific inputs and outputs and poor results in terms of innovation (patents, new products diffused in markets, new businesses…) (Edquist, McKelvey, 1998; Bitard et al., 2008). We decided to use the case of French SMEs to illustrate our analysis and to see whether or not this paradox was observable when focusing on SMEs. The case study was built upon a wide range review of literature (journal articles, reports, records) and the exploitation and analysis of open access data (OECD, Eurostat, INSEE) related to French SMEs’ practices. We adopted a single case study methodology (the French case) (Yin, 2009). The rationale for this methodological choice is explained by our interest in contemporary behaviors of French SMEs in terms of innovation. Moreover, single case studies are usually used when the case is extreme and unique which is the case of the French paradox identified and compared with the situation of France’s main commercial partners. Finally, single case studies are used to test existing theories, which is our goal when dealing with the role of AC and OI strategies.

Indicators of innovativeness of SMEs reveal the existence of the French paradox. France has adopted the European definition of SMEs with less than 250 employees which we retain in this paper.

In 2011, French SMEs represented 99.8% of French firms that hire 50% of total employees (Insee, 2014). SMEs represent only a fraction of the business R&D in OECD countries but more than their main partners. As shown in table 2, in 2011, SMEs performed 22.6% of total business R&D in France (which ranks France 21 out of the 28 OECD countries), 21.8% in United Kingdom, 14.9% in United States, 11% Germany and 4.4% in Japan. Meanwhile, they funded 23.6% of business R&D expenditures in France, 19.8% in UK, 9.7% in Germany, 16.3% in the US and 4.4% in Japan. Compared with its main trade partners, French SMEs then make a greater effort in R&D, but their results in terms of innovation output are weaker. If we look at the output of innovation activities, measured by number of patents, during the period of 2009-2011, French SMEs have one of the lowest proportion (57.5%) of patents owners as total number of firms (with

2. Another category of firms has been created – the “intermediate-sized enterprises” (entreprises de taille intermédiaire, ETI) which have between 250 and 4999 employees. The creation of the group ETI is under the observation that France has many less intermediate-sized enterprises than other big European economies such as Germany of United-Kingdom (OCDE, 2014) and more efforts should be made to boost the growth of young gazelle SMEs in order to enlarge the population of ETI and hence to rebalance the industrial structure. Although the innovativeness of ETI is a topical subject, it is not studied in this research in which the ETIs are included in the category of large firms. Moreover, although we are aware of the strong heterogeneity of the population of SMEs, due to the lack of detailed statistics (e.g., OCDE, Eurostat, Insee do not distinguish the different sub-groups of SMEs in innovation statistics and France is absent in the CIS) we analyze them as a whole.
more than 20 employees) of OECD countries, which is only better than Germany (55.4%) and Japan (27%). The share of patents filed by young firms under 5 years and the average number of patents filed by young firms under 5 years in France is also under the OECD average (OECD, 2014), except the business-sector services (figure 2). The paradox – which we call here the “French paradox” – is that the result of the innovation activities of French SMEs does not correspond to their efforts.

Table 2 – Selected indicators of innovativeness of SMEs in selected OECD countries

<table>
<thead>
<tr>
<th></th>
<th>France</th>
<th>UK</th>
<th>Germany</th>
<th>US</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business R&amp;D performed*</td>
<td>22.6</td>
<td>21.8</td>
<td>11</td>
<td>14.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Business R&amp;D funded by firms*</td>
<td>23.6</td>
<td>19.8</td>
<td>9.7</td>
<td>16.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Patents**</td>
<td>57.5</td>
<td>62.4</td>
<td>55.4</td>
<td>61.8</td>
<td>27</td>
</tr>
<tr>
<td>Trademarks**</td>
<td>68.8</td>
<td>64.6</td>
<td>65.9</td>
<td>84.7</td>
<td>17.3</td>
</tr>
</tbody>
</table>

* By SMEs (1 to 249 employees), as percentage of total business sector, in 2011
** Firms (20 to 249 employees) with trademarks and patents as % of firms with more than 20 employees, 2009-11
Source: Data compiled from OECD STI Scoreboard 2013, OECD StatExtrats and Eurostats

Figure 2 – Patenting activity of young firms by sector, 2009-11

Source: OECD STI Scoreboard 2013

To explain this paradox, we decided to go deeper into the analysis of KC of SMEs by applying the key issues that figured out in table 1, in order to put...
forward if there are some specific characteristics in terms of both AC and external partnerships (OI).

**HOW TO EXPLAIN THE FRENCH PARADOX?**

**Structural Characteristics of SMEs and the evolution of innovation policies**

*Structural characteristics of French SMEs*

The French paradox that we have identified may be explained by structural characteristics of SMEs in general, and hence of French SMEs.

*Table 3 – Selected indicators of innovativeness of SMEs (10 to 249 employees) according to Innovation Union Scoreboard 2014*

<table>
<thead>
<tr>
<th></th>
<th>EU</th>
<th>BE</th>
<th>DK</th>
<th>DE</th>
<th>ES</th>
<th>FR</th>
<th>IT</th>
<th>NL</th>
<th>AT</th>
<th>FI</th>
<th>SE</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMEs innovating in-house</td>
<td>31,8</td>
<td>39,8</td>
<td>40,8</td>
<td>45,2</td>
<td>22,1</td>
<td>29,9</td>
<td>34,8</td>
<td>39,1</td>
<td>36,3</td>
<td>33,2</td>
<td>37,7</td>
<td>-</td>
</tr>
<tr>
<td>Innovative SMEs collaborating with others</td>
<td>11,7</td>
<td>20,1</td>
<td>15,5</td>
<td>14</td>
<td>5,8</td>
<td>11,1</td>
<td>4,4</td>
<td>14,9</td>
<td>20,5</td>
<td>16,5</td>
<td>17,5</td>
<td>22,3</td>
</tr>
<tr>
<td>SMEs introducing product or process innovations</td>
<td>38,4</td>
<td>50,3</td>
<td>41,6</td>
<td>57</td>
<td>28,1</td>
<td>32,7</td>
<td>39,8</td>
<td>46</td>
<td>42,2</td>
<td>44,8</td>
<td>47,4</td>
<td>21,3</td>
</tr>
<tr>
<td>SMEs introducing marketing/organizational innovations</td>
<td>40,3</td>
<td>41,7</td>
<td>42,6</td>
<td>60,5</td>
<td>27,7</td>
<td>42,8</td>
<td>43</td>
<td>36,9</td>
<td>42,3</td>
<td>38,9</td>
<td>42,1</td>
<td>30,6</td>
</tr>
</tbody>
</table>

Source: Eurostat

A major explanation of the paradox is that the innovation performance of French SMEs is underestimated due to the difficulties of collecting data related to SMEs’ R&D efforts and the lower visibility of incremental or non-technological innovations (Reboud, Mazzerol, 2014). As the European Innovation Union Scoreboard (2014) shows (table 3), in 2010, the part of French SMEs that introduce product or process innovation as a percentage of all SMEs (32.7%) is under the European average level (38.4%). However, French SMEs are more active in introducing organizational and marketing innovation (42.8%) than their European counterparts (40.3%). This trend is confirmed by the result of French SMEs measured by trademarks (68.8%), which is better than Germany (65.9%), Japan (17.3%) and the
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United-Kingdom (64.6%) as shown in the table 2. Indeed, Incremental and marketing innovations, as measured by the trademarks, although not directly contributing to technological progress (measured by patents), involve the use of new technologies and knowledge. The higher share of investment in R&D by French SMEs can be partly explained by the fact that countries with a strong services sector, like France, tend to use more trademarks for protecting their intellectual asset (OECD, 2010).

Moreover, the poor results of French SMEs in terms of patents might be biased by their intellectual asset practices since they prefer non-statutory methods in particular trade secrets to protect their KC (Gallié, Legros, 2012). In this context, the traditional indicators for AC which are developed for big firms do not reflect the reality of SMEs (Huet, Lazaric, 2008). Instead of having an R&D department as big firms to generate radical innovation, they rather have a design office, composed of engineers and technicians and focusing on incremental innovations. This has a positive impact on the innovation performance of French SMEs and helps them to better extract the benefit of innovation collaboration (Bougrain, Haudeville, 2002).

Hence, the capacity of cooperation of SMEs is more correlated to skills and strategy than to R&D intensity. The cooperation decision in SMEs is related to their capacity for interaction, which is conditioned by their transformational capabilities and their cognitive distance (Nootboon, 1994; 2000). Thus, French SMEs will more easily cooperate under the condition of co-technological development and of similarity of skills (Huet, Lazaric, 2008). Moreover, the configurational capabilities are also essential as demonstrated by a recent study which shows that SMEs with effective knowledge management are more organized for networking and interacting with external resources because they know where to find knowledge and what to do with the knowledge acquired (Boly et al., 2014).

Structural characteristics of SMEs, mostly related to AC appear to be a major factor explaining the French paradox. But another important part of the explanation stems from their particular place within innovation networks, as revealed by the review of their OI practices.

**Innovation policies and their impact on the KC strategy of SMEs**

One main explanation of the French paradox can be that SMEs do not valorize their KC themselves but through innovation networks. Their efforts in terms of investments may then not be visible. This can be partly explained by the evolution of innovation policies. In the past, these policies were mostly focused on large companies (the “national champions” of the period of growth following the Second World War) but in the 1980s, they became more directed
towards SMEs. And the current evolution of these policies (in France as all over the world) is orientated towards the building of networks, considered as the main tool of innovation performance (Laperche, Uzunidis, 2010).

As a matter of fact, the French innovation policies towards SMEs have been criticized as concentrating on the reduction of costs of innovation by favoring “individual growth” of firms (direct and indirect measures, public procurement) and static efficiency through the sharing of equipment (Carré, Levratto, 2009). Indeed, French public policies emphasized entrepreneurship and in particular high-tech start-ups. This has still been the case since the late-2000s with the promotion of start-ups and innovative SMEs through various instruments such as direct (for example loans of OSEO, national context of start-ups issued of the public research) or indirect (JEI, JEU, exoneration for venture capital or business angels, research tax credit3, etc.) financial support, coaching and networking services (incubators, clusters, technological transfer services, etc.), or public procurement policies (Liu, 2013b, Uzunidis et al., 2014).

However, under the new French innovation policies that have been initiated since 2005, SMEs are being pushed to collaborate with other firms and notably bigger ones on R&D projects with the aim of increasing the managerial know-how and to intensify links between firms notably through the competitiveness clusters.

The competitiveness clusters policy launched in 2005 can be considered as one step toward the emphasis on a collective capacity building by clearly targeting collaborative research projects carried out by firms of different sizes. Although before 2005 there already existed the “technopoles” that promoted R&D networks between firms and public research institutions (Liu, 2013b), the competitiveness clusters were the first instrument that focused on collaboration between firms in particular between large and small firms with juicy funding. This policy has had a significant impact on firms’ networking and innovation collaboration. As members of clusters, French SMEs receive more public support (grants and fiscal measures notably the CIR) than those that are not members of clusters, even though they might not participate in collaborative R&D projects (Dordet-Bernadet, 2013) while for big firms, to participate in a collaborative R&D project with SMEs can bring them extra public funding.

3. Indeed, France offers the most generous tax incentives for business R&D of all OECD countries and the second highest combined support for business R&D (both R&D tax incentives and direct support through grants, contracts and loans) as a percentage of GDP, after Korea (Liu, 2013a). In 2011, SMEs and large firms represented 88.5% and 9.3% of total recipients of research tax credit respectively; and received 28.2% and 48.1% of total research tax credit (CIR) respectively, which represent 30.9% and 68.1% of total eligible R&D expenditure (MESR, 2013).
All large firms, as well as the ETIs and the SMEs that spent more than 16 million euros in R&D before 2005, joined the clusters (Dordet-Bernadet, 2013). By the end of 2009, almost 40% of clusters have participated at least one collaborative project while the average participation rate was 1.9 per firm (Wemelbeke, 2011). These elements lead us to consider that the French innovation policy, favoring collaboration between SMEs, ETI and larger companies contribute to the explanation of the French paradox.

**The place of SMEs within innovation networks**

**SMEs as part of OI strategies of large companies**

Innovative small firms generally play key roles in innovative networks. By cooperating with specialized high-performance small businesses, groups have access to technology outside their usual fields of research and can integrate innovative technologies and complementary skills within their KC (inbound OI). In this case, the probability of buyout of young firms by large firms increases with the size of the firm due to the larger stock of knowledge (Barrot et al., 2011). Cooperation with small businesses also allows large firms to produce at a lower cost by increasing the speed of development. Moreover, SMEs are also a channel for large companies to monetize their unused technology (outbound OI).

An accurate analysis of innovation networks in France reveals that innovative SMEs are indeed strongly linked with larger corporations. These strong links may offer an explanation to the French paradox since the poor results in terms of innovation would not reveal poor competences in terms of valorization/use of their KC but rather a valorization of SMEs' KC through networks built by large companies. In other terms, the KC of French small innovative companies would be used to enrich the KC of other larger companies. These strong links are shown firstly by the role of corporate venture capital in the birth and growth of small innovative businesses and secondly by the structure of innovative collaborative projects, which are mostly carried out in the framework of French competitiveness clusters. Hence, the buyout of big French young technological firms by French or foreign groups is also more frequent than other firms (Barrot et al., 2011).

Regarding venture capital, French corporate investors represented 8.3% on average of total private equity funds raised during the period from 2007-2013 which is slightly lower than the average European level (10.4%) and far behind Germany (21.3%). This can be explained by the high share of French public agencies (30.3%) in venture capital (compared with 24.1% of European average and 16.2% of Germany) (table 4). However, only some
20s corporate ventures count for 10% of total French venture capital and 7.2% of funds raised in 2010. Although French venture capitalists in general tend to invest largely in later-stage venture (56% compared with 48% for Europe and 42% for Germany) (EVCA, 2014), survey shows that French corporate ventures are more driven by strategic motivations with concern on accessing new and potential technology and market than pure financial motivations (Veil, 2012). 10 of the 15 French corporation ventures studied are either attached directly to the board of director (Dassault Système, Rhodia, Saint-Gobain, Veolia) or to the department of innovation (Alcatel-Lucent, Bouygues Telecoms, SFR, SNCF, Suez Environnement, Total), which more or less provide coaching for start-ups with a strategy of potential M&A (ibid.). In this context, the start-ups that receive capital are tightly involved in the innovation process of its investor and their KC may be valorized through the various methods such as joint development agreements, production or distribution agreements or joint ventures that the corporate venture uses to promote their development.

Table 4 – Selected data of new funds raised and invested by country of the fund management team (average of period 2007-2013)

<table>
<thead>
<tr>
<th></th>
<th>FR</th>
<th>UK</th>
<th>D</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venture funds raised during the year by investor type, as % of total venture funds raised</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate investors</td>
<td>8,28</td>
<td>3,52</td>
<td>21,3</td>
<td>10,4</td>
</tr>
<tr>
<td>Government agencies</td>
<td>30,3</td>
<td>14,12</td>
<td>16,3</td>
<td>24,1</td>
</tr>
<tr>
<td>Investments by country of private equity firm, as % of total venture funds invested</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seed</td>
<td>2,3</td>
<td>1,2</td>
<td>7,2</td>
<td>3,8</td>
</tr>
<tr>
<td>Start-up</td>
<td>42</td>
<td>41,9</td>
<td>51</td>
<td>47,8</td>
</tr>
<tr>
<td>Later stage venture</td>
<td>55,7</td>
<td>56,9</td>
<td>41,8</td>
<td>48,5</td>
</tr>
</tbody>
</table>

Source: calculated based on data from 2013 European Private Equity Activity, EVCA (2014).

**Innovation collaboration of SMEs in competitiveness clusters**

The influence of large corporations is also observable in partnership and collaboration practices. In France, it is through research programs at national and European levels or through clusters that SMEs are encouraged to work with large groups. Although there are various schemes that support collaborative innovation such as the cluster policy (pôle de compétitivité), national research agency (ANR) or strategic industrial innovation fund (ISI), the clusters provide the most important source of partnership and funding for SMEs’ collaborative projects.

Being involved in competitiveness clusters has a positive impact on French SMEs’ AC. In 2009, the SMEs in the 71 competitiveness clusters
spent more in R&D than similar companies outside these clusters (Dordet-Bernadet, 2013); they are also more likely to cooperate with international partners than those outside the cluster (Hovaguimian, 2013). Particularly, SMEs in the innovation networks that are built around large companies (the most competitive clusters including 7 global clusters and 10 clusters with global reach of which 6% of the members are large, companies compared with 3% in the 54 national clusters, see figure 3) participate more actively in collaborative projects. In 2010, 30% of total annual granted projects were led by SMEs while in 60% of total annual granted projects, one SME at least was involved in global clusters and clusters with global reach, compared with 23% and 53% in national clusters (table 5). This suggests that innovative SMEs are more involved in the co-valorization process when there is a strong presence of large companies.

**Figure 3** – Size distribution of firms by types of clusters, in 2010

![Graph showing size distribution of firms by types of clusters, in 2010](image)

Source: data compiled from the Tableaux de bord de compétitivité. Edition 2011, INSEE

**Table 5** – Collaborative projects of competitive clusters granted in 2010

<table>
<thead>
<tr>
<th></th>
<th>Global clusters</th>
<th>Clusters with global reach</th>
<th>National clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total granted</strong></td>
<td>594</td>
<td>331</td>
<td>1453</td>
</tr>
<tr>
<td>SMEs led</td>
<td>147</td>
<td>116</td>
<td>334</td>
</tr>
<tr>
<td>Involved at least 1 SME</td>
<td>311</td>
<td>226</td>
<td>771</td>
</tr>
</tbody>
</table>

Source: data compiled from the Tableaux de bord de compétitivité. Editions 2010 and 2011, INSEE
Large companies weight heavily in the governance of clusters, thanks to their financial capacities to support the operation of the cluster and the visibility that they bring in (Bearing Point-Erdyn-Technopolis, 2012). In 2011, an average cluster with 187 members was composed by 15.5% of large companies and 57.7% of SMEs, with other partners such as public research institutions, training centers, etc. The governance instance of clusters (direction and administrative board) is composed 26% of large companies, compared with 25% of SMEs. Nevertheless the practices depend on the structure of the cluster. As Figure 4 shows, the two most common forms of partnership between firms and with public research partners in French cluster are: 1) one or several large companies as leader, surrounded by partners SMEs and public research institutions; 2) SMEs as leader and collaborating with academic partners. These two forms often coexist within a cluster where the “sub-clusters” based on different research projects can be identified as in the case of microelectronic and IT system solutions (Dang, 2011).

Figure 4 – Forms of partnerships within competitiveness clusters

In the first form, large company often play crucial roles in the governance of clusters, as it is the case for Valéo, Saint-Gobain, Renault or PSA, where they initiate R&D programs involving SMEs (Laperche, Lefebvre, 2011). SMEs in these clusters are often in a position as sub-contractors, which lead to interdependency. SMEs innovate and are specialized on the high quality services or products to satisfy the needs of big firms. Their technological specialization is built around the core technology of the cluster like in the sub-cluster MRG specialized in fabless within the cluster of Communicant and system solution (SCS) (Dang, 2011). In the second form, while academic partners are key source of knowledge for SMEs
The knowledge capital of SMEs: the French paradox

(Bearing Point-Erdyn-Technopolis, 2012), the latter searches wider outside the existed network for partnerships (Dang, 2011) and opportunities.

The explanation of the poor results in valorization of SMEs’ KC drawn from the comparison of these two schemes is that one part of the KC of French SMEs is not valorized directly through the market. SMEs belonging to innovation networks dominated by large firms are involved in their innovation process through which they valorize their KC and less seek other channels of commercialization.

CONCLUSION AND FUTURE RESEARCH

In this study, we built an analytical framework and proposed a new assessment tool by combining two key concepts related to the KC development – AC and OI – to assess innovation activities of firms. Based on a literature review, we applied this scheme to SMEs and identified their main characteristics as regards KC constitution and valorization. Applied to the French case, we have highlighted what we call the French paradox, expressed by relatively important investment by SMEs in R&D and a weak performance in terms of innovation outputs. Although this may be partly explained by structural characteristics of SMEs, our study reveals the interest in linking the two concepts of AC and OI in the analysis of KC. As a matter of fact the apparent weak outputs of French SMEs in terms of innovation activities appear to be strongly linked to their integration into innovation networks, notably dominated by larger companies. The valorization of SMEs’ KC thus appears to be not always achieved by the SMEs themselves but through the intermediation of larger companies, enriched by the specific knowledge developed by these SMEs. At this point of our analysis, the question of the consequences of these strong links between innovative SMEs and large companies may arise.

For an SME, taking part in the innovation strategy of a larger company may be an essential means to improve its technological product or process development, since it may benefit from the financial, technological and marketing support of the large company which in turn will reinforce the SME’s KC. It is thus for them a powerful means to be profitable and even sometimes to survive. However, this collaboration may be difficult due to the unequal and asymmetrical power relations between the two partners. In case of conflicts, for example dealing with the intellectual property rights of products developed jointly, the SME may be disadvantaged, due to its weaker resources. The strong links developed within a “closed” cluster built around large companies will increase SMEs’ dependency on large companies.
to valorize their intellectual asset and thus reduce the scope for alternative channels of commercialization.

Our paper put forward the case of France and highlighted the particular place that SMEs play within innovation networks. Future research will apply this theoretical scheme to empirical research, both quantitative and qualitative, in order to define the nature of collaboration between big and small firms in both intra- and inter-cluster levels and to map the channels through which SMEs valorize their KC. It will also allow us to better understand the performance of different sub-groups of SMEs, as well as to go deeper in the analysis of the heterogeneity of strategies and actions, through the illustration of typical profiles of SMEs.

REFERENCES


The knowledge capital of SMEs: the French paradox


