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Partners and geographical scale of SMEs' open innovation: Does business group affiliation matter?

François DELTOUR[1], Sébastien LE GALL[2] and Virginie LETHIAIS[3]

Abstract

Small businesses face multiple constraints on innovating that open innovation (OI) has potential to help overcome. The aim of this study is to examine the association between business group affiliation and the extent of OI engaged in by SMEs. Unlike independent SMEs, those that have affiliations might benefit from internal and also external networks to initiate partnerships to innovate. We analysed data collected from 711 French SMEs that engage in innovation to assess the association between business group affiliation and open innovation practices. We found that business group affiliation has no significant relationship with the degree of engagement in open innovation or with partnership openness. Nevertheless, we found that affiliation to an international group influences the geographical openness of SMEs' innovation. These findings contribute to our understanding of open innovation among SMEs by acknowledging the geographical challenges of partnerships in open innovation.

Keywords

Open Innovation – SME – Business group – Geography of cooperation

[1] IMT Atlantique, LEMNA, Nantes, France francois.deltour@imt-atlantique.fr
[2] Université Bretagne Sud, LEGO, Marsouin, Vannes, France sebastien.le-gall@univ-ubs.fr
[3] IMT Atlantique, LEGO, Marsouin, Brest, France virginie.lethiais@imt-atlantique.fr

Introduction

Innovation processes have changed significantly over the last decade. Previous research suggests that firms accessing resources beyond their organisational boundaries tend to be more successful than those that do not (Chesbrough, 2006). The role of external resources on firms' innovation capacities is critical and this in turn depends on a firm's internal abilities to reach these external resources (Meulman et al., 2018). Small and medium-sized companies (SMEs) frequently face this challenge, compared to large companies (OECD, 2017).

Current research suggests that SMEs are able to increase their innovative capacity by engaging in cooperation with external partners through a process of open innovation (OI) (Gassmann et al., 2010; Gronum et al., 2012; Lee et al., 2010). The problem for SMEs though is that motivations to adopt an OI strategy are different from those of larger companies. For larger companies, achieving economies of scale is one of the main motivations. In contrast, SMEs tend to be motivated by the potential for activating scarce resources that are otherwise difficult to access and spreading the risks associated with innovation (Wynarczyk et al., 2013). For SMEs, the reward for engaging in OI might, under certain circumstances, contribute to an improvement in economic performance (Gronum et al., 2012; Verbano et al., 2015).

For an SME wanting to innovate, the challenge of accessing external resources differs according to whether they are the affiliated with a business group. As business group boundaries go beyond firm boundaries, affiliated SMEs cooperative innovation capacity can be positively influenced (Boyd and Solarino, 2016). However, the status of the company (independent or group affiliated) influences the range of resources that SMEs can access in two opposite ways. On the one hand, belonging to a business group may compensate for a lack of internal resources (Boyd and Solarino, 2016) which then might reduce the incentive to mobilise external resources, compared to

independent SMEs. This could have the effect of motivating group-affiliated SMEs to establish collaborative arrangements exclusively to their business group at the expense of external OI. On the other hand, group-affiliated SMEs are able to draw on key innovation resources available not only from their own network (customers, suppliers, competitors, etc.) but also from the business groups' internal network (Carney et al., 2011). This increases the number of potential innovation partners. Similarly, business group affiliations may also change the spatial process of innovation for SMEs with significant variations depending on the scope of the owner group. For example, the innovation of multinational companies' foreign subsidiaries often results from the complex interactions between local, head office and other entities of the group (Cano-Kollmann et al., 2016).

The purpose of this article is to understand to what extent SME business group affiliation influences their open innovation practices. The first step consists of examining the idea of "group mobilisation" by affiliated SMEs and testing the extent of the association between SME affiliation and the probability of collaboration with external partners (i.e., openness probability). This points to whether the other member firms of a business group to which an SME belongs are resources for innovation. It also provides an insight into how such cooperation occurs at the expense of cooperation with external partners. We then analyse the role of SME affiliation on the variety of collaboration (i.e., partnership openness). This part of the analysis addresses the association between group affiliation and the types and variety of partnerships mobilised by an SME. Finally, we analyse the role of SME affiliation on the geographical scale of resource mobilisation (i.e. geographical openness) using two different measures: sources of ideas for innovation and collaboration partners. This helps to provide insights into the geographical scale of SMEs resource mobilisation in the innovation process.

To achieve our research aims, we use data obtained from a representative regional firm-level survey conducted in 2015 for a regional observatory, on a sample of 1,469 French SMEs (firms between 10 and 250 employees). The 711 firms that declare innovation activity over the past two years constitute our data set. Our results show that cooperation with other affiliates of the business group is less frequent in domestic than in international groups. Then, we show that group affiliated and independent SMEs have the same openness probability and similar OI practices with external partners. Finally, SMEs belonging to international groups show higher levels of geographical openness.

This article is structured as follows. The next section presents the theoretical background of the research and develops the hypotheses tested in this study. This is followed by an explanation of the research methods and data employed. The results are then presented and discussed. This paper concludes with a discussion of the implications of the results to current theory and practice of SME innovation.

Theoretical background

Innovation is a growth modality that requires firms to use and create knowledge. Open innovation is based on the idea that firms cooperate with external partners in various ways: they can mobilise multiple resources from external partners in their innovation process, like customers, suppliers, competitors or research laboratories ("outside-in" OI); they also can outsource their ideas by contributing to the innovation of these partners ("inside-out" OI); they finally can mix these two practices and follow a "coupled" OI strategy (Bogers et al., 2018; Chesbrough, 2006). This seems all the more necessary for independent SMEs handicapped by their small size (Rogers, 2004). Nevertheless, not all SMEs are equal in their access to resources. Affiliation to business groups -

the set of firms under common ownership and control - has to be taken into accounts in analysing the way SMEs access resources and collaborate for innovation.

In this theoretical background, we deal with the role of group affiliation on OI practices in SMEs. Firstly, we specifically study the influence of group affiliation on the probability to resort to OI and on innovation partners' variety. Secondly, we question how the geographical openness - that is the geographical scale of ideas and collaborations - may depend on the scope of the business group.

Open innovation in SMEs and the influence of group affiliation

Open innovation is a useful concept to understand how firms establish an innovation process. It is also a broad concept that encompasses multiple forms, such as knowledge sourcing, crowdsourcing, inter-organisational alliances, licensing agreements or collaborations (Bogers et al., 2018). The common element is that an OI process is distributed among several actors. Scholars initially studied OI among large firms but more recently have extended their attention to SMEs (Van de Vrande, 2009; Lee et al. 2010). Van de Vrande et al. (2009) show that involvement of actors such as clients, business partners or employees is a common practice in SMEs, while more sophisticated practices like alliances or licensing agreements remain reserved for large companies.

Open innovation developed from the idea that the rise of the knowledge economy, where knowledge is largely distributed, requires firms to look beyond their internal abilities to innovate. This is particularly the case for SMEs, where a lack of internal resources and competencies is well recognised (Bjerke and Johansson, 2015). There are many studies that point to why SMEs engage in cooperation. It makes it possible to compensate for a lack of internal resources, to share costs and reduce the risks associated with innovation (Tether, 2002; Ebersberger and Herstad, 2013). The positive effects of cooperation on a firm’s capacity to innovate is evident whether one takes

into account the diversity of size of a firm (Bjerke and Johansson, 2015), whether one considers the type of partner, the characteristics of the sector, and the nature of innovation (Freel et al., 2003).

In order to examine OI practices in SMEs, dimensions such as the number of external sources or the variety of partners are often used (Verbano et al., 2015, Hewitt-Dundas and Roper, 2017). This "partnership openness" is characterised by a wide range of practices, from low to high open partnership level. Incidentally, partnership openness raises the potential difficulties for the firm in finding and selecting the innovation partners (Meulman et al., 2018). Nevertheless, in order to specify OI practices of SMEs, it is essential to consider group affiliation. The ability of companies to mobilise resources internally, and in particular within the business group they belong, is an important factor in influencing the capacity to innovate (Boyd and Solarino, 2016). Bjerke and Johansson (2015) stress that collaborations with other entities of a business group have a far stronger positive effect on innovation than collaborations with external partners. Numerous factors may deter firms from engaging in OI, especially specific costs of collaboration, intellectual property rights management or loss of knowledge (Tether, 2002; Van de Vrande et al., 2009). These factors may explain why firms prefer internally develop innovation or control their external interactions by only cooperating for innovation with other members of their business group. Business groups, especially multinational firms, frequently organise their innovative activities by leaving their subsidiaries (whatever their size) relatively autonomous, in order to gain agility and reactivity (Ben Mahmoud-Jouini et al., 2015). Head offices encourage subsidiaries, which "gain power" (Mudambi et al., 2014), not only to rely on the group but also and above all to develop external cooperation to innovate (Cano-Kollmann et al., 2016).

While there is little doubt that the affiliation to a business group may influence SMEs' practices of cooperation for innovation, there is room for better understanding the extent and nature of the

impacts on these practices. Indeed, the literature highlights two opposite effects. On the one hand, the relative lack of innovation resources of independent SMEs compared to those with group affiliates could lead them to further open their innovation process (the need effect). On the other hand, independent SMEs are able only to rely on their own network might tend to activate external cooperation for innovation (the network effect) while SME in a business group would most likely rely on other members of their group, especially if one has advantages of scale. In light of this, we examine the following hypothesis:

Hypothesis 1: Business group affiliation influences SMEs' probability to cooperate for innovation (i.e. openness probability).

Hypothesis 2: Business group affiliation influences the variety of SMEs' partnership of cooperation for innovation (i.e. openness partnership).

The geographical openness for SMEs innovation

Independent SMEs often follow a "proximity law" and focus on their immediate environment; their managers regularly overestimate all that is close and underestimate what is distant and tend to focus on local opportunities (Torrès and Julien, 2005). Consequently, innovation practices of independent SMEs tend to be more rooted in their local region than firms affiliated to national or international groups (Julien, 2008).

However, the role of geographical proximity should not be overestimated when thinking about the connections between innovation and partners' interaction. Partners can remotely coordinate and activate other forms of proximity such as cognitive, organisational, social or institutional

proximities (Boschma, 2005; Jespersen et al., 2018). During the innovation process, business groups whose members are geographically dispersed tend to be adept at managing the gap between organisation (non-geographical) and physical (geographic) space. Torre and Rallet (2005) use the concept of "organised proximity" to account for the interactions of members of a distant network, linked by feelings of belonging and similarity.

The spatial dimension of the sources of innovation thus depends on the ability of independent SMEs to capture the signals that business opportunities generate locally and beyond (Doran et al., 2012) from which cooperation can result. The spatial dimension draws attention to different geographical scales, from local to international (Lorentzen, 2007; Vissers and Dankbaar, 2016). According to Dettmann et al. (2015), cooperation at regional level alone does not guarantee successful cooperation. Doran et al. (2012) consider that such a narrow geographical focus might be detrimental to the innovation dynamics of SMEs.

The spatial dimension has received particular attention from international management scholars, especially the dynamics of proximity and distance. According to the Uppsala internationalisation model, growth through foreign markets follows a principle of proximity or, as Johanson and Vahlne (1977) put it, a short "psychic distance". The hindrance to international development, and ultimately to cooperation with international partners, could be seen as a tyranny of distance perceived by actors, whether cultural, administrative, geographical, economic (Ghemawat, 2001), technological (Mayrhofer, 2004), institutional (Kostova et al., 2008), or a combination thereof.

Even if some "born global" SMEs set up their business model by directly going beyond the constraints of international distance (Oviatt and McDougall, 2005), we can assume that the geographical horizon of the resources mobilised for innovation (sources of ideas, cooperation) will

be closely linked to the ownership type of the SME. SMEs affiliated to business groups that have already invested and experimented with networks and markets beyond the regional or domestic level will benefit from the group experience and resources. In light of this, we test the following hypotheses, related to geographical openness:

Hypothesis 3: Business group affiliation influences the geographical scale of sources of ideas for innovation of SMEs.

Hypothesis 4: Business group affiliation influences the geographical scale of cooperation partnerships of SMEs.

Research method

Data collection

In order to test our hypotheses, data was drawn from a 2015 Marsouin[4] survey of 1,494 SMEs located in the Brittany region of France. This survey adopts a simplified definition of SME, based only on the number of employees. The firms in the sample had 10 to 250 employees and operated in the industrial, commercial and service sectors (excluding the agricultural sector and public service sector).Of these, 711 identified of being engaged in innovation. Out of this number, 260 identified as cooperating with external partners. According to the Community Innovation Survey (CIS), innovation in Brittany is similar to the average of France (Insee, 2012), while France has a slightly higher innovation rate than the European Union (Eurostat, 2014).

[4] Marsouin is both an observatory of digital practices and a network of 15 research centres.

The survey was mainly conducted on-line, consisting of a questionnaire that elicited information from SMEs about their innovation policy, their main sources of ideas for innovation, as well as plans and activities for cooperative innovation, detailing both the type and geographical distribution of cooperation partners. The survey was sent to all SMEs in the Brittany region (around 7,000 firms) listed in the Brittany Chamber of Commerce and Industry register. Firms were sent an e-mail invitation with a link to the survey. Firms that did not answer on-line were contacted for responding by phone. Firms were chosen so as to provide a good final representativeness in terms of location, size, and business sector compared to the regional economy (quota sampling method). Ultimately, we collected 1,469 complete questionnaires (an 18% response rate). In most cases, the firm's chief executive officer (CEO) or the chief financial-administrative officer was the respondent. The 711 SMEs who declare innovative activities constitute our data set. The following table shows the main characteristics of the sample. In the appendix, Table 7 presents the variables used in the models and also gives information on the sample characteristics.

Table 1: The main characteristics of the sample

<table>
<tr><td colspan="3" rowspan="3">1469 SMEs</td><td>Independent</td><td>1052 (71.6%)</td></tr>
<tr><td>domestic group:</td><td>260 (17.7%)</td></tr>
<tr><td>international group:</td><td>157(10.7%)</td></tr>
<tr><td colspan="4">SMEs with innovation</td><td>SMEs with no innovation</td></tr>
<tr><td colspan="4">711 (48.4%)</td><td rowspan="5">758 (51.6%)</td></tr>
<tr><td>New Product/services only</td><td>New processes only</td><td colspan="2">New products/services & new processes</td></tr>
<tr><td>259 (17.6%)</td><td>90 (6.1%)</td><td colspan="2">362 (24.6%)</td></tr>
<tr><td colspan="4">Cooperation for innovation</td></tr>
<tr><td colspan="2">Yes</td><td colspan="2">No</td></tr>
<tr><td colspan="2">269 (18.3%)</td><td colspan="2">442 (30.1%)</td></tr>
</table>

Variables and methods

The definition of innovation employed in this study is close to the one used in the Community Innovation Survey (CIS): a firm is considered innovative if it launched a new product or service or if it introduced new processes in the last two years. When respondents identified their SME as being innovative, they were also asked to indicate whether the SME cooperated with other organisations in their innovation activities and, if so, with what type of partners did they work with. The survey listed seven options: other companies in their business group; competitors; suppliers; customers; universities or public laboratories or research organisations; consultants or private R&D laboratories; other types of partners. We measured capacity to cooperate in two ways: a binomial variable indicating whether or not the SME has cooperated to innovate over the last two years, and the number of different types of partners with which the SME has cooperated.

The geographical levels of cooperation were measured using an adaptation of Lorentzen's (2007) scale, distinguishing local, regional, national, and international scale. In our survey, the sources of ideas were measured by asking respondents to provide the main geographical scale of their sources of ideas. Respondents were then asked to indicate the main scale for each type of partner innovation they cooperate with. From this, we set up identified an aggregated variable that indicates the scale of cooperation with the most distant type of external partner.

Finally, we collected data on four control variables. The first three control variables relate to firm characteristics. Current research identifies several structural characteristics of the firm as traditional determinants of their cooperative behaviour. Size and sectors tend to significantly influence not only the propensity to innovate (Mairesse and Mohnen, 2010; Magrini and Galliano, 2012) and to cooperate but also the patterns of cooperation, including the nature of cooperation (the type of

partners) and the geographical scale of cooperation (Bjerke and Johansson, 2015; Vissers and Dankbaar, 2016). Moreover, the qualification profile of employees appears to be closely associated with the innovation propensity (Mairesse and Mohnen, 2010; Bjerke and Johansson, 2015; Hewitt-Dundas and Roper, 2017) and can also affect the capacity to cooperate. In our study, company size is estimated using the number of employees, measured in three modalities (between 10 and 19 employees; between 20 and 49 employees; 50 employees or over). Sectors of activity are integrated into the models by means of binomial variables indicating whether the firm belongs to either: 1- commerce, 2- industry (manufacturing, mining and other industries), 3- construction and 4- transport and services. We measured employee qualification levels using the percentage of employees having completed a higher education (undergraduate degree) course in three modalities (less than 10%, from 10% to 49% and 50% or over). The fourth control variables relate to firms' IT resources. Several studies show the influence of information technologies (ITs) on SMEs' capacity to innovate (Higón, 2012) and also to engage in OI (Verbano et al., 2015). When firms invest in ITs and develop their digital abilities, they can reach remote networks or resources and can better coordinate and then cooperate with multiple actors (Aguiléra and Lethiais, 2015; Aguiléra et al., 2015). We will integrate into the models a variable that corresponds to the investment in human resources dedicated to the corporate IT. This variable takes three modalities depending on whether the firm has an established IT department, whether at least one employee of the company is dedicated to IT, or whether none of these skills exist internally. In the appendix, the Table 7 shows the characteristics of the variables used in the models.

To analyse the data, we employed a series of binomial Logit models. The first model (model 2) estimates the likelihood that innovative firms have cooperated. The dependent variable equals 1 if

SMEs cooperated and 0 if not, and only those SMEs that reported innovation are included in the model. Secondly, a series of 3 models estimates the ability of SMEs to mobilise sources of ideas at different geographical scales. The first one (model 2.1) models the likelihood that the main scale of sources of ideas is international. The second model (model 2.2) opposes the mobilisation of sources of ideas beyond the borders of the region (at the national or international level) versus within the region (at the regional or local level). The third model (model 2.3) estimates the probability of being mainly focused on the local scale. The same method is adopted to assess the capacity of firms to mobilise cooperation partners at different geographical scales. Model 3.1 estimates the probability of cooperating with at least one type of international partner. Model 3.2 estimates the likelihood of having cooperated with at least one type of partner outside the region, rather than cooperating only with partners located within the region. The small number of SMEs cooperating only at local level (38 companies) does not allow us to model the likelihood of cooperating only at local level. Business groups affiliation and the international vs. national dimensions of these groups are variables at the heart of our research. We therefore included in each model a 3-modality variable, with 0 if the SME is independent, 1 if it belongs to a domestic group and 2 if it belongs to an international group.

We fulfilled our analysis of SMEs ability to cooperate with the investigation of SMEs ability to cooperate with a wide variety of external partners, depending on their ownership. We therefore carried out average equality tests in order to compare the number of external partner types mobilised, firstly on the basis of a group affiliation and secondly on the basis of the group's international versus national features.

Results and Discussion

The effects of business group affiliation on openness probability

SMEs cooperation for innovation

Almost half (48%) of the 1,469 SMEs in Brittany surveyed identified as being engaged in innovation (Table 1). While SMEs have a strong interest in OI (cost and risk reduction, new skills, etc.), a minority of SMEs in this study effectively cooperate. Indeed, 38% of the innovative SMEs (269) report as having entered cooperative innovation relationships with partners (external or within the business group). This percentage drops to 36.5% (260 companies) for external partnerships that exclude cooperation with other firms in the same business group. This low level of SMEs' OI reflects the 'market failure' stressed by Hewitt-Dundas and Roper (2017), interpreted as a lack of understanding of the potential benefits of OI by firms, a lack of information about the capabilities of potential partners and a lack of information about the trustworthiness of potential partners. This result can be compared to that obtained by Bjerke and Johansson (2015) who find that 472 of the 636 Swedish firms they interviewed said that they collaborate with other firms or organisation for developing their business (without strict relation to innovation activities). This means that collaboration could be less systematic in the field of innovation than in the more general field of "business", confirming Van de Vrande et al.'s (2009) finding that firms can be reluctant to engage in OI.

Internal cooperation within a business group

The results of this study suggest that within a business group, the search for internal cooperation varies according to the scope of the group.

Table 2: Percentage of cooperation with different types of partners, N=260

Type of partners	Share of companies that cooperate with this type of partner		
	Among the independent SMEs N=174	Among SMEs belonging to a domestic group N=42	Among SMEs belonging to an international group N=44
Other firms in the group		60.5 %	76.6 %
Other firms in the sector	41.9 %	46.5 %	44.7 %
Customers	58.7 %	69.8 %	57.4 %
Suppliers	68.7 %	86 %	72.3 %
Universities, public laboratories or research organisations	17.9 %	23.3 %	27.7 %
Consultants and private R&D laboratories	24.6 %	18.6 %	23.4 %

Table 2 presents the cooperation's rate with each type of partner identified in the survey. It was found that there is a tendency for cooperation to be more frequent when the business group is international than when it is domestic (76.6% compared to 60.5%). Moreover, the group appears as the first source of collaboration partners for SMEs belonging to international groups, before suppliers (72.3%) and customers (57.4%). For SMEs belonging to domestic groups, collaboration with other members of the group is less than with suppliers (86%) or customers (69.8%). The question remains though as to whether this cooperation is at the expense of cooperation with external partners. To answer this question, we calculated the probability to cooperate with external partners, regarding SMEs affiliation.

Business group influence on the probability of external cooperation

Table 3 presents the results of the binomial logit model which estimates the probability of cooperating with external partners for 711 innovative SMEs (Model 1). The table includes the value of the coefficients, the level of significance (one star for 10%, two for 5% and three for 1%, NS for a non-significant variable or modality). However, in a Logit model, the estimated coefficient of an explanatory variable only informs the direction of the relationship between the explanatory variable and the explained variable. It is then usual and recommended interpreting odds ratios to judge the influence of each explanatory variable. An odds ratio equalling to X implies that a firm multiplies by X its cooperation probability for the modality taken into consideration, in relation to the reference modality. The second column of the table shows the odds ratios for the significant variables or modalities. For the multinomial variables, the reference modality is noted 'Ref'.

Table 3: Results of the model 'probability of cooperating with external partners' (Model 1)

Explanatory/Control variables	Coefficient	Odds ratios
Belonging to business group		
International group	0.05 (NS)	.
Domestic group	-0.21 (NS)	.
Independent SMEs	Ref.	Ref.
Firm characteristics		
Sector of activity		
Trade	0.05 (NS)	.
Industry	0.05 (NS)	.
Construction	0.02 (NS)	.
Services and Transport	Ref.	Ref.
Size		
From 50 to 250 employees	0.17 (NS)	.
From 20 to 49 employees	0.33 (NS)	.
From 10 to 19 employees	Ref.	Ref.

Employees' qualification		
Highly qualified	1.17 ***	3.24
Qualified	0.59 ***	1.82
Lowly qualified	Ref.	Ref.
IT Resources		
Internal IT Skills		
IT department	0.63 ***	1.88
IT employee	0.07 (NS)	.
None	Ref.	Ref.
% of concordance	**65 %**	
Observations	**N=711**	

Table 3 shows that there is no effect of group affiliation (domestic or international) on the probability of cooperating for innovation. This result leads us to reject Hypothesis 1, that was suggesting that business group affiliation influences SMEs' probability to cooperate for Winnovation. The ability of group affiliated SMEs to exploit their internal network during their innovation process therefore seems not be a disadvantage to the mobilisation of external cooperation. No collaboration trade-off is revealed. Conversely, the power of the internal network (Carney et al., 2011) does not imply a larger probability to cooperate with external partners for affiliates, compared to independent firms.

Two of the four control variables are significant. Both the employees' qualification level and the presence of an IT department in the firm have a positive impact on the probability of cooperation. This last result confirms the crucial role of IT resources on the capacity of the firm to cooperate with external partners, already highlighted in the literature (Aguiléra and Lethiais, 2015; Aguiléra et al., 2015). More generally speaking, information technologies have been repeatedly shown to positively influence SMEs' OI (Verbano et al., 2015). The positive impact of the employee's

qualification supports the findings of Bjerke and Johansson (2015) that internal knowledge must be accompanied by external competences to generate innovation.

The effects of business group affiliation on partnership openness

Business group influence on the nature of external cooperation

Table 4 presents the results of the chi-square tests of independence between the variable 'belonging to a business group' (3 modalities) and the probability of cooperating with each type of partner identified in the survey.

Table 4: Tests of independence between belonging to a business group and the probability of cooperating with different types of partners, N=269

Type of partners	Test of independence	
	Khi 2	Prob.
Other firms in the sector	0.36	0.84
Customers	1.97	0.37
Suppliers	5.18	0.07
Universities, public laboratories or research organisations	2.44	0.29
Consultants and private R&D laboratories	0.69	0.71

It is interesting to note that belonging to a business group, and thus the possibility of cooperating internally, only slightly modifies external cooperation behaviour. Only the probability of cooperating with suppliers points to a dependent relationship, but with a probability of 0.07. Moreover, the results illustrated in Table 2 indicate that independent SMEs are less likely to cooperate with the suppliers (68.7%) than are SMEs belonging to a domestic group (86%) and SMEs affiliated to an international group (72.3%). For all other types of partners (customers, other firms in the sector, universities, public laboratories or research organisations, consultants and

private R&D laboratories and other types of partners), the analysis concludes that the probability of cooperation is independent of group affiliation. Table 2 shows that in the specific case of cooperation for innovation, the results support the work of Bjerke and Johansson (2015) that highlights the predominance of "vertical linkages, both backward and forward in the value chain" in collaboration arrangements. In this study, it was found that that regardless of affiliation, SMEs tend to cooperate more with suppliers or customers than with other firms (assimilated as competitors).

Business group influence on the variety of external cooperation

Finally, we compare the average number of types of innovation partners that independent firms collaborate with to those that affiliated firms work with (distinguishing domestic and international group affiliates). On a scale from 1 to 7 types of partners, the means of each group differ slightly but not significantly: 2.44 types of partners for independent firms compared to 2.63 for affiliated SMEs and 2.62 and 2.64 respectively for domestic and international group affiliates. This implies that independent SMEs do not mobilise a significantly different variety of external partners than SMEs belonging to a business group. Furthermore, group scope has no significant effect the variety of cooperation partnerships. The results contrast with Hypothesis 2, that was suggesting that business group affiliation influences the variety of SMEs' partnership of cooperation for innovation.

Our study suggests that even if SMEs are able to rely on their group in their innovation process, this does not influence the probability of external collaboration. Neither does it imply a greater external mobilisation. The two opposite effects identified in the literature, the "need effect" which would involve higher openness probability and partnership openness by independent SMEs and

the “network effect” which would imply higher probability and partnership openness by affiliated SMEs, in this study are indeed opposing to the extent that they seem to cancel each other out. This could be explained by looking at the restraints on each. On the one hand, the limited resources of independent SMEs reduce their ability to absorb external knowledge and skills (Cohen and Levinthal, 1990; Muscio, 2007), especially firms with low-skilled labour. SMEs may face a trade-off between internally deployed resources and resources for cooperation (Ebersberger and Herstad, 2013). The fear of a loss of independence brought about by cooperation (Tether, 2002) or a desire to protect intellectual property (Van de Vrande et al., 2009) could be other explanations. On the other hand, as argued by Ben Mahmoud-Jouini et al. (2015), multinational firms may leave their subsidiaries to make innovation decisions relatively autonomously which contributes to attenuating the “network effect”.

The effects of business group affiliation on geographical openness

The geographic scale of sources of ideas for innovation

The 711 innovative SMEs were initially invited to assess the main geographical horizon of the sources of ideas for innovation according to four modalities: local, regional, national and international. The main horizons for SMEs are local (35.9%) and national (33.3%). A minority of firms place the main horizon at the international (12.5%) and regional (18.3%) levels.

Table 5 presents the results of the Logit models which estimate the probability of locating its main horizon beyond 3 possible boundaries: the national, regional and local borders. The table includes the value of the coefficients, the level of significance (one star for 10%, two for 5% and three for

1%, NS for a non-significant variable or modality) and the odds ratios for the significant variables or modalities. For the multinomial variables, the reference modality is noted "Ref".

Table 5: Results of models 'probability of mobilising sources of ideas at different spatial scales'

Explanatory/Control variables	Model 2-1 International vs. intra-national scale		Model 2-2 Extra-regional vs. intra-regional scale		Model 2-3 Local vs. extra-local scale	
Belonging to business group						
International group	0.91 **	2.50	1.18 ***	3.27	-1.07 ***	0.34
Domestic group	-0.02 (NS)	.	0.21 (NS)	.	-0.30 (NS)	.
Independent SME	Ref.		Ref.		Ref.	
Firm characteristics						
Sector of Activity						
Trade	0.14 (NS)	.	0.04 (NS)	.	0.44 *	1.56
Industry	0.84 ***	2.34	0.48 **	1.63	-0.04 (NS)	.
Construction	-1.06 *	0.35	-0.65 **	0.52	0.70 ***	2.02
Services and Transport	Ref.		Ref.		Ref.	
Size						
From 50 to 250 employees	-0.30 (NS)	.	0.08 (NS)	.	-0.13 (NS)	.
From 20 to 49 employees	0.34 (NS)	.	0.29 (NS)	.	-0.33 *	0.72
From 10 to 19 employees	Ref.		Ref.		Ref.	
Employees' qualification						
Highly qualified	1.68 ***	5.39	1.18 ***	3.28	-1.23 ***	0.29
Qualified	0.79 *	2.23	0.89 ***	2.45	-0.76 ***	0.47
Lowly qualified	Ref.		Ref.		Ref.	
IT Resources						
Internal IT Skills						
IT department	0.88 ***	2.43	0.22 (NS)	.	-0.52 *	0.59
IT employee	-0.35 (NS)	.	-0.25 (NS)	.	0.12 (NS)	.
None	Ref.		Ref.		Ref.	
% of concordance	**76.6 %**		**70.8 %**		**71.7%**	
Observations	**N=711**					

The hypothesis 3 is confirmed empirically. It is found that the geographical scope of the business group to which an SME belongs influences the geographical horizon of the available sources of ideas for SME's innovation. Belonging to an international group tends to positively impact the probability of mobilising sources of ideas internationally, as well as on the probability of calling upon sources of ideas beyond the regional boundary. Conversely, it negatively affects the probability of mobilising sources of ideas mainly at the local level. However, the modality *domestic group* is nonsignificant in the three models, indicating no difference between independent SMEs and firms affiliated to a domestic group when considering the geographical scale of sources of ideas mobilised in the innovation process. So, the international scope group is the only configuration that has a significant impact on the geographical extend of the sources of ideas mobilised by SMEs in this study, allowing them to enlarge their horizon.

Furthermore, the results of this study imply that sector, the qualification profile of employees and, to a lesser extent, internal IT skills also have an influence on the geographical scale mobilised for sources of ideas to support SME innovation activities. A higher qualified workforce and a better IT resources endowment tend to negate the influence of geographical barriers (i.e. distance) to the sources of ideas for innovation. The sectoral effects are not surprising, highlighting more distant scales of sources of ideas for industrial firms and closer ones for construction and trade sectors.

The geographical horizon of cooperation for SME innovation

With regard to geographical scales, we categorized responses by taking into account the most distant cooperation on all types of cooperation partners. Once again, we distinguish between local, regional, national and international levels. The values for the sample are respectively 13.0%, 24.5%, 36.5% and 26.0%.

The small number of SMEs that only cooperate at the local level does not allow the building of a model about the probability of mobilising only local partners. Table 6 presents the results of Models 3.1 and 3.2.

Table 6: Results of models 'probability of mobilising cooperation partners at different spatial scales'

Explanatory/Control variables	Model 3-1 International vs. intra-national scale		Model 3-2 Extra-regional vs. intra-regional scale	
Belonging to business group				
International Group	1.13 ***	3.11	0.49 (NS)	.
Domestic Group	0.17 (NS)	.	0.31 (NS)	.
Independent SMEs	Ref.		Ref.	
Firm characteristics				
Sector of Activity				
Trade	0.01 (NS)	.	-0.09 (NS)	.
Industry	0.79 *	2.22	0.54 (NS)	.
Construction	-0.89 (NS)	.	-1.01 **	0.36
Services and Transport	Ref.		Ref.	
Size				
From 50 to 250 employees	-0.76 *	0.46	-0.62 (NS)	.
From 20 to 49 employees	-0.61 *	0.54	-0.55 *	0.57
From 10 to 19 employees	Ref.		Ref.	
Employees' qualification				
Highly qualified	1.70 **	5.15	1.29 ***	3.66
Qualified	1.88 **	6.54	1.69 ***	5.43
Lowly qualified	Ref.		Ref.	
IT Resources				
Internal IT Skills				
IT department	0.46 (NS)	.	1.18 **	3.26
IT employee	-0.07 (NS)	.	-0.57 *	0.57
None	Ref.		Ref.	
% of concordance	**71.4 %**		**74.4 %**	
Observations	**N=260**			

Results are broadly similar to those presented in table 5. Hypothesis 4, suggesting SMEs' group affiliation influences the geographical scale of cooperation partnerships (i.e. geographical openness), is partially supported. Only SMEs affiliated to international groups differ from independent SMEs. Belonging to an international group multiplies by three the probability of mobilising partners at the international level (model 3.1). However, international affiliation does not affect the probability of mobilising partners outside the region (model 3.2). The geographical scale of cooperation thus depends on taking into account the international dimension of the business group. For firms in this study, international borders seem to put a significant drag on establishing partnerships. More important in cooperation for innovation is the length of time an SME has worked with a partner; this is similar to foreign market penetration which usually involves long-term learning (Johanson and Vahlne, 1977). International growth experience therefore seems to benefit SMEs in terms of cooperation by opening up opportunities (Johanson and Vahlne, 2006). This study confirms interrelations between SMEs' innovation and internationalisation (Love and Roper, 2015): SME affiliation to an international business group appears as a powerful marker for innovation as it opens up the field of international partnerships and triggers wide perspectives in terms of ideas.

Internationally affiliated SMEs seem to benefit from their groups' experience, which have penetrated foreign markets. These SMEs better manage the "distances" generated by international cooperation in particular (Ghemawat, 2001; Kostova et al., 2008).

Conclusion

Our research contributes to analysing the role of SMEs' group affiliation on their OI practices. The literature indicated two opposing influences on SME propensity to mobilise external cooperation with regards to their group affiliation: first is the "need effect" that involves higher external

resource mobilisation by independent SMEs and second is the “network effect” that implies higher mobilisation by affiliated SMEs. In this study, the combination of these effects makes it difficult to make firm conclusions about the role of business group influences on the OI practices of SMEs.

That said, this paper contributes to a better understanding of open innovation practices in SMEs in that we found that innovation collaboration of affiliated SMEs with other entities of the business group is not detrimental to external cooperation beyond the group boundaries. However, neither the probability to cooperate with external partners nor the variety of partnerships is affected by affiliation to a business group, whether domestic or international. It seems that these two effects neutralise each other. The findings of this study suggest that innovation resources originating beyond national borders are more regularly used by SMEs affiliated to international groups, compared to independent SMEs and to domestic business group affiliates. As SMEs’ internationalisation and innovation are interdependent (Love and Roper, 2015), the challenge stands in enabling firms that cannot rely on the strength of a business group to broaden the geographical scope of their activity in order to innovate. Institutional actors in the territory where they locate can contribute to this by promoting an international trade support policy, which may limit the impediments to business development beyond borders (OECD, 2017). Moreover, SMEs should more systematically adopt digital tools to interact remotely (Aguiléra et al., 2015) and to benefit from a "real-time multi-location" (Torre, 2008), which is essential in the coordination of remote networks and in innovation processes.

The methodological choices made in this study does place some limitations on the generalisability of the findings. First, the independence of the partnership openness regarding SMEs status has to be considered in light of the definition of the external partner's variety. Indeed, the partner's variety which measures the number of types of partners is a classical assessment (Hewitt-Dundas and

Roper, 2017). Other results could be obtained by using the total numbers of partners instead. However, such a measure would be difficult to collect given the complexity of relationships in modern supply chains. Second, whereas the geographical scale of sources of ideas measures the main scale of mobilisation of this type of resource, the geographical scale of cooperation partnerships adopt a "farthest" measure. Therefore, measuring the tendency of SMEs affiliated to international groups to mobilise international scale of cooperation might not fully reflect the extent of low-level local cooperation that might also be occurring.

These limitations do not detract from the contributions this study makes to thinking about geographical and organizational 'boundaries' in an increasingly complex and interdependent environment. Cainelli and Iacobucci (2011) argue that for analysing the organisation and behaviour of firms, the business group is a more appropriate unit of analysis than the firm. When studying the OI phenomenon, we confirm that taking into account group affiliation helps to better understand the innovation policies and practices of SMEs.

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Appendix

Table 7: Descriptive statistics for the variable used in the models

Dependent variables				
External cooperation propensity (model 1)				
Yes		No		Total
260 (36.5 %)		451 (63.5 %)		711 (100%)
Mobilization of sources of ideas at different spatial scales				
	Yes	No		Total
International (model 2.1)	89 (12.5%)	326 (87.5%)		711 (100%)
Extra-regional (model 2.2)	326 (45.9%)	385 (55.1%)		
Local (model 2.3)	255 (35.9%)	456 (64.1%)		
Mobilization of cooperation partners at different spatial scales				
	Yes	No		Total
International scale	68 (26.2%)	192 (73.8%)		260 (100%)
Extra-regional scale	161 (61.9%)	99 (38.1%)		
Explanatory variable : Belonging to business group				
Independent SME	Domestic group	International group		Total
491 (69.1%)	122 (17.2%)	98 (13.8%)		711 (100%)
174 (66.9%)	42 (16.1%)	44 (16.9%)		260 (100%)
Control variables				
Sector of activity				
Trade	Industry	Construction	Services and transport	Total
184 (25.6%)	197 (27.7%)	129 (18.1%)	201 (28.3%)	711 (100%)
67 (25.8%)	72 (27.7%)	38 (14.6%)	83 (31.9%)	260 (100%)
Size : numbers of employees				
From 10 to 19 employees	From 20 to 49 employees	From 50 to 250 employees	Non-response	Total
331 (46.6%)	238 (33.5%)	127 (17.9%)	15 (2.1%)	711 (100%)
109 (41.9%)	89 (34.2%)	56 (21.5%)	6 (2.3%)	260 (100%)
Employees' qualification (percentage of employees having received higher education)				
Low qualified (less than 10%)	Qualified (from 10 to 49%)	Highly qualified (50% and over)	Non-response	Total
155 (21.8%)	231 (32.5%)	216 (30.4%)	109 (15.3%)	711 (100%)
35 (13.5%)	84 (32.3%)	112 (43.1%)	29 (11.1%)	260 (100%)
Internal IT Skills				
IT department	IT employee	None		Total
100 (14.1%)	172 (24.2%)	439 (61.7%)		711 (100%)
55 (21.2%)	63 (24.2%)	142 (54.6%)		260 (100%)