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# **Behaviors among SMEs in terms of open innovation practices and actors involved.**

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## **Abstract:**

This paper aims to explore the existing behaviors among SMEs in terms of open innovation practices and actors involved ; type of company where it still seems difficult to implement an open innovation approach. The objective is to identify the combinations of practices and actors to open up the innovation process, in order to help practitioners in their decision making regarding the practices to implement and the actors to collaborate with. Our results, based on a literature review and a survey of 85 SMEs in Normandy, identify 11 open innovation practices and 10 actors involved in 3 potential steps of the process. As a result, we highlight 3 different behaviors among interviewed SMEs.

**Key words:** Open Innovation, SME, innovation practices, actors, behaviors

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## **1. Introduction.**

Although since the formulation of the open innovation concept (Chesbrough, 2003), the literature on open innovation has been evolving exponentially, SMEs generally receive little attention on the topic (Brunswick & Van de Vrande, 2014; Kirschbaum, 2005; Ollila & Elmquist, 2011). A systematic review (Usman, Roijackers, Vanhaverbeke, & Frattini, 2018) of articles published on Web of Science in the field of innovation management as well as related fields such as strategic management shows that the literature on open innovation in SMEs is highly fragmented and multidisciplinary. Indeed, open innovation is a polymorphic concept (Péni, Hussler, & Burger-Helmchen, 2011) that can be approached from a multitude of facets. Building on the work of Huizing (2011), Battistella et al. (2017) explain that developing and operating innovation activities in collaboration with external stakeholders requires new decisions that need to be delineated into: when, how, with whom, for what purpose, and in what way.

Van de Vrande et al (2009) are the first to look at open innovation practices applied by small and medium-sized enterprises. The study focuses on the levers and barriers perceived by SMEs when adopting an open innovation approach, which is measured using eight practices reflecting technology exploration and exploitation. They show that companies rarely focus on technology exploitation or exploration but rather tend to combine these two aspects. They also conclude that the so-called "open" firms are generally the largest firms. Finally, the study implicitly suggests a sequence in the adoption of open innovation, starting with customer involvement, followed by employee involvement and external networking, and ending with more "advanced" practices such as intellectual property licensing, R&D outsourcing and

venture capital. To understand the adoption of open innovation, Bianchi et al. (2011) propose a framework including organizational modes (main open innovation practices organized according to the direction of knowledge flow: outside-in or inside-out), types of partners and phases of the R&D process. However, this framework was developed specifically for firms in the biopharmaceutical industry and therefore cannot be generalized to other industries or firm sizes. Huizing (2011) reviews the understanding of the concept of open innovation by addressing questions of what (the openness model), when (the dependence on the context characterized by factors internal and external to the firm) and how (the process). He advocates a framework that helps managers decide at what stage of the innovation process and with which with which external parties to collaborate in order to capture the value of development and exploit the innovation activities. Theyel (2013) evaluates the adoption of open innovation activity during different value chain activities (technology development, product development, manufacturing, and marketing) with different actors (customers and suppliers). The study highlights the importance of careful selection of open innovation activities and partners. Bigliardi et Galati (2016) identify SME profiles focusing on the open innovation practices adopted by Italian SMEs as well as the barriers and levers to open innovation adoption. Thus, they highlight four main barriers and three company profiles. However, the list of open innovation practices identified is not complete and previous studies have proposed other practices that were not included in the survey. Only the most widespread practices in the literature were considered. Finally, the study refers to a specific country and the sample is too small for the results to be generalized. Battistela et al. (2017) explore the different practices, actors, and tools adopted by SMEs to open up their innovation process. They propose a conceptual framework and an exploratory analysis conducted with companies from different industries. The study reveals that outside-in practices are more present than inside-out practices and that they involve a wide variety of actors and tools. Coupled process practices were mainly observed within established partnerships and collaboration is mainly done through a co-creation process. However, this study is exploratory and requires empirical validation.

Starting from the observation that further research has not yet contributed fully to the understanding of the adoption of open innovation by the SME, we propose to explore the link between open innovation practices, actors involved and essential steps of the open innovation process in order to address three of the five decision domains proposed by Huizing (2011), namely the how (the practices), the with whom (the actors) and the what purpose (steps of the open innovation process). The objective is to identify existing behaviors among SMEs in terms of open innovation practices and actors involved, in order to assist practitioners in their decision-making regarding which practices to implement and with whom to collaborate.

## **2. Theoretical background.**

### **2.1. Open innovation practices.**

Open innovation practices are generally approached according to the form of openness, and even though the classification of models remains a complex area (Dahlander & Gann, 2010; Huizing, 2011), a trend seems to be emerging: the categorization of approaches according to the direction of the knowledge flow (Ahn, Mortara, & Minshall, 2013; Bigliardi & Galati, 2016; Van de Vrande et al., 2009). Therefore, the study of open innovation practices is often simply reduced to the three main logic models (outside-in, inside-out, and coupled process). However, firms that use more practices are found to be more open to innovation than those that use few practices (Burcharth, Knudsen, & Søndergaard, 2014). Open innovation practices

are therefore more precisely defined than simply defining the three identified logics, and require the identification of activities that firms adopt and deploy when they choose to innovate in an open manner (Chesbrough & Crowther, 2006; Van de Vrande et al., 2009).

### **2.1.1. Outside-in practices.**

Outside-in includes activities to tap external knowledge to obtain new sources for innovative ideas. This approach aims to obtain, integrate, and bring an external innovation to market (West & Bogers, 2014). It involves conducting activities to acquire new external knowledge or technology.

Companies can develop a co-design practice by directly involving customers or end users (Gassmann, 2006; Spithoven, Vanhaverbeke, & Roijackers, 2013; Van de Vrande et al., 2009). The active involvement of these external stakeholders in the different design phases allows their needs and expectations to be taken into account (Burcharth et al., 2014; Gassmann, 2006; Van de Vrande et al., 2009; Von Hippel, 1986) in order to better meet them. Another way to integrate external resources into the innovation process is crowdsourcing. This approach aims to outsource an activity from the company to a number of multiple actors (Howe, 2006; Pénin & Burger-Helmchen, 2012; Schenk & Guittard, 2016). It is an online participatory activity in which an organization offers a group of individuals to voluntarily engage in a task by contributing their labor, money, knowledge, or experience. With the goal of mutual exchange, the individual will receive social or monetary recognition as a result of their participation (Arolas, 2012). To acquire technologies, companies may need to acquire or use intellectual property rights such as patents (Gassmann, 2006; Lee, Park, Yoon, & Park, 2010; Van de Vrande et al., 2009; Wynarczyk, Piperopoulos, & McAdam, 2013). The use of licensing-in to exploit external knowledge allows the firm to reduce time-to-market (Burcharth et al., 2014; Chesbrough, 2003; Gassmann, 2006). To acquire knowledge, firms resort to know-how acquisition. This practice aims to acquire technical and scientific services from external entities (Burcharth et al., 2014; Gassmann, 2006; Harland & Nienaber, 2014; Holzmann, Sailer, Galbraith, & Katzy, 2014; Wynarczyk et al., 2013) when the company does not have the resources in-house. Firms can also integrate a network that will allow them to develop relationships or collaborate with external network partners and thus support the innovation process (Lee et al., 2010; Van de Vrande et al., 2009; Wynarczyk et al., 2013). To capture strategic skills or knowledge and attempt to access new markets or innovative technologies, firms can turn to venture capital (Kim et al., 2008; Vanhaverbeke, van de Vrande, & Chesbrough, 2008; Waites & Dies, 2006). This arrangement consists of investing funds directly in a promising venture capital company (start-up or innovative SME) for innovative projects. This type of collaboration allows the investing company to benefit from feedback on niche markets in which it could not enter.

Outside-in is considered to be the dominant dimension in mature, asset-intensive firms (Chesbrough & Crowther, 2006), as well as in firms belonging to low-tech sectors (Gassmann & Enkel, 2004). Firms typically resort to this type of model when the skills or technologies are not available in-house and their development would require too much effort, time, or money to be done in-house (Greco, Grimaldi, & Cricelli, 2016). This open innovation approach seems appropriate for companies with limited resources (Huizingh, 2011) and would positively impact

the innovation capacity of these organizations (Laursen & Salter, 2004; Parida, Westerberg, & Frishammar, 2012).

### **2.1.2. Inside-out practices.**

In its inside-out dimension, also called outbound, open innovation consists in offering its knowledge and technologies to its external environment. This process includes activities that allow the organization to add value to unused internal assets by selling or revealing them to other companies. The purpose of revealing is to reveal knowledge without expecting revenue streams (Ayerbe, 2015). For example, a company that has filed a patent may establish a licensing agreement with a supplier to enhance the value of its patent, or a prototype may be resold to an interested customer.

Inside-out activities can be related to licensing-out and consist of selling licenses or technologies not used by the company in order to maximize profits (Dong & Pourmohamadi, 2014; Gassmann, 2006; Lee et al., 2010; Lichtenthaler & Ernst, 2009; Van de Vrande et al., 2009; Wynarczyk et al., 2013). A company can also develop a disruptive innovation project through the creation of a new legal entity independent of the parent company (Kirschbaum, 2005; Lichtenthaler & Ernst, 2009). This is known as a spin-off. The knowledge and technologies acquired by companies are not always valued (Lanzolla & Suarez, 2012). Yet they can be a source of direct and indirect profit (Cassiman & Valentini, 2016).. Through these various contractual forms (licensing-out, and spin-off), companies try to leverage their technological knowledge, generating additional revenues (Lichtenthaler & Ernst, 2007). Apart from licensing, any knowledge asset can be sold to increase the firm's financial performance (Chiaroni, Chiesa, & Frattini, 2010). Firms typically use this type of model to increase profitability, increase internal R&D flexibility, improve innovation capacity, shorten time-to-market, or expand market access (Chesbrough & Schwartz, 2007). Selling unused concepts helps to de-clutter the innovation process (Chesbrough, 2006a). If concepts are not used, the effort generated in the innovation process is usually lessened because these inventions decrease the perceived value of the investments. Efforts will be focused more on commercializing these concepts rather than on finding new profitable trajectories. Inside-out therefore requires the mobilization of distribution and innovation capabilities, and this approach is generally more prevalent in high-tech sectors (Gassmann & Enkel, 2004).

### **2.1.3. Coupled process practices.**

The coupling process is, at least from a theoretical point of view, the ultimate goal of open innovation. This approach consists of combining inside-out and outside-in processes and sharing them within a network of partners. It allows companies to jointly develop and commercialize innovations (Enkel & Gassmann, 2010). Two approaches can be distinguished (Piller & West, 2014): bidirectional and interactive

In the bidirectional coupled, actors pursue separate efforts to create innovation and other useful knowledge. This knowledge is then shared in the form of contracts, licenses, etc. Knowledge flows are used to augment each organization's own internal efforts to create and commercialize innovation. Research consortia and collaborative R&D are open innovation practices that can be linked to this type of approach, since they involve conducting R&D activities with external partners. A research consortium is an agreement between partners to

carry out joint R&D activities. It differs from co-development in that the cooperation is not only an inter-firm alliance, but can involve university laboratories or independent research centers. Whether it is a research or co-development consortium, the different stakeholders learn from their partners and transmit information to them (Jullien & Pénin, 2014), to strengthen the absorption and innovation capacities and enhance the capacity for valorization (Kherrazi & Saïd, 2018).

In the interactive coupled, the creation of innovation or knowledge takes place outside a particular company. It is more about an interactive collaboration between different actors leading to a joint innovation. Open source consists of making available to communities the technologies and skills that the company masters in order to encourage the emergence of new technical solutions, and then to be able to exploit knowledge coming from outside (Pénin, 2013). It therefore responds to a coupled interactive approach. In the framework of a strategic alliance, different entities will join forces with the aim of benefiting from know-how in exchange for rapid access to a market, for example. The objective is to capture knowledge to quickly bring an innovation to market, this approach is also part of the coupled interactive process.

The table below summarizes all the open innovation practices identified in the literature. More details are given in Annex 1.

<b>Outside-in</b>	<b>Inside-out</b>	<b>Coupled process</b>
Co-conception Crowdsourcing Licensing-in Know-how acquisition Venture	Licensing-out Spin-off	<b>Bidirectional</b>
		Open-source
		M&A
		<b>Interactive</b>
		R&D collaborative Research consortia

Table 1: Synthesis of open innovation practices identified in the literature.

**2.2. Actors involved in the open innovation.**

The open innovation model cannot be viewed as a simple dichotomy between an open and a closed process, but involves different levels of openness (Dahlander & Gann, 2010; Huizingh, 2011) involving different types of actors. The effectiveness of open innovation does not only depend on internal knowledge flows (Chesbrough & Bogers, 2014; Dahlander & Gann, 2010; Huizingh, 2011), but is linked to the active participation of external stakeholders either as contributors to the creation of new knowledge or as receivers of knowledge used to generate innovations. Beyond customers and suppliers, the competences essential to the development of the firm can be held by competitors, consultants, research institutes, universities, government institutes, laboratories, start-ups...(Chesbrough, 2003; Dries, Van Looy, & Debackere, 2005; Tether & Tajar, 2008). Innovation is no longer limited to partnerships and integrates actors whose positions in the value chain are different and/or indirect. The logic of innovation is therefore no longer solely centered on the company, but on a network of interconnected actors (Sawhney & Nambisan, 2007).

In addition to internal employees, the main source actors of innovation for SMEs are customers and suppliers (Battistella et al., 2017). User or customer knowledge is a source of innovative ideas that companies commonly rely on (Laursen & Salter, 2006; Piller & West, 2014). Indeed, end-users and consumers are increasingly important in the innovation process of SMEs (Brunswick & Van de Vrande, 2014; Lee et al., 2010; Scuotto, Santoro, Bresciani, & Del Giudice, 2017), as are communities that represent an important external source of knowledge, practical experience, and innovation (Bogers et al., 2017). For technological innovations, SMEs collaborate more with universities (Marangos & Warren, 2017) or research centers. This type of partnership favors the development of collaborative R&D, the transfer of human resources, or the commercialization of intellectual property rights (Perkmann & Walsh, 2007). Public research and innovation institutions and government agencies, on the other hand, can help SMEs connect, communicate, and collaborate with independent partners and other parties to renew innovation practices (Gabriele, D'Ambrosio, & Schiavone, 2017; Vrgovic, Vidicki, Glassman, & Walton, 2012). Indeed, these institutions create the context for regulation, intellectual property law, financial markets, and industry structures in which firms can innovate (Battistella et al., 2017).

Collaborations with external parties tend to benefit the firm not only in terms of innovation, but also in terms of financial performance. This is the case, for example, with collaborations with suppliers due to the combination of complementary capabilities and common goals between the company and suppliers (Un, Cuervo-Cazurra, & Asakawa, 2010). Collaborations with research centers and universities, on the other hand, have a positive impact on product innovations (Huang & Rice, 2009; Tsai, 2009; Un et al., 2010). The possible differences between stakeholders can lead to heterogeneous factors that contribute or not to the adoption of an open innovation approach. When the knowledge is related to the preferences/needs of customers/users, or to a context requiring experts to contribute to the definition of the problem and the contribution of knowledge to solutions, the integration of external stakeholders is relevant. Conversely, their importance decreases in situations where knowledge is tacit and its development is linked to contextual aspects of an organization (Bogers et al., 2017).

### **2.3. Essentials steps of the open innovation process.**

Different processes have been proposed in the literature to model how firms leverage external sources of innovation: acquisition, assimilation, transformation, and exploitation (Zahra & George, 2002); strategy, sourcing, integration, and metrics (Chesbrough & Crowther, 2006); motivating, integrating, and exploiting (West & Gallagher, 2006); as well as wanting, finding, getting, and managing (Slowinski & Sagal, 2010). Based on the analysis of these models, West and Bogers (2014) propose a four-steps model in which a linear process consisting of three major steps (obtaining innovations from external sources, integrating innovations, and commercializing innovations) is combined with interactions between the firm and its collaborators.

Obtaining innovations from external sources requires two steps: companies must first identify the sources of innovation, and then bring those innovations into the company. The main activities involved in obtaining innovation from external sources are search, selection and

acquisition. While important, the innovation identification and acquisition step alone is not sufficient. In order for firms to make the most of external sources of innovation, the acquired innovations must be fully integrated into the firm's R&D activities. To do this, absorptive capacity—that is, a firm's ability to assimilate and use external knowledge—is a critical element. The last step, commercializing, is to establish the right business model in relation to the strategy in order to capture or create value (Chesbrough, 2006b). Note that research on the acquisition and use of innovation from external sources implicitly assumes that technology from external sources is commercialized in the same way as internally developed technology. Since the open innovation model is not a linear model, but one that includes reciprocal relationships, a fourth stage of interaction makes the process of advantage interactive. These interactions can take the form of feedback or mutual exchange (West & Bogers, 2014).

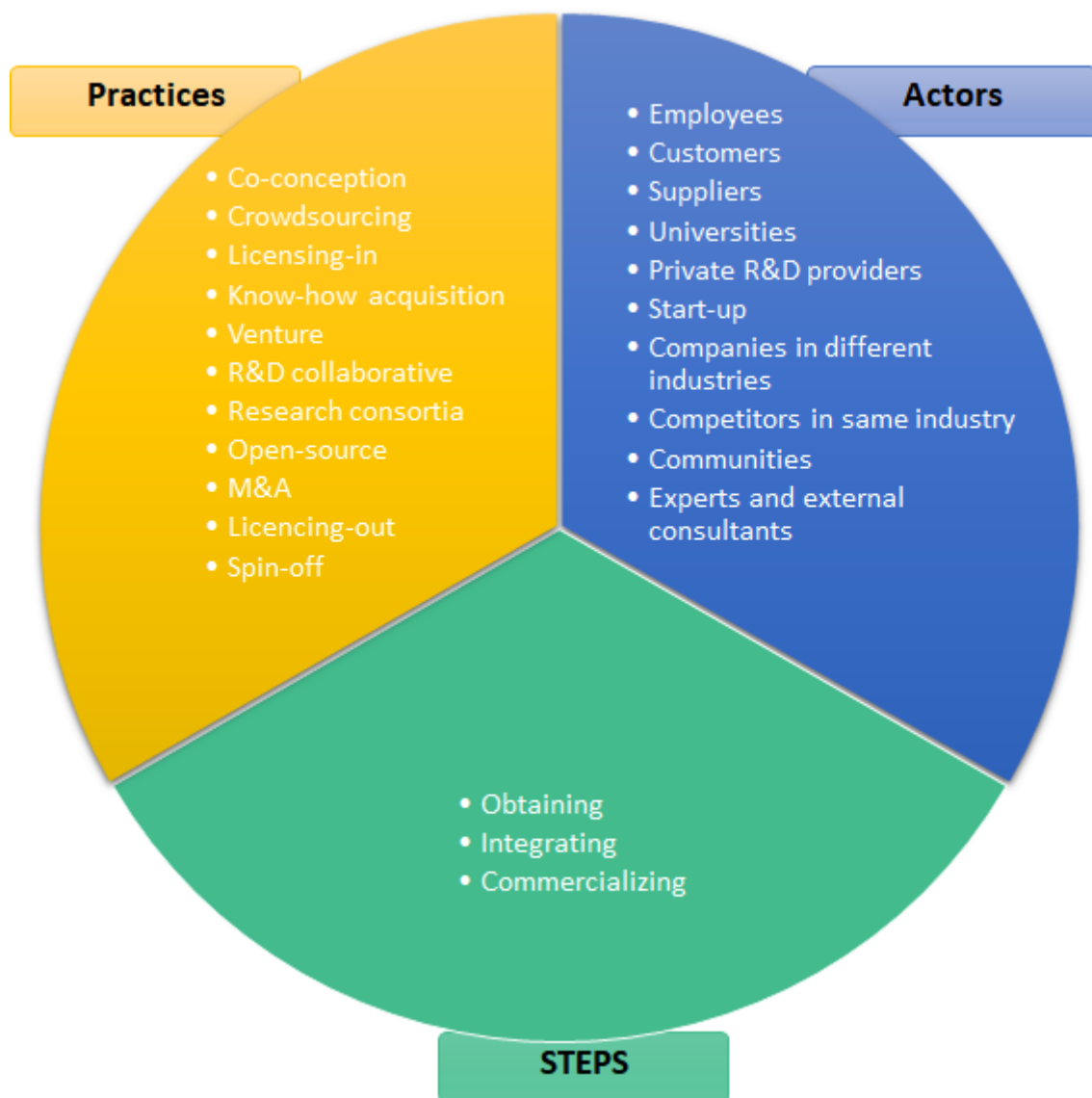


Figure 1 : Research framework



### 3. Research methodology.

#### 3.1. Data collecting.

Our empirical analysis is based on data from SMEs located in Normandy and belonging to the manufacturing or specialized, scientific and technical activities sector. To define a company as an SME, we based ourselves on the European Commission's definition (2016) of a company with a payroll of less than 250 and a turnover not exceeding 50 million euros. Data was collected between July 2018 and March 2019 via a questionnaire specifically designed for our study. SME managers were asked to fill in information regarding the involvement of different actors in the innovation process and the collaborative practices deployed.

The survey was organised into several sections:

- General Information - This section collects general data on the type and location of the company or the employee-base.
- Open Innovation practices - This section focuses on the innovation practices developed by companies to carry out innovation projects. For each of the proposed practices, the respondent was asked to specify if it is adopted or not. Example affirmations are: "The customer is involved in the design process" or "New technologies are commercialized through the creation of a new independent entity".
- Open innovation actors. This section focuses on the company's links with external actors. As previously, the respondent was asked to specify each of the statements are true or false. Sample questions include "Employees are involved in the innovation process" or "Suppliers are involved in innovation project".
- Innovation process. This section focuses on three of the main steps of open innovation process (obtaining, integrating and commercializing). The respondent was asked to specify in which steps the company involves external actors.

Finally, our sample consists of 85 SMEs. Table 2 presents the descriptive characteristics of the sample of SMEs investigated

Sector	Number of firms	%	Size classification	Number of firms
Manufacturing	48	56,5	< 50 employees	30
			Between 50 and 25 employees	18
Specialized, scientific and technical activities	37	43,5	< 50 employees	30
			Between 50 and 25 employees	7
Total	85	100		85

*Table 2 : Descriptive characteristics of the sample investigated.*

#### 3.2. Data Analysis.

In order to identify different profiles of SMEs adopting an open innovation approach, we perform a principal component analysis followed by a hierarchical ascending classification and the K-means method. Multivariate descriptive analysis methods such as principal correspondence analysis are frequently used in a classification approach in order to reduce

the number of dimensions (Bocquet, Bas, Mothe, & Poussing, 2013). We begin our principal component analysis (PCA) by looking at the reliability of the measures (Table 3). Measures will be considered reliable if:

- The Kaiser-Meyer-Olkin (KMO) of each variable is greater than 0.6.
- The overall Kaiser-Meyer-Olkin (KMO) is greater than 0.7.
- The Cronbach's alpha for each variable is greater than 0.6.
- The overall Cronbach's alpha is greater than 0.7.
- The explained variance is greater than 60%.
- Bartlett's test of sphericity is significant at 0.0001.

	KMO	Cronbach's alpha
Licensing-in	0,701	0,685
Know-how acquisition	0,620	0,724
R&D collaborative	0,720	0,623
M&A	0,734	0,663
Research consortia	0,691	0,631
Open-source	0,666	0,685
Licensing-out	0,746	0,681
Spin-off	0,831	0,670
Global	0,719	0,701

*Table 3 : Results of the Kaiser-Meyer-Olkin (KMO) test and Cronbach's alpha for the selected dependent variables.*

We then perform a hierarchical bottom-up classification, using the coordinates of the observations obtained by the PCA. The analysis of the variability of all eight components (Table 4) leads us to retain only those components whose eigenvalue is greater than 1/8 of the sum, i.e. 0.18. We decide to retain the first two components explaining 55.28% of the total variance.

	F1	F2	F3	F4	F5	F6	F7	F8
Eigenvalue	0,55	0,26	0,16	0,15	0,11	0,09	0,09	0,06
Variability (%)	37,28	18,00	10,83	10,21	7,54	6,15	5,90	4,09
cumulative %	37,28	55,28	66,11	76,32	83,85	90,01	95,91	100,00

*Table 4: Variability of the 8 PCA components*

To group the SMEs in our sample into homogeneous categories with regard to open innovation practices and to identify different profiles, we need to have an overview of the classes formed and to define their number. To do this, we carry out a hierarchical ascending classification. To determine the final number of clusters, we used the dendrogram (Figure 2) and the statistical accuracy of the classification, measured by the ratio of intra- and inter-cluster variances and the number of firms per cluster (Table 5).

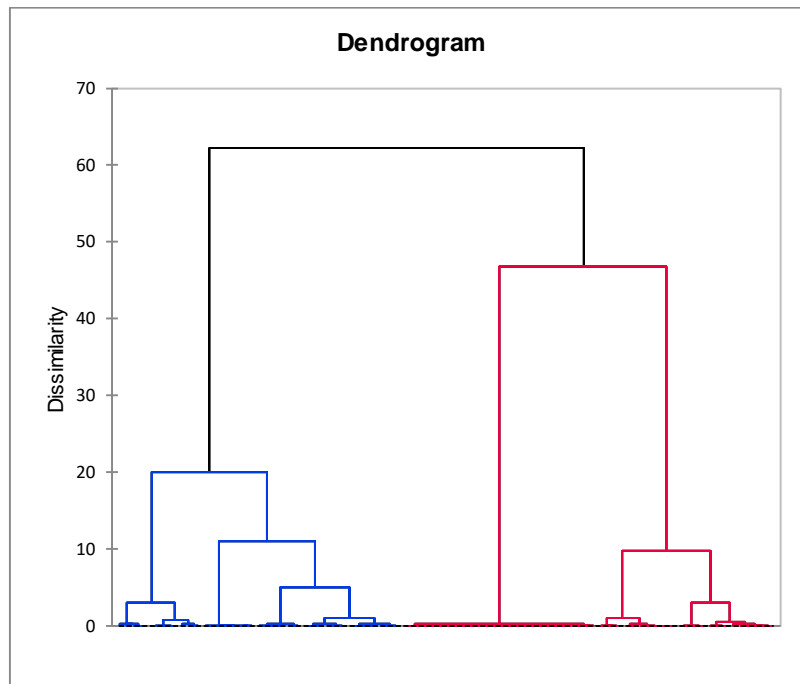


Figure 2 : Dendrogram of the hierarchical ascending classification

Cluster	1	2	3
Size	23	37	25
Ratio of intra-cluster	35,9%		
Ratio of inter-cluster	64,1%		

Table 5: Results of the decomposition of the three classes according to the CAH

We then proceed to a dynamic clustering (non-hierarchical) or K-means method to identify relatively homogeneous companies according to the chosen characteristics. By integrating the number of groups (fixed at three by the hierarchical ascending classification), we obtain the final distribution of our classes (Table 6).

Cluster	1	2	3
Size	30	31	24
Ratio of intra-cluster	33,7%		
Ratio of inter-cluster	66,3%		

Table 6: Results of the decomposition of the three classes according to the K-mean

Finally, we characterize the different clusters thus obtained, by comparing the different modalities of each of the variables (Table 7). A modality is considered characteristic of the cluster if its abundance in the cluster is judged significantly higher than what would be expected given its presence in the population. The abundance of a modality is defined by comparing its percentage in a specific class to its percentage in the population.

## 4. Results and discussion.

### 4.1. Empirical results

Based on previous criteria, we arrived at a three-class solution. Taking into account the different variables, we qualified the groups as "closed innovative SMEs" (cluster 1 - 35.3%), "acquisition innovative SMEs" (cluster 2 - 36.5%) and "interactive innovative SMEs" (cluster 3 - 28.2%).

		Cluster 1 (30 SME)	Cluster 2 (31 SME)	Cluster 3 (24 SME)
<b>ACTORS</b>				
	Employees	0,900	0,903	0,958
	Customers	0,833	0,935	0,917
	Suppliers	0,633	0,839*	0,667
	Universities	0,233***	0,419	0,708***
	Private R&D providers	0,033***	0,387	0,542***
	Start-up	0,133	0,161	0,458***
	Companies in different industries	0,267**	0,452	0,708***
	Competitors in same industry	0,033	0,129*	0,000
	Communities	0,000	0,000	0,042
	Experts and external consultants	0,167***	0,484*	0,417
<b>PRACTICES</b>				
Outside-in	Licensing-in	0,033*	0,161	0,208
	Know-how acquisition	0,000***	0,742***	0,250
	Co-conception	0,833	0,935	0,958
	Crowdsourcing	0,033	0,000	0,042
	Venture	0,067*	0,097	0,375***
Coupled process	R&D collaborative	0,133***	0,355	1,000***
	Research consortia	0,033***	0,226**	1,000*
	M&A	0,000***	0,710***	0,583***
	Open-source	0,100	0,129	0,375***
Inside-out	Licensing-out	0,000**	0,032	0,333***
	Spin-off	0,067**	0,065**	0,500***
<b>STEP PROCESS</b>				
	Obtaining	0,333*	0,581	0,500
	Integrating	0,533	0,645	0,708
	Commercializing	0,333	0,323	0,708***
<b>DESCRIPTIVE CHARACTERISTICS</b>				
	Service sector (vs. manufacturing)	0,167***	0,484	0,708***
	50 - 250 employees (vs. less than 50)	0,433**	0,258	0,167

**Note** : p-value significant at the level of 1% \*\*\*, 5% \*\* and 10%\*

*Table 7 : Characterization of clusters.*

The three clusters obtained can be described as follows. The first cluster is composed by 30 SMEs mainly operating in manufacturing sector. With the exception of co-conception

(although this is the lowest score of the three clusters), our analysis shows that SMEs in this cluster have low scores on all open innovation practices and external actors (except customers and suppliers although this is the lowest score of the three clusters) are little involved in the innovation process and these SMEs mainly seek for integrating knowledge. Openness is therefore only very slightly developed. We named this cluster "closed innovative SMEs" in accordance with the work of Chesbrough (2003) who contrasts open innovation and closed innovation where only the role of internal resources is privileged. The second cluster is composed by 31 SMEs with mainly less than 50 employees, operating in both manufacturing and service sector. In addition to employees and customers, SMEs in this cluster involve suppliers and competitors more than SMEs of other clusters for obtaining and integrating innovation. They mainly adopt know-how acquisition and M&A practices. As a reminder, a M&A is an association of different entities with the aim of taking advantage of know-how in order to capture knowledge to quickly bring an innovation to market. The name of this cluster, "innovative acquisition SMEs" is inspired by the work of Dahlander and Gann (2010). The authors propose four forms of openness categorized according to the approach used (outside-in or inside-out) and according to the financial criterion (with or without financial cost). They define acquisition innovation as the enrichment of an R&D process through the purchase of external resources, which seems to correspond to the practice of SMEs in this group. Finally, the third cluster is composed by 24 SMEs mainly operating in service sector with less than 50 employees. Also in addition to employees and customers, SMEs in this cluster involve universities, private R&D providers, start-up and companies in different industries for integrating and commercializing innovation. These SMEs have high scores on collaborative R&D and research consortia, as well as a high adoption of spin-offs. The SMEs in this group are the ones that use intellectual property titles the most, both for licensing-in and especially for licensing-out. They also adopt open-source and venture capital more than SMEs in the other two clusters, although these are not major practices. Strategic alliances are also developed. In naming this class "interactive innovative SMEs," we drew on the two approaches to coupled process distinguished by Piller and West (2014). As a reminder, in the interactive approach, the creation of innovation or knowledge takes place outside a particular firm. It is more of an interactive collaboration between different actors leading to a joint innovation.

Figure 3 summarizes this analysis in the form of a diagram showing the salient features of each group of SMEs in our sample.

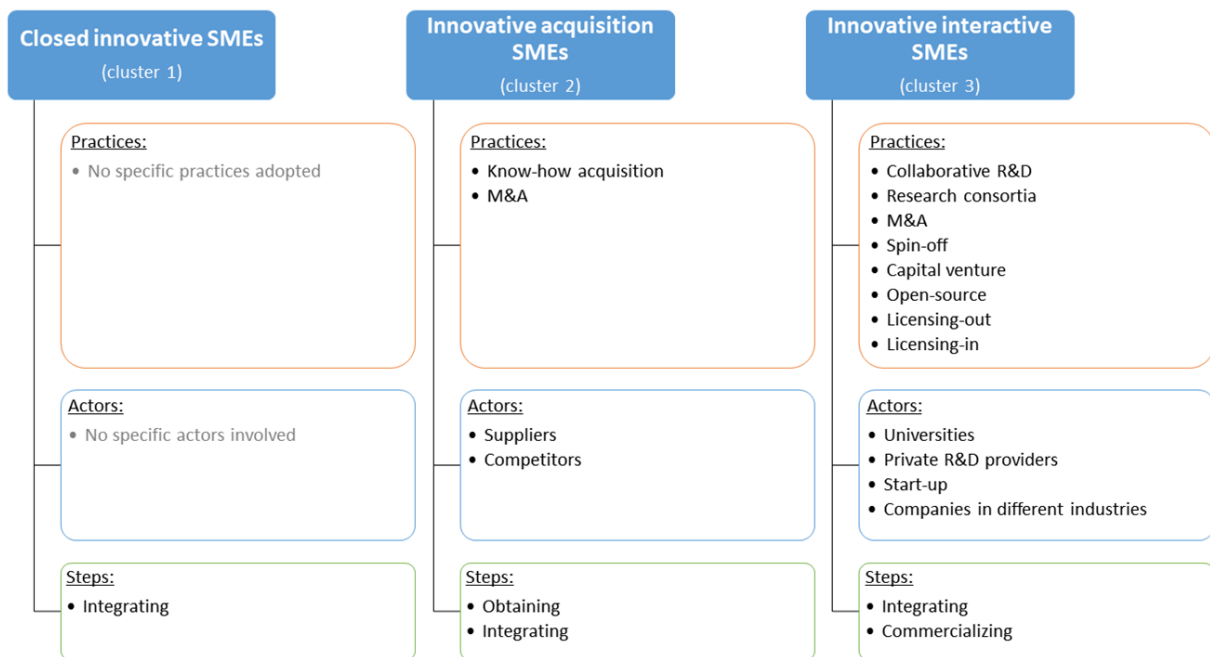


Figure 3: Summary of the classification

## 4.2. Discussion.

As mentioned previously, Chesbrough and Brunswicker (2013) find that internal employees are mentioned as a major source of innovative ideas. Our results seem to support this by showing that regardless of the SME's behavior towards open innovation, employees are very much involved in the process. In fact, in the three cluster, more than 90% of SMEs involve their employees. Our results also show that customers and supplier are also the most involved stakeholder. It is in accordance with several authors who highlight that in addition to internal employees, the main source actors of innovation for SMEs are customers and suppliers (Battistella et al., 2017; Laursen & Salter, 2006; Piller & West, 2014). Moreover, previous studies show that collaborative R&D (Marangos & Warren, 2017) and the commercialization of intellectual property rights (Perkmann & Walsh, 2007) are developed in partnership with universities or research centers. In the third cluster, SMEs are in partnership with universities and private R&D providers and it is the cluster where licensing-in, licensing-out and collaborative R&D are the most adopted.

Van de Vrande et al. (2009) observe that SMEs have a preference for non-monetary innovation activities .i.e. practices such as co-design, research consortium, crowdsourcing or networking (Chesbrough & Brunswicker, 2013). They even state that user involvement in the innovation process is the most common open innovation practice in SMEs. In our sample, the most adopted practice is indeed co-design: more than 90% of SMEs have adopted this practice. Collaborative R&D, strategic alliance and research consortium are also highly developed practices. However, crowdsourcing is the least adopted open innovation practice by SMEs. Therefore, the SMEs in our sample do not favor non-monetary open innovation practices, but those where intellectual property is easiest to manage and where financial expenses are lower.

Whereas Van de Vrande et al. (2009) find that SMEs in industry and services adopt OI approaches in relatively similar ways, Mina et al. (2014) and Rangus and Drnovsek (2013) find difference differences in OI adoption between the industry and service sectors (Mina et al., 2014; Rangus & Drnovsek, 2013). Our results show that innovative closed SMEs (mainly industrial) do not have the same practices as innovative interactive SMEs (mainly service). However, there is no differentiation in the case of innovative acquisition SMEs, which are as much industrial as service SMEs. Our results can thus help explain the difference in the results found by Van de Vrande et al. (2009) and Mina et al. (2014) and Rangus and Drnovsek (2013). Also, according to Rangus and Drnovsek (2013) service firms are more involved in most open innovation activities than industrial firms especially in licensing activities and in involving employees in the innovation process. Our classification shows that interactive innovative SMEs are mainly specialized activity firms that adopt the most open innovation practices, and whose employees are involved in the innovation process, while closed innovative SMEs are mainly industrial firms that adopt few open innovation practices, and whose employees are little involved in the innovation process. It therefore validates the findings of Rangus and Drnovsek (2013).

## **5. Conclusion.**

The objective of this research was to examine the existing behaviors among SMEs in terms of open innovation practices and actors involved. To reach this goal, we used a literature review to propose a framework with 11 open innovation practices for the “how” dimension, 10 stakeholders for the “with whom” dimension and three linear steps for the “what purpose” dimension. Then, we survey 85 SMEs in Normandy to collect our data. To finish, we carried out a classification that revealed three clusters of SMEs. One cluster of SMEs known as closed innovators, which do not practice much open innovation. A second cluster named acquisition innovators, where SMEs seek to enrich their R&D process by purchasing external resources. A third cluster of interactive innovators, which promote collaboration between different actors to achieve joint innovation.

Several contributions emerge from our research. From a theoretical point of view, it attempts to contribute to open innovation research by providing a better understanding of SMEs' behavior in terms of open innovation practices and actors involved. By focusing on 3 of the 5 dimensions, it follows the call of Huinzigh (2011) for developing and operating collaborative activities for innovation into “when, how, with whom, what purpose, and in what way” dimensions. Another theoretical contribution concerns the identification of three groups of SMEs with distinct profiles in terms of adoption of open innovation practices. This theoretical contribution is important because it can explain some of the contradictory results we find in the literature, especially regarding the adoption of open innovation practices in the industry and service sectors.

From a managerial point of view, a better understanding of the open innovation practices adopted and the main actors involved in the different stages of the open innovation process could lead to a more thoughtful implementation of open innovation by SMEs. It offers a framework based on practices, actors and essential steps that managers can refer to when

deciding how (with whom and what purpose) to deploy the different practices. This study could therefore help SME managers to better identify open innovation practices to set up, and to better identify actors to be involved in implementing this approach. Thus, SMEs wishing to develop an open approach for integrate or commercialize innovation, collaborate more with universities, private R&D providers, start-up and companies in different industries.

Finally, we recognize some limitations to our study that require further research contributions. First, our study refers to a specific region and two sectors of activity. In order to generalize the results, we would need a more diversified sample of companies in terms of activity sector as well as a comparison with SMEs operating in different regions or even countries. A larger sample would also allow for the identification of additional behaviors. In addition, further research is needed not to modify the theoretical framework, but to complete it with the two others dimensions proposed .i.e. in what way and when.

### Références :

- Ahn, J. M., Mortara, L., & Minshall, T. (2013). The effects of open innovation on firm performance: a capacity approach. *Science, Technology and Innovation Policy Review*, 4(March), 74- 93.
- Arolas, E. E. (2012). Towards an integrating crowdsourcing definition, 32, 189- 200. <https://doi.org/10.1177/016555150000000>
- Ayerbe, C. (2015). Quelle organisation pour l'open innovation. In *Atelier Innovation de l'AIMS*.
- Battistella, C., De Toni, A. F., & Pessot, E. (2017). Practising open innovation: a framework of reference. *Business Process Management Journal*, 23(6), 1311- 1336.
- Bianchi, M., Cavaliere, A., Chiaroni, D., Frattini, F., & Chiesa, V. (2011). Organisational modes for Open Innovation in the bio-pharmaceutical industry: An exploratory analysis. *Technovation*, 31(1), 22- 33. <https://doi.org/10.1016/j.technovation.2010.03.002>
- Bigliardi, B., & Galati, F. (2016). Which factors hinder the adoption of open innovation in SMEs? *Technology Analysis & Strategic Management*, 7325(August), 1- 17. <https://doi.org/10.1080/09537325.2016.1180353>
- Bocquet, R., Bas, C. Le, Mothe, C., & Poussing, N. (2013). Are firms with different CSR profiles equally innovative ? Empirical analysis with survey data. *European Management Journal*, 31(6), 642- 654.
- Bogers, M., Zobel, A., Afuah, A., Almirall, E., Dahlander, L., Frederiksen, L., ... Ter Wal, A. (2017). The open innovation research landscape : established perspectives and emerging themes across different levels of analysis. *Industry and Innovation*, 2716(1), 1- 33. <https://doi.org/10.1080/13662716.2016.1240068>
- Brunswick, S., & Van de Vrande, V. (2014). Exploring open innovation in small and medium-sized enterprises. In H. Chesbrough, W. Vanhaverbeke, & J. West (Éd.), *New Frontiers in Open Innovation* (p. 135- 156). Oxford University Press.
- Burcharth, A. L. de A., Knudsen, P. M., & Søndergaard, H. A. (2014). Neither invented nor shared here: The impact and management of attitudes for the adoption of open innovation practices. *Technovation*, 34(3), 149- 161.
- Cassier, M., & Dominique Foray. (2001). Économie de la connaissance : le rôle des consortiums de haute technologie dans la production d'un bien public. *Économie et Prévision*, 4(5), 107- 122.
- Cassiman, B., & Valentini, G. (2016). Open innovations : are inbound and outbound knowledge flows really complementary? *Strategic Management Journal*, 37(6), 1034- 1046. <https://doi.org/10.1002/smj>
- Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business School Press.
- Chesbrough, H. (2004). Open innovation: Renewing growth from industrial R&D. *10th Annual Innovation Convergences, Minneapolis*, 27.



- Chesbrough, H. (2006a). *Open business models : How to Thrive in the New Innovation Landscape*.
- Chesbrough, H. (2006b). Open innovation: A new paradigm for understanding industrial innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Éd.), *Open innovation: Researching a new paradigm* (p. 0- 19). Oxford University Press on Demand.
- Chesbrough, H. (2006c). The era of open innovation. *Managing innovation and change*, 127(3), 34- 41.
- Chesbrough, H., & Bogers, M. (2014). Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation Keywords. In H. Chesbrough, W. Vanhaverbeke, & J. West (Éd.), *New Frontiers in Open Innovation* (p. 1- 37). Oxford University Press.
- Chesbrough, H., & Brunswicker, S. (2013). *Managing Open Innovation in large firme*.
- Chesbrough, H., & Crowther, A. (2006). Beyond high-tech: early adopters of Open Innovation in other industries. *R&D Management*, 36(3), 229–236.
- Chesbrough, H., & Schwartz, K. (2007). Innovating Business Models with Co-development Partnerships. *Research-TechnologyManagement*, 50(1), 55- 59. <https://doi.org/Article>
- Chiaroni, D., Chiesa, V., & Frattini, F. (2010). Unravelling the process from Closed to Open Innovation: Evidence from mature, asset-intensive industries. *R&D Management*, 40(3), 222- 245. <https://doi.org/10.1111/j.1467-9310.2010.00589.x>
- Commission européenne. (2016). Guide de l'utilisateur pour la définition des PME. *Marché intérieur, industrie, entrepreneuriat et PME*. <https://doi.org/10.2873/697424>
- Dahlander, L., & Gann, D. (2010). How open is innovation? *Research Policy*, 39(6), 699- 709. <https://doi.org/10.1016/j.respol.2010.01.013>
- Dong, A., & Pourmohamadi, M. (2014). Knowledge matching in the technology outsourcing context of online innovation intermediaries. *Technology Analysis & Strategic Management*, 26(6), 655-668.
- Dries, F., Van Looy, B., & Debackere, K. (2005). Interorganizational collaboration and innovation: toward a portfolio approach. *Journal of Product Innovation Management*, 22(3), 238-250.
- Enkel, E., & Gassmann, O. (2010). Creative imitation: exploring the case of cross-industry innovation. *R&D Management*, 40(3), 256-270.
- Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&D Management*, 39(4), 311-316. <https://doi.org/10.1111/j.1467-9310.2009.00570.x>
- Gabriele, R., D'Ambrosio, A., & Schiavone, F. (2017). Open innovation and the role of hubs of knowledge in a regional context. *Journal of the Knowledge Economy*, 8(3), 1049-1065.
- Gassmann, O. (2006). Opening Up the Innovation Process : Towards an Agenda. *R&D Management&d Management*, 36(3), 223-228. <https://doi.org/10.1111/j.1467-9310.2006.00437.x>
- Gassmann, O., & Enkel, E. (2004). Towards a theory of open innovation: three core process archetypes. In *R&D Management Conference*. Lisbonne, Portugal.
- Greco, M., Grimaldi, M., & Cricelli, L. (2016). An analysis of the open innovation impact on firm performance. *European Management Journal journal*, 34(5), 501-516. <https://doi.org/10.1016/j.emj.2016.02.008>
- Harland, P., & Nienaber, A.-M. (2014). Solving the matchmaking dilemma between companies and external idea contributors. *Technology Analysis & Strategic Management*, 26(6), 639-653.
- Holzmann, T., Sailer, K., Galbraith, B., & Katzy, B. (2014). Matchmaking for open innovation– theoretical perspectives based on interaction, rather than transaction. *Technology Analysis & Strategic Management*, 26(6), 595-599.
- Howe, J. (2006). The rise of crowdsourcing. *Wired magazine*, 14(6), 1-4.
- Huang, F., & Rice, J. (2009). The role of absorptive capacity in facilitating" Open innovation" outcomes: A study of Australian SMEs in the manufacturing sector. *International Journal of Innovation Management*, 13(02), 201-220. <https://doi.org/10.1142/S1363919609002261>
- Huizingh, E. (2011). Open innovation: State of the art and future perspectives. *Technovation*, 31(1), 2-9. <https://doi.org/10.1016/j.technovation.2010.10.002>
- Jullien, N., & Pénin, J. (2014). *Innovation ouverte : vers la génération 2.0* (Vuibert).
- Kherrazi, S., & Saïd, K. (2018). Dynamique d ' innovation et modes de management des

- consortiums de R&D : une étude exploratoire du programme-cadre Horizon 2020. In *Aims XXVIIe Conférence Internationale de Management Stratégique*.
- Kim, S. ., Ahn, D. ., Song, J. ., Lee, J. ., Bae, Y. ., & Jun, J. . (2008). Building Open Innovation System: Theory, Practice and Policy Implication. In *STEPI*. Seoul.
- Kirschbaum, R. (2005). Open innovation in practice. *Research Technology Management*, 48(4), 24-28.
- Lanzolla, G., & Suarez, F. (2012). Closing the technology adoption–use divide: The role of contiguous user bandwagon. *Journal of Management*, 38(3), 836-859.
- Laursen, K., & Salter, A. (2004). Searching high and low: what types of firms use universities as a source of innovation? *Research Policy*, 33(8), 1201-1215.
- Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2), 131-150. <https://doi.org/10.1002/smj.507>
- Lee, S., Park, G., Yoon, B., & Park, J. (2010). Open innovation in SMEs-An intermediated network model. *Research Policy*, 39(2), 290-300. <https://doi.org/10.1016/j.respol.2009.12.009>
- Lerner, J., & Tirole, J. (2005). The economics of technology sharing: Open source and beyond. *The Journal of Economic Perspectives*, 19(2), 99-120.
- Lichtenthaler, U., & Ernst, H. (2007). External technology commercialization in large firms: results of a quantitative benchmarking study. *R&D Management*, 37(5), 383-397. <https://doi.org/10.1111/j.1467-9310.2007.00487.x>
- Lichtenthaler, U., & Ernst, H. (2009). Opening up the innovation process: the role of technology aggressiveness. *R&D Management*, 39(1), 38-54.
- Loilier, T., & Tellier, A. (2004). Comment peut-on se faire confiance sans se voir? Le cas du développement des logiciels libres. *Management*, 7(3), 275-306. <https://doi.org/10.3917/mana.073.0275>
- Loilier, T., & Tellier, A. (2011). Que faire du modèle de l'innovation ouverte ? *Revue française de gestion*, 210(1), 69-85. <https://doi.org/10.3166/rfg.210.69-85>
- Marangos, S., & Warren, L. (2017). A mapping for managers: open innovation for R&D intensive SMEs in the life sciences sector. *European Journal of Innovation Management*, 20(2), 210-229.
- Mina, A., Bascavusoglu-moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy*, 43(5), 853-866. <https://doi.org/10.1016/j.respol.2013.07.004>
- Montelisciani, G., Gabelloni, D., Tazzini, G., & Fantoni, G. (2014). Skills and wills: the keys to identify the right team in collaborative innovation platforms. *Technology Analysis & Strategic Management*, 26(6), 687-702.
- Ollila, S., & Elmquist, M. (2011). Managing open innovation: exploring challenges at the interfaces of an open innovation arena. *Creativity and Innovation Management*, 20(4), 273-283.
- Parida, V., Westerberg, M., & Frishammar, J. (2012). Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance. *Journal of Small Business Management*, 50(2), 283-309. <https://doi.org/10.1111/j.1540-627X.2012.00354.x>
- Pénin, J. (2013). Are you open? An investigation of the concept of openness for knowledge and innovation. *Revue économique*, 64(1), 133-148. <https://doi.org/10.3917/reco.641.0133>
- Pénin, J., & Burger-Helmchen, T. (2012). Crowdsourcing d'activités inventives et frontières des organisations. *Management international*, 16, 101-112. <https://doi.org/10.7202/1012396ar>
- Pénin, J., Hussler, C., & Burger-Helmchen, T. (2011). New shapes and new stakes: a portrait of open innovation as a promising phenomenon. *Journal of Innovation Economics*, 7(1), 11. <https://doi.org/10.3917/jie.007.0011>
- Perkmann, M., & Walsh, K. (2007). University–industry relationships and open innovation: towards a research agenda. *International Journal of Management Reviews*, 9(4), 259-280.
- Piller, F., & West, J. (2014). Firms, users and innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Éd.), *New Frontiers in Open Innovation* (p. 29-49). Oxford University Press. <https://doi.org/10.1093/acprof>
- Rangus, K., & Drnovsek, M. (2013). Open innovation in Slovenia: A comparative analysis of

- different firm sizes. *Economic and Business Review for Central and South-Eastern Europe*, 15(3), 175.
- Sawhney, M., & Nambisan, S. (2007). *The global brain: Your roadmap for innovating faster and smarter in a networked world*. Pearson Prentice Hall.
- Schenk, E., & Guittard, C. (2016). Crowdsourcing et développement d'un écosystème d'affaires: une étude de cas. *Innovations*, 1(49), 39-54. <https://doi.org/10.3917/inno.049.0039>
- Scuotto, V., Santoro, G., Bresciani, S., & Del Giudice, M. (2017). Shifting intra-and inter-organizational innovation processes towards digital business: an empirical analysis of SMEs. *Creativity and Innovation Management*, 20(3), 247-255.
- Slowinski, G., & Sagal, M. (2010). Good practices in open innovation. *Research Technology Management*, 53(5), 38-45. <https://doi.org/10.1080/08956308.2010.11657649>
- Spithoven, A., Vanhaverbeke, W., & Roijackers, N. (2013). Open innovation practices in SMEs and large enterprises. *Small Business Economics*, 41(3), 537-562. <https://doi.org/10.1007/s11187-012-9453-9>
- Tennenhouse, D. (2004). Intel's open collaborative model of industry-university research. *Research-Technology Management*, 47(4), 19-26.
- Tether, B., & Tajar, A. (2008). Beyond industry-university links: Sourcing knowledge for innovation from consultants, private research organisations and the public science-base. *Research Policy*, 37(6), 1079-1095.
- Theyel, N. (2013). Extending open innovation throughout the value chain by small and medium-sized manufacturers. *International Small Business Journal*, 31(3), 256-274. <https://doi.org/10.1177/0266242612458517>
- Tsai, K.-H. (2009). Collaborative networks and product innovation performance: Toward a contingency perspective. *Research Policy*, 38(5), 765-778.
- Un, C. A., Cuervo-Cazurra, A., & Asakawa, K. (2010). R&D collaborations and product innovation. *Journal of Product Innovation Management*, 27(5), 673-689.
- Usman, M., Roijackers, N., Vanhaverbeke, W., & Frattini, F. (2018). A systematic review of the literature on open innovation in SMEs. In V. Wim, R. Nadine, & U. Muhammad (Éd.), *Researching Open Innovation in SMEs* (p. 1-28). World Scientific.
- Van de Vrande, V., De Jong, J. P. J., Vanhaverbeke, W., & De Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(6-7), 423-437. <https://doi.org/10.1016/j.technovation.2008.10.001>
- Vanhaverbeke, W., van de Vrande, V., & Chesbrough, H. (2008). Understanding the advantages of open innovation practices in corporate venturing in terms of real options. *Creativity and Innovation Management*, 17(4), 251-258. <https://doi.org/10.1111/j.1467-8691.2008.00499.x>
- Von Hippel, E. (1986). Lead users: a source of novel product concepts. *Management science*, 32(7), 791-805.
- Vrgovic, P., Vidicki, P., Glassman, B., & Walton, A. (2012). Open innovation for SMEs in developing countries—An intermediated communication network model for collaboration beyond obstacles. *Innovation*, 14(3), 290-302.
- Waites, R., & Dies, G. (2006). Corporate research and venture capital can learn from each other. *Research-Technology Management*, 49(2), 20-24.
- West, J., & Bogers, M. (2014). Leveraging external sources of innovation: a review of research on open innovation. *Journal of Product Innovation Management*, 31(4), 814-831.
- West, J., & Gallagher, S. (2006). Challenges of open innovation: the paradox of firm investment in open-source software. *R&D Management*, 36(3), 319-331.
- Wynarczyk, P., Piperopoulos, P., & McAdam, M. (2013). Open innovation in small and medium-sized enterprises: An overview. *International Small Business Journal*, 31(3), 240-255. <https://doi.org/10.1177/0266242612472214>
- Zahra, S., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of management review*, 27(2), 185-203. <https://doi.org/10.5465/APBPP.2000.5438568>



## Annex 1 - Open innovation practices reviewed in literature

Practices	Definition	References
<b>OUTSIDE-IN</b>		
- Licensing-in - In-sourcing - Inward IP licensing	Exploiting external knowledge to reduce time-to-market and find new ideas	(Burcharth et al., 2014; Chesbrough, 2003; Gassmann, 2006; Lee et al., 2010; Van de Vrande et al., 2009; Wynarczyk et al., 2013)
- Venture - Spin-in	Invest in promising venture companies to bring new ideas	(Kim et al., 2008; Waites & Dies, 2006)
- Know-how acquisition	Buy R&D services provided by external organizations	(Burcharth et al., 2014; Gassmann, 2006; Harland & Nienaber, 2014; Holzmann et al., 2014; Wynarczyk et al., 2013)
- Co-conception - Co-design - Customer involvement	Accessing new ideas by involving customers in the R&D or design process.	(Burcharth et al., 2014; Gassmann, 2006; Van de Vrande et al., 2009; Von Hippel, 1986)
- Crowdsourcing	Outsource an activity to a large number of anonymous actor.	(Howe, 2006; Pénin & Burger-Helmchen, 2012; Schenk & Guittard, 2016)
<b>COUPLED PROCESS</b>		
- R&D collaborative - Co R&D	Conducting R&D with external partners	(Burcharth et al., 2014; Chesbrough, 2006c; Gassmann, 2006; Harland & Nienaber, 2014; Holzmann et al., 2014; Lee et al., 2010; Montelisciani, Gabelloni, Tazzini, & Fantoni, 2014; Tennenhouse, 2004; Van de Vrande et al., 2009; Wynarczyk et al., 2013)
- Research consortia	Pool resources and commit to perform services to achieve a contracted research project.	(Cassier & Dominique Foray, 2001; Jullien & Pénin, 2014)
- M&A	Absorb corporate knowledge by building or redeeming an alliance strategy	(Enkel, Gassmann, & Chesbrough, 2009; Gassmann & Enkel, 2004)
- Open-source	Open an internal project to form a new market and test customers' response	(Chesbrough, 2004; Lerner & Tirole, 2005; Loilier & Tellier, 2004, 2011; Pénin, 2013; West & Gallagher, 2006)
<b>INSIDE-OUT</b>		
- Licensing-out - Out-sourcing - Outward IP licensing	Licensing or selling unused technologies to maximize profit.	(Dong & Pourmohamadi, 2014; Gassmann, 2006; Lee et al., 2010; Lichtenthaler & Ernst, 2009; Van de Vrande et al., 2009; Wynarczyk et al., 2013)
- Spin-off - Essaimage - Spin-out	Spin-off internal organizations to commercialize disruptive technologies	(Kirschbaum, 2005)