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Open innovation in SMEs-towards formalization of openness[1]

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Abstract. Open innovation has been widely debated in management literature. However, little attention has been given to how small and medium sized enterprises manage to open up their innovation process. Consequently, various questions remain unanswered. In particular, we want to shed light on the following issue: how small and medium-sized enterprises manage organizational changes in their journey from closed to open innovation. A literature review examines how small and medium-sized enterprises open up their innovation process based on nine perspectives. Then, the reference framework addresses the organizational changes embedded in evolving from closed to open innovation. In this sense, we use acknowledged concepts on organizational change research to carry out an in depth-case study on a small and medium-sized enterprise evolving in the sports equipment industry. The results demonstrate that, in its journey from closed to open innovation, the small and medium-sized enterprise has to stimulate and to manage changes to four company's dimensions i.e. corporate culture, networking, organizational structure and knowledge management systems. The paper concludes by highlighting the diverse organizational changes undertaken by the company on these four dimensions. Based on this paper's conclusion, managerial implications and discussion for future research are drawn.

Keywords: Open Innovation, SME, Business Management, Decision Making, Knowledge Management, Entrepreneur.

1 Introduction

Open innovation is a growing field of interest among practitioners and scholars (Chesbrough and Appleyard, 2007; Gassmann et al., 2010). Since new phenomena emerge from leading industries, such as, software, telecommunication, electronics, biotechnological, and pharmaceutical, previous theories, such as, Corporate Strategy (Ansoff, 1965), customer active paradigm (von Hippel, 1978), absorptive (Cohen and Levinthal, 1990)/ receptive capacity (Hamel, 1991)/ dynamic capabilities (Teece et al., 1997) seemed to be limited to fully explain the activities undertaken by those companies (Chesbrough, 2003). In fact, these industries expand on opening up their innovative process using external resources, such as, networks, innovation communities, volunteer contributors and ecosystems as sources of value creation (Chesbrough and Appleyard, 2007). Companies such as UNIX (Linux), IBM, and LEGO (Lego MindStorm), among others, have been largely investigated by academics.

Consequently, academics started to study those industries. Chesbrough (2003) elaborates on the phenomenon of value creation through integration of external

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resources and externalization of internal ones. He coined it open innovation, which tends to provide a holistic view of the phenomenon. Even though some argue that open innovation is comparable to above cited theories (Aylen, 2010; Elmquist et al., 2009), most acknowledge that Chesbrough's approach adds a more holistic dimension (Gassmann et al., 2010; Huizingh, 2010) and emphasizes the relevance of IP (Huston and Sakkab, 2006; Piller and Walcher, 2006). Chesbrough et al. (2006, p. vii) define open innovation as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand markets for external use of innovation, respectively". By reflecting on Chesbrough et al. (2006) definition, one can say that the definition is vague and wide. If every aspect of the above definition must be fulfilled, based on current empirical studies, only few companies are engaged into "real" OI. On the other hand, if the definition is taken apart (Gassmann and Enkel, 2004) then most companies could be considered to be engaged in OI. Trott and Hartmann (2009) also argue that OI should not be taken as the yin of the closed innovation yang. However, researchers need to bear in mind that not every form of collaboration is OI. For instance, Sony Ericsson collaborates on the supply chain view of "OI" described by Groen and Linton (2010), but is not engaged into OI, because they purposely use internal resources for innovation with some contact with external sources only; while Android purposely gives access to its technology for anyone to openly collaborate. Those examples being extremes, there might be other companies lying between those extremes. Taking into consideration the latter and that OI's definition is vague and wide, OI might take different forms and might appear to different degree.

Since academics focused most of their studies on large and multinational enterprises, small and medium sized enterprises (SMEs) were left on the side. Furthermore, Gassmann et al., (2010, p. 215) state that "while most of the firms described in early works on open innovation were large multinational firms, it has become apparent that smaller and medium- sized firms are also opening up their innovation process" (). Consequently, a few academics have focused their OI research on SMEs. van de Vrande et al. (2009) quantitatively tested trends, motives and challenges embedded in open innovation in SMEs; their results demonstrate that open innovation is widely spread among SMEs and more importantly keep on spreading. van de Vrande et al. (2009) also pinpoint the main issues related to opening up the innovation process for SMEs as being organizational and cultural barriers. Organizationally, previous studies demonstrated main barriers are related to venturing, external participation and outsourcing of R&D (van de Vrande et al., 2009). Culturally, main barriers are related to the not-invented-here (NIH) syndrome and lack of internal commitment (Chesbrough and Crowther, 2006; Katz and Allen, 1982). In line with van de Vrande et al. (2009) conclusion, academics examine what SMEs can do so as to reduce the cultural and organizational barriers to open innovation. As a result, Ramos et al. (2009) address the open knowledge and technology transfer issue. Mogollon et al. (2010) concentrate on the importance of open-mindedness for implementing open innovation to overcome cultural barriers in SMEs. A study from Lee et al. (2010) suggests the participation of intermediaries facilitating the implementation of open innovation in SMEs.

However, during our research we were not able to find published studies focusing on open innovation in SMEs that study the form of the organizational changes bound with SMEs evolving from closed to open innovation perspective. This goes along with Chiaroni et al. (2010, p. 1) stating that "an issue that deserves further attention is the anatomy of the organizational change process through which a firm evolves from being a Closed to an Open Innovator.". Moreover, previous studies (e.g. Chesbrough, 2003) show that companies being engaged in open innovation are far more competitive than others-e.g. UNIX (Linux), Procter and Gamble (Connect and Develop), LEGO (Lego MindStorm) - thus this increases interest in seeing whether

SMEs could reap the same benefits. Consequently, this paper wants to address the knowledge gap existing between implementing open innovation and SMEs theories. As a first attempt to understand how SMEs implement open innovation, the following research question is formulated:

> *"How do SMEs try to overcome the organizational and cultural barriers when evolving from closed to open innovation?"*

The aim is to describe how SMEs implement open innovation by addressing the issue of organizational and cultural barriers needed to be overcome when SMEs evolve from closed to open innovation. In order to understand this context and to further develop the language of SMEs empirical data are collected through a case study.

The article is structured as follows: the second section consists of a review of relevant literatures on OI. The third section develops a reference framework for this study, derived from the literature review, to be used as a guide to gather and analyze data. The fourth section consists of an analysis of collected data. The final section concludes this article and launches a discussion for future researches.

2 Literature review

As previously stated, most of existing research carried out on open innovation (OI) uses data from MNE's. Consequently, due to limited number of studies on SMEs, the following proposition has been made: in order to understand the challenges faced by SMEs in their journey from closed to open innovation, both closed and open innovation perspectives (Chesbrough, 2003) need to be discussed. Through, Gassmann et al. (2010) nine perspectives along with research on OI streams in MNEs, the challenges faced by MNEs are identified. We choose to base our reflection on Gassmann et al. (2010) perspectives considering this scholar has been studying OI for years. Moreover, he has been working with influential scholars in the OI field such as, among others, Henry Chesbrough, Wim Vanhaverbeke and Ellen Enkel. Thanks to Gassmann et al. (2010) theoretical frame, we drew a combined theoretical and practical overview of open innovation (Dufour and Son, 2011). By combining the challenges faced by MNEs in opening up their innovation process and theories on SMEs intrinsic characteristics, we pinpoint the challenges faced by SMEs (for more details, please refer to Dufour and Son, 2011).

2.1 From closed to open innovation

Chesbrough (2003) introduces open innovation as an alternative to traditional internal innovation in large companies. He describes OI as a means of commercializing internal and external ideas thanks to internal and external tools. As Chesbrough (2003, pp. 36-37) puts it: "in this new model of open innovation, firms commercialize external (as well as internal) ideas by deploying outside (as well as in-house) pathways to the market". In this approach, Chesbrough (2003) argues that closed innovation-traditional internal innovation-is not the strategic asset it was before. Companies could not carry out innovation on their own while remaining competitive, because of increased complexity of products and technologies (Chesbrough, 2003). As a consequence, companies were forced to find new ways for innovating. Chesbrough and Appleyard (2007) add that ownership, entry barriers, switching costs and intra-industry rivalry were of great importance in closed innovation, whereas they are secondary items within OI; in other words, closed and open innovation present crucial generic differences. Chesbrough (2003) identifies that the main difference resides in the internal-external dualism. On the one hand, Chesbrough's closed innovation philosophy requires everything to be done in-house. On the other hand,

Chesbrough's OI philosophy advocates for openness towards other actors (Chesbrough, 2007). The above discussion indicates that we consider Chesbrough's definition from before to be considered as if a firm is using OI if they are open in only one or a few parts of their innovation activities. In this study we connect to this view.

Table 1. Contrasting principles of closed and open innovation

Closed innovation principles	Open innovation principles
The smart people in our field work for us.	Not all of the smart people work for us so we must find and tap into the knowledge and expertise of bright individuals outside our company.
To profit from R&D, we must discover, develop and ship it ourselves	External R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We don't have to originate the research in order to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is better than getting to market first.
If we create the most and best ideas in the industry, we will win	If we make the best use of internal and external ideas, we will win.
We should control our intellectual property (IP) so that our competitors don't profit from our ideas	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

Note: Inspired from "The era of open innovation" by Chesbrough, 2003, Sloan Management Review, 44(3), 38.

Table 1 underlines, among other things, the internal-external duality existing between Chesbrough's closed and open innovation model. There is a high self-reliance level in closed innovation; for instance, discovering, developing, shipping, commercializing, creating, are actions that should be conducted in-house in an extreme closed innovation setting. On the contrary, an extreme open innovation setting advocates actions taken in-house, as well as, externally to cope with current products and technologies complexity. In other words, OI is about tapping into knowledge of experts outside companies to complement for companies' internal knowledge; balancing internal and external R&D; taking advantage of others' discoveries; carefully thinking business model instead of being first on the market; balancing internal and external ideas; taking advantage of others' use of owned IP and taking advantage of others' IP when it embraces companies' business model. Those two innovation models are extreme pictures; consequently, some scholars end up believing that the best chance to sustain open innovation relies on balancing traditional business strategy with open initiatives (Chesbrough and Appleyard, 2007; Chiaroni et al., 2010; Enkel et al., 2009; Pontiskoski and Asakawa, 2009). Thus, we can extrapolate that companies also evolve between these two extremes. That is; basically every firm is involved in OI to some extent, even if most firms are involved to a very low degree. Only a few innovation projects (e.g. LINUX, LEGO MindStorm) could be considered to be assessed with a high degree of OI.

2.2 Review of open innovation and empirical findings in MNEs

As a consequence to Chesbrough's (2003) research, scholars have been studying OI under different streams in order to identify what MNEs do in order to achieve and

sustain OI. By studying those streams, scholars have brought practical solutions to the scientific world through empirical studies. Gassmann et al. (2010) group these different streams under nine perspectives. We choose to base our reflection on Gassmann et al. (2010) perspectives because he has been studying OI for years. Moreover, he has been working with influential scholars in the OI field such as, among others, Henry Chesbrough, Wim Vanhaverbeke, and Ellen Enkel. Consequently, he has a broad theoretical standpoint over OI that has allowed him to design a rather objective literature review on the topic. Thanks to Gassmann et al. (2010) theoretical frame, we draw a combined theoretical and practical overview of open innovation. First of all, the nine perspectives i.e. spatial, structural, user, supplier, leveraging, process, tool, institutional, and cultural are defined. Secondly, table 2 gathers what MNEs are recommended to do in order to succeed at opening up their innovation process.

The spatial perspective relates to the globalization of innovation. Thanks to access to markets and resources (Gassman, 2006), as well as, new communication and information channels increasing information sharing, innovation can be carried out by different parties located at different places in the world (Gassmann et al., 2010). This leads to the need of improved information sharing systems. The structural perspective relates to the increasing division of work in innovation. More complex technologies engender specialization. Specialization engenders alliances and R&D outsourcing (Gassmann et al. 2010; Hagedoorn and Duysters, 2002). As Chesbrough in Allio (2005, p. 24) puts it: "innovation overall is a team sport" . This is meant to increase competence sharing and innovation efficiency. The user perspective relates to the integration of users in the innovation process. This enables organizations to know users' requirements thanks to, for instance, toolkits or early involvement of users in the innovation process (von Hippel, 1986, 1988; von Hippel and Katz, 2002; Gassmann et al., 2010). The supplier perspective relates to the involvement of suppliers in the innovation process (Gassmann et al., 2010). Early involvement of suppliers in the innovation process significantly augments innovation performance (Hagedoorn, 1993, 2002). The leveraging perspective relates to the use of external technology and IP in order to leverage internal technology and IP, and vice-versa. Technology and/or IP neglected by an organization can be useful to another one (Gassmann et al., 2010). The process perspective relates to the three processes in open innovation. (1) The outside-in process, which consists of seeking out technologies outside the organization. (2) The inside-out process, which consists of selling out technologies. (3) The coupled process, which gathers the two previous ones (Gassmann and Enkel, 2004). The tool perspective relates to the set of tools that are required in order to integrate users and/or integrate external problem solvers to the innovation process (Gassmann et al., 2010). The institutional perspective relates to the free revealing of inventions, findings, discoveries and knowledge in order to accelerate innovation and get it more efficient (von Hippel and von Krogh, 2003, 2006). The cultural perspective relates to organization mindset. In open innovation, the not-invented-here mindset (Katz and Allen, 1982) is something that must be overcome (Chesbrough, 2003). This implies that value must be given to outside competence and know-how (Gassmann et al., 2010) to cope with increasing products and technologies complexity.

Table 2 below gathers recommendations brought to respectively each perspective on OI in MNEs. The left column displays the names of the perspectives on open innovation. In the right column lay the solutions elaborated by MNEs on the challenges they face to sustain open innovation. Those solutions were brought by scholars to the scientific world thanks to empirical studies. In order to avoid the pitfall of over-generalization we present in the right column what is recommended in order to succeed in implementing OI instead of what must be done in order to succeed.

Table 2. Perspective on OI vs. recommendations to succeed

Perspectives on open innovation	What is recommended in order to succeed
The spatial perspective	Codification of information
	Information and communication systems
The structural perspective	Keep core competencies and outsource the rest
	Have partners at disposal
	Adjust organizational structure
The user perspective	Early integration of users in innovation process
	Tool kits
	Virtual platforms
The supplier perspective	Early integration of suppliers in innovation process
The leveraging perspective	Balancing internal and external knowledge
The process perspective	Building networks
	Act as knowledge brokers
	Creation of external business units
The tool perspective	Development and/or use of tools such as users' toolkits, networks and problem solving platforms
The institutional perspective	Licensing
	Open initiatives
	Train employees and install checkpoints
The cultural perspective	Acceptance of openness
	From DIY to NIH
	Integration of innovation mentality and support of innovation

It can be assumed what MNEs carry out in order to succeed in implementing OI is inherent to their intrinsic characteristics. Equally, what SMEs are likely to carry out in order to succeed in implementing OI is inherent to their intrinsic characteristics too. As a result, drawing from results of empirical studies on OI in MNEs, it is possible to theoretically elaborate on what features of OI are likely to be achieved by SMEs and what features are not. Thus, after defining what SMEs are in European Union, it is interesting to look at the differing characteristics that exist between MNEs and SMEs. This helps us to identify what the challenges to OI are for SMEs.

2.3 Open innovation in small and medium-sized enterprise (SME)

In Europe, SMEs represent the majority of all enterprises by 99%. There is no doubt that SMEs play a central role in the European economy. They are the main source of entrepreneurial skills, employment and innovation. In 2005, within the 25 EU countries, there are 23 million SMEs providing approximately 75 million jobs.

Among practitioners and scientist no doubt sustains under, which SMEs and MNEs conduct their business differently in several aspects. This is because differences exist in policy making procedures, structure and utilizations of resources (Ghobadian and Gallear, 1997). In an attempt to clarify and compile theories on SMEs and MNEs, Ghobadian and Gallear (1997) elaborate on a comparative table highlighting the major differences between both kinds of enterprises. Table 3, below, highlights the

factors that, according to us, are the most relevant concerning the opening up of the innovation process in SMEs. Ghobadian and Gallear (1997) original table is designed for analyzing total quality management (TQM) but it still has a general value in terms of analyzing other aspects, such as OI, in SMEs. Some non-relevant factors to study OI in SMEs have been excluded compared to the original table from Ghobadian and Gallear (1997).

Table 3. Comparison between SMEs and MNEs

	Small and medium sized organizations	Large organizations
Structure	Flat with few layers of management, Flexible structure and information flows, Normally rapid response to environmental changes.	Hierarchical with several layers of management, Rigid structure and information flows, Normally slow response to environmental changes.
Procedure	Activities and operations not governed by formal rules and procedures. Low degree of standardization and formalization, Flexible and adaptable processes.	Activities and operations governed by formal rules and procedures. High degree of standardization and formalization Rigid and unadaptable processes.
Behavior	Mostly organic, Fluid culture.	Mostly bureaucratic, Culture inertia.
Processes	Strategic process incremental and heuristic.	Strategic process generally deliberate and formal.
People	Individual creativity encouraged, Dominated by pioneers and entrepreneurs, Modest human capital, financial resources and know-how.	Individual creativity stifled, Dominated by professionals and technocrats, Ample human capital, financial resources and know-how.
Contact	Normally dependent on a small customer base.	Greater scope for an extended customer base.

Note: Inspired from "TQM and organization size" by Ghobadian, and Gallear, 1997, International Journal of Operations and Production Management, 17(2), 128-129.

It is generally recognized that SMEs have usually an organic structure. In this structure, the level of specialization, standardization and formalization is rather low, while loose and informal working relationships prevail (Ghobadian and Gallear, 1997 (see table 3)). Plus, in a changing environment, organic structures that promote innovativeness and/ or adaptive behavior are the key to survival to the new situation (Burns and Stalker, 1966).

SMEs organizational flat structure and fewer layers of management result in a more flexible and adaptable work environment. Owing to their size, SMEs are on the strategic apex run by a single manager (Ghobadian and Gallear, 1997; Zahra and Filatotchev, 2004). Consequently, the decision making process is centralized to the manager with the effect that the manager can be either the main catalyst for change or the main stumbling block to change. Plus, diffusion of information and communication process, are more efficient and less complex to manage and organize within flat structure.

Since SMEs' culture rely on a fewer amount of people, once the need for change has been recognized, cultural change is easier to attain than in MNEs (Ghobadian and Gallear, 1997). However, the need for change seems to be harder to recognize in SMEs. This is due to limited resources and external contacts that can warn managers for changes, as well as, the style of management, high time pressure on SMEs' manager shoulders, and lack of clear processes and procedures to react quickly. Nonetheless, SMEs are result-oriented, which is a valuable trigger for attaining cultural change (Ghobadian and Gallear, 1997; Welsh and White, 1981).

Managers in SMEs are responsible for many facets of the enterprise and many decisions. As a result, the planning process is not formal. This implies that multi-functional planning arises within the mind of individuals. This subconsciously stimulates creativity among SMEs workers since no formal process exists and all doors remain opened (Ghobadian and Gallear, 1997). SMEs also regroup pioneers and entrepreneurs.

A major pitfall for SMEs is resources scarceness. SMEs suffer from an important lack of human capital, financial resources and know-how (Welsh and White, 1981; Ghobadian and Gallear, 1997; Caloghirou et al., 2004). Additionally, SMEs have a limited customer and supplier base, which both increases their bargaining power over enterprises. Nonetheless, this limited base allows SMEs to focus more intensively on their customers and suppliers needs (Ghobadian and Gallear, 1997).

2.4 Relating the nine perspectives of OI to the SME context

The description of MNEs and SMEs inherent characteristics show us the main differences existing between them. Combining OI practices in MNEs and differing characteristics between MNEs and SMEs, allow us to extrapolate on how challenging it can be for SMEs to sustain OI. Consequently, we present the results of this extrapolation. Some of our extrapolations are supported by previous studies on certain angles of OI in SMEs. Due to a lack of research on OI in SMEs, other ones only rely on inherent characteristics of SMEs. This analysis sheds light on the potential barriers to sustain OI that SMEs might suffer from, because of their inherent characteristics (for a more detailed approach, please refer to Dufour and Son, 2011).

The spatial perspective: SMEs activities and operations are governed by informal and loose procedures. Consequently, SMEs' environment is characterized as having a high degree of tacit knowledge (Teece, 2000). This organizational characteristic is recognized as being an issue to interact with external environment (van de Vrande et al., 2009), because, in order to be exchanged efficiently, information needs to be codified (Hacievliyagil and Auger, 2010). To transform tacit knowledge into codified

knowledge requires human intervention and knowledge on how to codify information through, for example, knowledge management systems. Although, based on Ghobadian and Gallear (1997) study, SMEs have limited human resource to be allocated to and know how to embrace this change. This can inherently result into the emergence of a potential knowledge management system barrier (Ramos et al., 2009).

The structural perspective: SMEs are already acquainted with identifying their core competencies and outsourcing some R&D activities (van de Vrande et al., 2009; Rundquist and Halila, 2010). Plus, SMEs are already heavily committed in collaborating through forming alliance to share risks, gather complementary competencies and create synergies (Lee et al., 2010). Nevertheless, SMEs are recommended to adapt their organizational structure in order to sustain OI (Hacievliyagil and Auger, 2010). Adapting their structure allow SMEs to avoid a potential barrier (van de Vrande et al., 2009). SMEs, as described by Ghobadian and Gallear (1997), have flat and organic structure. This is a plus point for SMEs to adapt their organizational structure. Indeed, this kind of structure allows flexible and adaptable work environment, which is of great support to adjust organizational structure required to open up the innovation process. Moreover, organic structure is recommended in a changing environment because it promotes innovativeness and/or adaptive behavior (Ghobadian and Gallear, 1997). However, adapting organizational structure remains a challenge that has to be overcome by SMEs in order to implement OI successfully.

The user perspective: integrating users in the network is a popular practice among SMEs (van de Vrande et al., 2009). The flat structure present in SMEs, as well as, the organic structure facilitates the early integration of users, due to their high level of flexibility (Ghobadian and Gallear, 1997; Lee et al., 2010). However, SMEs are not willing to integrate users by using similar toolkits and internet platforms as MNEs due to the investment it represents (Ramos et al., 2009). Consequently, by having incremental, heuristic process, encouraging individual creativity and promoting entrepreneurial behavior, SMEs manage to develop practices to integrate users that are unstructured and informal, and; thus, do not require massive investment (van de Vrande et al., 2009). SMEs can afford to interact with users in such a manner because they have small customer base.

The supplier perspective: as Gassmann et al. (2010) notice, this perspective has not been deeply investigated. Nonetheless, SMEs must enable supplier's early integration in their network, because it positively affects the innovation process (Gassmann, 2006). It has been argued in the user perspective that SMEs have positive features to integrate external partners; thus, by extension suppliers, as well. Based on SMEs relative small size, the proposition can be made that they have relative small supplier base. Implicitly, a second proposition can be made that SMEs can develop similar practices to integrate suppliers as the one used to integrate users i.e. unstructured and informal.

The Leveraging perspective: SMEs due to their lack of resources have always been forced to look for collaboration with other organizations in order to access lacking technologies and combine them with theirs (Ramos et al., 2009). Consequently, SMEs are used to scanning their environment in quest for missing technology and are used to not relying only on their internal R&D (Spithoven, et al., 2010). Thanks to flexible, adaptable, incremental and heuristic processes, SMEs are likely to be able to adjust their processes (such as knowledge management systems) to external findings in order to leverage their internal technologies and vice-versa. Encouraged individual creativity may also lead to find novel ways for combining external and internal technologies. This is supported by van de Vrande et al. (2009) who found that SMEs rely on initiatives of their employees.

The Process perspective: both inside-out and outside-in processes require the

building of networks to either internalize or externalize technologies. In spite of few contacts due to their small size and little number of employees, SMEs access additional networks through collaborative networks (Aguero and Sanchez, 2010). The outside-in process is carried out in MNEs through knowledge brokers. SMEs cannot afford knowledge brokers because of a lack of financial and human resources (Ramos et al., 2009). Moreover, SMEs small customer base leads to less feedback than with large customer base. Inside-out process is likely to happen in SMEs. Pioneering and entrepreneurial firms need to sell their finding in order to enlarge their resources pool. Unlike MNEs, SMEs are not able to create external business unit in order to develop and promote their finding because of a lack of resources (van de Vrande et al., 2009).

The Tool perspective: due to their lack of resources, SMEs cannot afford the utilization of existing tools, such as, knowledge management systems and crowdsourcing platforms (Ramos et al., 2009). It is even less likely that they develop their own platforms. Moreover, SMEs have small networks to help them.

The Institutional perspective: SMEs being pioneering and entrepreneurial firms are likely to be willing to license out technologies in order to earn money and thus enlarge their resources pool. However, licensing technologies requires prior financial investment, which few SMEs are able to afford (Van de Vrande et al., 2009; Bianchi et al., 2010). Another means of revealing technologies is to freely reveal it through open initiatives. SMEs might not want to reveal their discoveries because of the risk of losing their inherent rents. However, Harhoff et al. (2003) argue that purposeful divulgation of discoveries leads to enhancing technology and making innovation more efficient, which increases ulterior rents. To do so, SMEs must know what to disclose and what not to disclose by training their employees. Unfortunately, SMEs employees are used to dealing with informal rules and procedures. Training them to formal rules and procedures would require significant resources involvement. Moreover, training is not part of the average cultural mindset of SMEs (Mogollon et al., 2010).

The Cultural perspective: cultural mindset of SMEs is one of the main elements hindering open innovation implementation. Van de Vrande et al. (2009) identify cultural issues as one of the principal barriers to open innovation. Because SMEs are entrepreneurial firms, founders are likely to be willing to keep control on their firm and be reluctant to disclose information about their discoveries. Consequently, accepting openness is peculiarly difficult when founders are still taking part in the business (Mogollon et al., 2010) and so could become a barrier to openness.

This analysis identifies the main organizational and managerial challenges SMEs may face and have to sort out in their journey from closed to open innovation. As a result, SMEs are recommended to take up those challenges to sustain their transformation. Consequently, if not seriously managed, those challenges can turn into barriers to open innovation. In accordance with previous study, those possible barriers to OI can be clustered into four dimensions: corporate culture management, networking, organizational structure and knowledge management systems (van de Vrande et al., 2009; Ramos et al., 2009; Mogollon et al., 2010; Lee et al., 2010).

3 Reference framework

This section describes the reference framework used in order to collect and interpret empirical data gathered through a single in depth case study. This reference framework consists of both organizational change theory and open innovation research. Moreover, parts of this reference framework are based on Chiaroni et al. (2010) study. This study presents important similarities to ours and was completed successfully.

3.1 Organizational change

The journey from closed to open innovation presents forms of organizational change. Chiaroni et al. (2010) demonstrate that this journey in MNEs and organizational change look alike thanks to four elements. Firstly, like organizational change, implementation of OI engages variation in both modes of action and cognition to make the most of external and internal possibilities. Secondly, cultural evolution from do-it-yourself mindset to not-invented-here mindset presents the same resistance to change as for organizational change. Thirdly, new routines must be established in both OI implementation and organizational change. Finally, like in organizational change, organizations implementing OI must go through a progressive trial and error process in order to establish their new environment.

The four elements of OI implementation described above apply to MNEs, as well as, SMEs. As a result, organizational change theory is an applicable method for studying OI implementation in SMEs and the potential barriers related to it.

One of the most famous organizational change models consists of three phases-unfreezing, moving, institutionalizing-and was developed by Lewin (1951). In order to have a more holistic view of each phase, we use Kotter (1996) that divides each phase in different stages. The first phase consists of establishing a sense of urgency, creating a guiding coalition to lead change, developing and communicating a vision. The second phase is aimed at empowering others to act and producing short-term wins. The third and last phase involves consolidating gains and anchoring the new culture.

Lewin's (1951) model consisting of three phases makes the organizational change easy to follow-starting point, moving phase and arrival-and so more reliable, as suggested by Chiaroni at al. (2010).

3.2 Barriers to OI implementation in SMEs

Understanding OI implementation requires identifying barriers that could hinder the journey from closed to open innovation. Our literature review identifies four potential barriers: corporate culture, networking, organizational structure and knowledge management systems. Those potential barriers to OI implementation, once known and mastered, can be utilized by managers to positively affect the journey from closed to open innovation. As Chiaroni et al. (2010, p. 225) put it: "they could also indeed be conceived as managerial levers on which a company can intervene to streamline its journey toward open innovation" .

Corporate culture. As demonstrated earlier, corporate culture in SMEs might hinder OI implementation. This is supported by Chesbrough and Crowther (2006) and van de Vrande et al. (2009). In SMEs, the cultural problem lies at the acceptance of openness (Mogollon et al., 2010). Once the acceptance of openness has occurred, cultural change in SMEs can be achieved relatively smoothly. Resistance to new culture acceptance in SMEs resides in their inherent characteristics (see table 3). Due to limited resources and external contacts, management style, high time pressure on SMEs' manager and lack of clear processes and procedures to react quickly, SMEs managers can miss warnings for change (Ghobadian and Gallear, 1997). Ghobadian and Gallear (1997) add that several factors can influence the culture of an organization i.e. education and training, employee participation programs, enhanced communication programs, revision of procedures and policies, modification of evaluation and reward system and behavior of top managers. One or more of these factors might be used by SMEs during their journey from close to open innovation.

Moreover, once the acceptance stage is reached, it is possible to plan cultural change. Senior and Swailes (2010, pp. 130-131) propose five steps towards cultural change that are the most widely accepted by scholars: "(i) assess the current situation, (ii) have some idea of what the aimed-for situation looks like; (iii) work out the what and how of moving the organization, or part of it, away from its current culture to what is perceived to be a more desirable one; (iv) intervene to bring about cultural change; and (v) monitor outcomes and adjust as needed".

Networking. As previously stated, SMEs have limited human resources, customers and suppliers base at disposal; consequently a rather limited network. A first step to overcome this issue is moving employees' network from an individual level to an organizational level (Chesbrough, 2003). But since, OI relies on the establishment of extensive networking; it is relevant for SMEs to find out additional ways to increase their network. In an attempt to enhance this issue, academics recommend SMEs to form inter-organizational relationship with universities and research centers (Ramos et al., 2009; Spithoven et al., 2010). Ramos et al. (2009) and Spithoven (2010) argue that both universities and research centers can act as knowledge brokers for SMEs by developing adapted information and communication tools and gathering a relevant amount of SMEs within research centers. Thus, by taking part into such activities SMEs can enlarge their network.

Laursen and Salter (2006) elaborated two variables allowing a company network to be measured in term of breadth i.e. the number of external sources or search channels that firms rely on, and depth i.e. the extent to which firms draw deeply from the different external sources or search channels. Firms using an open search strategy are more innovative than others (Chesbrough, 2003; Laursen and Salter, 2006), but open search strategy is costly (Cantner et al., 2009; Laursen and Salter, 2006). At a certain point openness, in terms of breadth and depth, can negatively influence innovation performance (Ibid.); Cantner et al. (2009) empirically demonstrate the inverted U-shape of network's breadth/depth and firms' innovative capacity. As a result, using too many external sources and search channels are time consuming, laborious and too expensive compared to resulting benefits (Cantner et al., 2009).

Organizational structure. Managing externally collected technology requires SMEs to adapt their organizational structure (Hacievliyagil and Auger, 2010). Even if SMEs possess favorable characteristics in order to adapt their organizational structure, this remains a challenge they must overcome in order to implement OI successfully. To do so, SMEs must increase their absorptive capacity; that is, the ability of recognizing valuable external technologies and to appropriate these external technologies. This can be done through technology intermediation (Spithoven et.al., 2010). However, technology intermediation in the case of SMEs is still a fuzzy concept. According to Spithoven et al. (2010), SMEs might require help from third parties in order to scan the market for new technologies and absorb them. These third parties can be, for instance, collective research centers where SMEs share R&D equipment, knowledge and knowledge on how to appropriate technologies. Furthermore, where SMEs do not have sufficient resources to afford knowledge brokers and crowdsourcing platforms, Ramos et al. (2009) propose that these roles are taken up by universities in order to help SMEs developing. Naturally, this also requires SMEs to have efficient knowledge management system (Hacievliyagil and Auger, 2010); this is discussed in the next section.

Knowledge management systems (KMS). It is acknowledged that SMEs cannot afford information and communication technology platforms as MNEs do (Nunes et al., 2006; Ramos et al., 2009). In a closed innovation perspective the need for KMS is mostly denied by managers (Nunes et al., 2006). There exist various explanations for this behavior. SMEs are acquainted with sharing information through informal

approaches (Ghobadian and Gallear 1997)-so called "between two ears" talks (Nunes et al., 2006). Plus, it is a long term investment and return on it is difficult to be obtained. As a result, developing KMS in a closed environment is not predominant (Nunes et al., 2006). Nevertheless, in an open innovation perspective, the need for KMS is more predominant since inter actions exist between organizations. Theorists acknowledge that OI enhances competiveness and innovativeness (Chesbrough 2003; Nunes et al., 2006). Thus, return on investment on KMS for SMEs managers engaged in OI is more tangible. Consequently, it helps managers implement KMS in SMEs.

Consequently, the establishment of knowledge management systems is more likely to be implemented in SMEs engaging in the journey from closed to open innovation (Gassmann et al., 2010). Nunes et al. (2006, p. 106) define KMS as "the process of critically managing knowledge to meet existing needs, to identify and exploit existing and acquired knowledge assets and artefacts and to develop new knowledge in order to take advantage of new opportunities and challenges" . Thus, KMS is relevant for opening up SMEs innovation process since OI is about leveraging internal and external knowledge flows to enhance a firm's innovativeness (Chesbrough, 2003).

Once SMEs have acknowledged the relevance of KMS in their journey from closed to open innovation, SMEs develops adapted information and communication technology (ICT) platform (Schubert and Leimstoll, 2008). It consists of transforming explicit and tacit knowledge-types of knowledge present in SMEs-into codified ones that are further shared through ICT platform. Depending on SMEs complexity, goals and objectives, this transformation may require training, benchmarking, sophisticated information technology and a base of trust (Nunes et al., 2006).

4 Method and data collection

The overall research design chosen for the empirical investigation is a case study (Yin, 2003). Firstly, the case study research design, using a qualitative research method, allows for having a more descriptive approach than a quantitative research method (Bryman and Bell, 2007). Thanks to qualitative method, questions, such as, "how and why" rather than "how much", as in a quantitative research method, are answered (Bryman and Bell, 2007; Yin, 2003). Secondly, case-study empirical material can be gathered through interviews, documents, artefacts and observations. Observation is not an exclusive condition when conducting a case-study (Yin, 2003). Thirdly, a case-study allows for a focus on contemporary events (Ibid.). Moreover, as advocated by many researchers, case study research is an efficient method for constructing a rich understanding of complex phenomena (Eisenhardt and Graebner, 2007). In particular, a single-case study design is chosen. This allows us to have an in-depth study of a unique critical case (Yin, 2003).

In order to find this SME, we first browsed the internet and looked for hints of open innovation in SMEs' history. We contacted some SMEs in order to verify whether they recognized some open activities in their innovation process. Not many SMEs recognized this openness. Later on, Björn Remneland-Wikhamn (project leader at openinnovationgbg.se-a blog for the open innovation platform run by researchers from Gothenburg University), during a personal discussion, advised us: "go to any SME and describe the theories and techniques; most probably you will find that some aspects are in place already in the companies"; we did so and utilized Lichtenthaler (2008) Likert-scale questionnaire to measure the extent to which companies were open.

Qualitative study is about trustworthiness rather than truth or value as in quantitative study; implying that method must be transparent and verifiable (Sandelowski, 1993). Consequently, reliability and validity of our study are briefly discussed hereinafter.

Data collection was carried out, firstly, through face-to face interviews. We started by a contact interview where we allowed the interviewee to tell a free story about how they run their product development in order to make sure they were a good case for us. Then, we asked each interviewee separately to talk and tell us their story, tell us if their way of innovating had changed. After that, the interviews were carried out through a semi-structured interview guide inquiring with whom and how they collaborate. During the interviews, the focus was put on our reference framework (corporate culture, networking, organizational structure, knowledge management systems). Secondly, we gathered further information in the company's annual reports in order to cross-check previously collected data (Yin, 2003). All interviews lasted between 30 minutes and one hour; they were recorded and transcribed; a data base was built (Ibid.). E-mail and telephone conversations allowed us to gather missing information. In sum, in order to increase reliability, we collected data through different data collection techniques until it became to be redundant (Bryman and Bell, 2007). In order to increase validity, we triangulated data sources and data collection techniques (Voss et al., 2002) which allowed us to cross-check gathered data. We cross-checked data by confronting all interviews, website information, and annual report information. Firstly, we conceptualized all data based on the four potential barriers. Secondly, within each potential barriers, we conceptualized all data based on Lewin's (1951) organizational change stages. This cross-checking resulted in the creation of the conceptualized table that can be found in appendix I.

5 Case description

Previously, the company produced electrical equipment. About 50 years ago, a manager spotted a product need in the sports market; he went to his boss and asked him to produce this sports equipment. Within a couple of year, he developed this equipment, which was first used at some competitions in Sweden. This product has been a success since then and the sports equipment division of the company split up from the rest of the company. From then on, the company produces the same sports equipment in close collaboration with its users, customers and suppliers in order to innovate and improve the equipment.

Today, the company evolves in the sport equipment industry. More precisely, the company develops weightlifting material, such as, barbells, dumbbells, and weights. The company is located in Sweden and sells its products all around the world; it has a branch in the USA. The company works under a flat structure where decisional power is spread through the CEO and key managers. Moreover, participation to idea generation is encouraged throughout the whole company. The company employs 47 people (based on the 2010 Annual Report) and is composed of eight departments i.e. sales export, sales Scandinavia, sales education, service, marketing, administration and financial, production and logistics, and product development. The company's turnover is SEK 86,569,000 (based on the 2010 Annual Report).

6 Analysis and results

As previously stated, data collected from interviews have been conceptualized in a table according to our reference framework-see appendix I. The studied company, before undertaking the organizational change process, to some extent already gathered complementary technologies from outside, but did not make this outside-in process a strategic asset to develop its products. Consequently, its network, structure and KMS were not adapted to sustain open innovation.

The analysis of each potential barrier is structured following the three different stages-unfreezing, moving, institutionalizing-the company has undergone during the change process.

6.1 Corporate culture

The company started its current activity in sports equipment from a market need. Soon, the company realized that customers and users opinions are a necessity to develop and perpetuate its activity. This feeling of necessity facilitated the awareness of openness importance towards external actors. In other words, necessity in this case is the trigger that helps to avoid the pitfall of acceptance of openness (Mogollon et al., 2010). Equally, the company was aware that it must work hand in hand with suppliers. The product development manager recognizes that they (in the company) know "a little of many things but not the details". Realizing the relevance and importance of the outside-in process (Gassmann and Enkel, 2004) in this case relates to the first phase of cultural change. State of urgency (Kotter, 1996) is created thanks to the feeling of necessity of seeking out technologies outside the organization.

This awareness and acceptance of openness is materialized by the CEO who creates an open climate. The CEO promotes and encourages openness inside and towards the outside of the company. By encouraging employees to hunt for technologies outside the company, the CEO promotes open innovation. Essentially, the CEO shows the way to openness; he integrates employees to decision process, which motivates them; he gives them the means to be open towards the outside through passing his open view-transparency, openness and careful listening to customers-onto them. These crucial steps permit a smooth integration (Ghobadian and Gallear, 1997; Senior and Swailes, 2010) of open mindset-not-invented-here-in the corporate culture. Moreover, the moving phase of corporate culture is made possible through different means. Firstly, the company stimulates visits at exhibitions, conferences, and competitions that permit its employees to gather technologies through face-to-face open dialog with users and customers. Secondly, the company encourages the use of the internet (e.g. Facebook) in order to additionally gather technologies from their customers. Finally, working hand in hand with suppliers is encouraged. This highlights that the company develops means to seek out technologies outside their boundaries and so they become engaged into open innovation activities (Gassmann and Enkel, 2004; Enkel et al., 2009).

In order to anchor open innovation in the company-institutionalizing (Lewin, 1951), the company made openness a strategic asset within and towards the outside of the company. Consequently, the outside-in process is a strategic asset of the company to sustain its competitive advantage (Chesbrough, 2003). In addition of its own ideas, the company scans the market for collecting ideas and needs from customers in order to develop its products. The company meets its users and customers at conferences, exhibitions and competitions; treats its customers as experts and listens to them carefully; completes its information collection and suggestions receipt through the internet [e.g. Facebook (Dufour and Son, 2011)]; and solicits users' and customers' help for product testing. Further in the product development, the company integrates the suppliers. The company shares technology gained from their users and customers with their suppliers in order to innovate hand in hand with them. Furthermore, the company often collaborates with university students and professors for product development. In substance, the company has institutionalized the cultural mindset required in order to sustain outside-in process of open innovation.

In sum, to overcome the potential cultural barrier, the CEO plays a crucial role in terms of creating awareness and instilling the cultural mindset required to sustain open innovation.

6.2 Networking

Once the company had institutionalized the cultural mindset required in order to sustain OI, it had to strive for developing its network (Chesbrough, 2003). The company was aware that having experts at its disposal sustains and enhances firm performance and compensates for a low number of employees. For them, it is a necessity to have experts to help getting work done. Moreover, the company recognized that a network consisting of suppliers, product users and field experts brings in priceless know-how. The product manager says: "the customers have been using the products; they know how the products are supposed to work". Thus, the company is aware that they have in-house knowledge/experts, but in a rather limited number due to its size, and; consequently, these external actors, such as, suppliers, product users and field experts can bring additional technologies to develop products (Chesbrough, 2003; Laursen and Salter, 2006). The company balances the in-house know-how with out-house ones. The company is aware that its best chance to sustain OI is to balance traditional business strategy with open initiatives (Chesbrough and Appleyard, 2007; Chiaroni et al., 2010; Enkel et al., 2009; Pontiskoski and Asakawa, 2009).

In this OI context, once the necessity of enlarging network was recognized, the company took various initiatives to get rid of the networking obstacle (Kotter, 1996). The company's first initiative was to look up among their employees' contacts, and pick up the relevant ones. The company took the CEO and employees' personal networks and moved it to organizational level (Chesbrough, 2003). The company's second initiative was to make the most of product users' and field experts' network to keep this enlarged network growing organically. As a result, the company can directly and/or indirectly benefit from knowledgeable users' networks. The company's third initiative was to have a high rate presence at exhibitions, conferences and competitions, which are places to be in order to enlarge existing networks. The company's fourth and last, initiative was to be present on a platform where questions/answers and suggestions can be exchanged between the company and their customers/users. Consequently, the company created a Facebook page to interact with even more people cost-less (Caloghirou et al., 2004; Ghobadian and Gallear, 1997; Welsh and White, 1981).

Today, one can say that the company succeeded and still succeeds at forming inter-organizational and inter-personal networks that they use so as to enhance their products development. The company has good, long lasting relationships with its suppliers, users and other institutions that can jump anytime into projects if needed (Pontiskoski and Asakawa, 2009). Moreover, the CEO says: "so it is suppliers, users, consultancy, Facebook and then you have employees in the company, so it is a catalogue of people that we use". Through this extended network, the company has built a rather stable network wherein they collect feedback, opinions and suggestions.

In sum, the company is aware that networking brings competitive know-how. To overcome the potential networking barrier, the company aims at refining its network in order to enhance quality through the creation of a valuable list of partners from, which it gathers in additional technology. Accordingly, the company develops its network in order to sustain the outside-in process of open innovation.

6.3 Organizational structure

OI cultural mindset and networking are to be supported by organizational structures that allow the company to absorb external technology and manage it efficiently in-house (Spithoven et al., 2010). Some years ago, the company realized that it should adapt its organizational structure (Hacievliyagil and Auger, 2010) in order to achieve more efficiency and clarity in product development. Up to then, their product

development was carried out "ad hoc" by random people in the organization. Consequently, the company was aware that it needed to adapt its structure in order to centralize all those random technologies existing within and outside the company (Ibid.). The company also realized that product development was a crucial element in order to sustain, consolidate and improve their position on the market (Chesbrough, 2003); the CEO says: "the embryo for that (keeping market position) is of course product development to design the right product. So it is important".

The company enabled itself to support outside-in practices through network's technology absorption; that required creating distinct departments of, which the product development department is the most important one for product innovation and improvement. In effect, creating this department was done through hiring a technical engineer who could centralize and handle technologies coming from other departments and networks (Spithoven et al., 2010); hence, this new department in the company aims at enhancing product development.

As a result of actions taken by the company, the product development department now exists and is run by a knowledgeable, skillful, experienced technical engineer. Now the company contains all departments needed to sustain OI through the outside-in process and grow in its industry. In addition, the different departments, but specifically the product development department, will be filled with more knowledgeable employees; the product development manager says: "I would like to hire more people because I see there are lots of things to do with product development".

In sum, the company is aware that product development is a crucial factor to consolidate its market position. To overcome the potential structural barrier; the company adapts its structure. By doing so, the company efficiently centralizes technologies to benefit from them so as to develop its products. By centralizing in- and out-house technologies, the company efficiently balances and leverages internal technologies with external ones.

6.4 Knowledge management systems

In an OI environment, it is acknowledged that KMS is relevant to identify, exploit and defend existing and acquired technologies (Chesbrough, 2003; Gassmann et al., 2010). In our case, the product development manager acknowledges: "I would like to click on a file and get all the steps in front of me. That would really be good to have all that documents". The company realizes that documenting disparate technologies into structured forms and reports can enhance technology flows within and outside the company; it helps ensuring that no technology is omitted. Moreover, the company is yet aware that risk of crucial technology disclosure is embedded in OI (Harhoff et al. 2003; Hacievliyagil and Auger, 2010) and so that KMS, through confidential agreement and IP protection, can also prevent technology from being stolen. Likewise, the company is aware that not patented products could be copied by others. So state of urgency (Kotter, 1996) is created by the necessity of documenting disparate technology and risks of loss of technology linked to OI (Harhoff et al. 2003; Hacievliyagil and Auger, 2010). This led the company to unfreeze the situation (Lewin, 1951) and to undergo some moves to overcome any previously cited issues.

Once the relevance of KMS has been acknowledged by the company, means can be undertaken to set it up (Schubert and Leimstoll, 2008). In order to enhance technology flows within and outside the company, an engineer was hired to run the product development department. He gathers all data related to product development and has started to digitalize technology collected here and there. He is the central person; other departments (marketing, sales, and education) that also receive and gather technology about products all report to him. The sales manager says: "they (sales

forces) bring all feedback from others to others to the product development manager"; equally the marketing manager says: "if someone hears something somewhere that is wrong or wishes from the customers, they go to the product development manager". Thus, the company has started the process of critically managing technology (Nunes et al., 2006) from rather informal procedures to more formalized ones. Moreover, the company created a confidential agreement form to be used when launching collaborative product development with suppliers. Likewise, the company takes advantage of Facebook to receive suggestions and gather technologies in a more formalized procedure and, in some cases, it writes down formal reports after meetings with suppliers. Nevertheless, due to the company's size and the nature of exchanged technology, structured reports and IP management are still far from being routine. Consequently, it can be said that KMS has not been institutionalized yet (Lewin, 1951), which means that the company can yet increase its degree of OI.

So far, the company still finds it manageable to have rather informal procedures even though some steps have been undertaken to prevent KMS from being a barrier (Lee et al., 2010; Mogollon et al., 2010; Ramos et al., 2009; van de Vrande et al., 2009) for the company's future and expanding activities. Consequently, this part is discussed further in the managerial implication section.

7 Conclusions and discussion

The purpose of this article is to answer the following research question: "How do SMEs try to overcome the organizational and cultural barriers when evolving from closed to open innovation?" In order to answer the research question an in-depth case study involving an SME active in mature sports equipment industry has been carried out. SMEs are usually committed in collaborating through forming alliances to share risks, gather complementary competencies and create synergies (Lee et al., 2010). OI takes place in an open business environment but an open business environment is not always OI (Chesbrough, 2007). Consequently, even though SMEs evolve more often in an open environment, they need to undertake changes so as to sustain OI. In order to cope with increasing products and technologies complexity, SMEs engaged in OI purposely collaborate openly with users/suppliers/partners to innovate and to remain competitive. Thanks to our analysis the following conclusions are drawn.

To overcome the four potential barriers-corporate culture, networking, organizational structure, and KMS-the studied SME has taken various measures. First, The CEO plays a key role in preventing the corporate cultural barrier. The CEO creates awareness and instills the cultural mindset required to sustain OI by making openness a strategic asset within and towards the outside of the SME. This finding is in line with Ghobadian and Gallear (1997) argue that managers in SMEs are responsible for the many facets of the enterprise and many decisions. As a result, the CEO is the main catalyst for overcoming the cultural barrier. Second, integrating users, suppliers, and partners in a network is a popular practice among SMEs (Gassmann, 2006; van de Vrande et al., 2009). This integration is facilitated by SMEs' organic structure (Ghobadian and Gallear, 1997; Lee et al., 2010). Nonetheless, in order to prevent the networking barrier, the SME aims at refining its network to enhance quality through the creation of a valuable list of partners from, which it gathers in additional technology. This result goes along with Pontiskoski and Asakawa (2009) who recommend having a good, long lasting relationship with its suppliers, users and other institutions that can jump anytime into projects if needed. Third, product development is a crucial factor for the SME. In order to overcome the organizational structural barrier, the SME created a product development department that integrates and handles technologies received through its network. This matches Hacievliyagil and

Auger (2010) and Spithoven et al. (2010) who argue that structural adaptation allows the company to absorb external technologies and manage them efficiently in-house. Fourth, the SME has started the process of critically managing technology (Nunes et al., 2006) from rather informal procedures to more formalized ones. However, due to the SME's size, small customers', suppliers' and partners' base, and the nature of exchanged technology, structured reports and IP management are still far from being routine. This result is supported by van de Vrande et al. (2009) who claim that SMEs develop practices to interact with users, suppliers and partners in unstructured and informal manners.

Based on our conclusion, we claim that the SME is involved into OI to some extent, mainly in the outside-in processes. The SME taps into knowledge of users/suppliers/partners outside its company's boundaries to complement its internal knowledge. The SME balances internal and external R&D. The SME takes advantage of users/suppliers/partners technologies. The SME carefully plans its business model by making OI a strategic asset. The SME balances internal and external technologies.

Nevertheless, the SME has not taken advantage of the inside-out perspective and others´ use of its IP yet, as well as, not taken advantage of others' IP. The latter does not disqualify the SME from being engaged into OI. Since Chesbrough et al. (2006) OI definition remains vague and wide and that Gassmann and Enkel (2004) argue that OI exists through three different processes, we claim that OI can take different forms and can appear at several degrees within an OI holistic view. We also claim that even though several degrees of OI can exist, it remains essential to carry out research considering all aspects of OI, as we did in this study. This is further discussed in the last section. In addition, we argue that the manner the SME implements OI is inherent to its intrinsic characteristics. However, for the sake of the SME, managerial implications are developed in the following section providing recommendations to improve the ways the SME sustains OI and balances OI to a relevant level.

7.1 Managerial implications

The studied SME has a strong market position. It can be said that this strong market position has been enhanced thanks to OI, which goes along with previous studies (e.g. Chesbrough, 2003). Consequently, the SME is recommended to nurture its approach to OI. Meanwhile, Enkel et al. (2009, p. 312) argue that "too much openness can negatively impact companies' long-term innovation success, because it could lead to loss of control and core competences". However, we believe that the SME must not be afraid to engage itself into more OI practices since it possesses confidential agreement on its core competence and has a strong brand image, which is difficult to usurp. Following, few recommendations are made.

Firstly, the SME realized that its network-users, suppliers, and partners-is its primary source of innovative ideas. Nevertheless, the SME needs to bear in mind previous research on the extent to which a firm is recommended to rely on its network. By using open search strategy, the SME will remain more innovative than others, but open search strategy is costly. Consequently, at a certain point openness can negatively influence the SME's innovation performance. As a result, relying too much on external sources and search channels is time consuming, laborious and too expensive compared to resulting benefits for the SME.

Secondly, as previously stated, the SME has not fully developed its KMS yet. In order to get the most of its interaction with its network, the SME is advised to formalize its procedures. So far, the SME formalized the manner it centralizes gathered in technologies. But the procedure to gather technology from network is recommended to be formalized for various reasons. For instance, it helps to ensure that no information is missed and/or disregarded, it helps to enhance the flow of gathered-in

technologies and it helps to keep structured traces of gained technologies. This can be done by developing semi-structured forms where most frequently debated topics are stated, but it remains primordial in an OI approach to leave space for network to express itself. Moreover, in order to protect its innovation works, the SME is advised to systematically have recourse to confidential agreement with its suppliers on the one hand. On the other hand, the SME is recommended to train its field employees what can be disclosed to users, customers and partners and what cannot be disclosed.

Thirdly, and based on the abovementioned recommendation, an OI approach can be differentiated between the SME departments. Since different departments-e.g. marketing department VS product development department-have different goals and deliverables, it seems accurate to adopt suited approaches to OI. For instance, the product development department could have its own tool to integrate further its network in product development. The idea would be to provide the network with a tool allowing it to freely think/reflect on how it would prefer sports equipment to look like. Likewise, the marketing department could ask users how they like their sports equipment and promote the SME's sports equipment through users' stories. Nonetheless, the SME has to bear in mind that too formalized approaches would decrease the benefits of OI. This paragraph presented some hints on how to nurture OI; however, these hints are neither exclusive nor exhaustive, so the SME is recommended to use its creativity to develop additional ideas to nurture its OI approach.

Finally, the SME is engaged in outside-in process, which is one of the three processes of OI. The outside-in process mainly consists of seeking out technologies outside of the organization. Another process of OI, called inside-out process, consists of selling out technologies. Basically, the SME, if engaged in inside-out process, would sell its know-how in order to enlarge its resources pool. As a remark, the last process of OI consists of combining outside-in and inside-out process, namely coupled process.

7.2 Discussion and future research

Based on our analysis and results and conclusion, we claim that some interesting angles could be further investigated through future research.

Firstly, a quantitative study based on our results would be useful to confirm our research outcomes. The quantitative study would apply to a large sample and test whether the different means to overcome organizational and cultural barriers when evolving from closed to open innovation found in this paper can be generalized. Then, we may see trends arising and consequently build some roadmap for SMEs to overcome organizational and cultural barriers when evolving from closed to open innovation.

Secondly, as we can see in the previous sections, the SME is involved into OI. But, as claimed in this paper, the SME can still nurture its OI approach. For example, the SME has a clear network project initiative and even to some extent uses its network in its product development; but, the product development department could have its own tool to integrate further its network in product development. Moreover, the SME is engaged in the outside-in process of OI; in the future, the SME could take more advantage of the inside-out process of OI.

According to us, this makes it relevant to discuss the degree of OI that can exist between extremely closed innovative companies and extremely open innovative companies, since we claim that companies can evolve between those two extremes. In order to measure the degree of OI, academics have to determine relevant criteria. For instance, Laursen and Salter (2006) elaborated two variables allowing a company network to be measured in term of breadth/depth. Moreover, Lichtenthaler (2008) developed a seven points Likert-type scale to measure firm's degree of openness.

Furthermore, this research would require refining Chesbrough et al.'s (2006) definition of OI, because it is vague and wide, and, as a consequence, allows too much interpretation. These two models combined with a refined definition of OI would give avenues for this research. This research could use quantitative research strategy applying developed criteria to a large sample of companies.

Thirdly, in our analysis, we could identify that the SME formalized some procedures, which is required to gather in technology efficiently. One could wonder whether over-formalization would hinder OI performance since OI stresses the importance of a certain level of laissez-faire. Consequently, research could be carried out on the degree of formalization and its influences on OI performance. This research would require quantitative research strategy applying the concepts of degree of formalization and OI performance to a large sample of companies. A similar study on 164 large Spanish firms has been carried out by Pertusa-Ortega et al. (2010) on the degree of formalization and knowledge performance, but no empirical evidence was found to support this hypothesis. In sum, due to the recent nature of this study and our research proposal, a literature gap in the degree of formalization and its influences on knowledge management is highlighted.

Fourthly, as we emphasize in our conclusion and as Ghobadian and Gallear (1997) state, the CEO in SMEs is responsible for the many facets of the enterprise and many decisions. Consequently, in SMEs the CEO can be either the main catalyst for change or the main stumbling block to change. Moreover, SMEs are dominated by pioneers and entrepreneurs. As Heirman and Clarysse (2004) argue pioneers' and entrepreneurs' values, goals, and skills shape their willingness to keep control over their SMEs. Likewise, Enkel et al. (2009) argue that the more a firm is engaged in OI, the more the risk of losing control over firm increases. As a result, this makes it relevant to us to study the influence that CEOs' willingness to keep control over their SMEs has on the extent to which CEOs are willing to engage into OI.

Fifthly, our study allows understanding on how SMEs try to overcome the organizational and cultural barriers when evolving from closed to open innovation. In addition, it could be interesting to study whether these potential barriers are overcome in a sequence of moves or whether these moves overlap each other. This might sound rather practical, but might be relevant to help SMEs' managers to implement OI successfully.

Sixthly, previous studies demonstrate the existence of barriers that firms face when evolving from closed to open innovation. Moreover, empirical studies indicate how firms overcome these barriers. Nevertheless, questions still subsist on how SMEs "can identify, plan and manage a pilot project so as to unfreeze the status quo and prepare the ground for a successful shift toward Open Innovation" (Boscherini et al., 2010, p. 1065). This means to study what happens before SMEs attempt to shift from closed to open innovation as Boscherini et al. (2010) studied for large firms.

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10 Appendix

Company background		Unfreezing	Moving	Institutionalizing
Previously, the company produced electrical equipment. About 50 years ago, a manager spotted a product need in the sports market; he went to his boss and asked him for producing this sports equipment. Within a couple of year, he developed this equipment, which was first used at some competitions in Sweden. This product has been a success since then and the sports equipment division of the company split up from the rest of the company. From then on, the company produces the same sports equipment in close collaboration with its users, customers, and suppliers in order to innovate and improve the equipment.	Corporate culture	From the beginning, the company's activity stemmed from a market need. The CEO recognizes that the culture is the most important element in order to be opened. In addition, he says that it is his job as a leader to instill that open mindset to his employees. The company recognizes that it depends on customers' opinion, feedback, and expertise (technologies). Moreover, the company is aware that customers' integration is essential to their business. The company recognizes that suppliers are the most knowledgeable actors to help it developing physical products. The product development manager recognizes that they (in the company) know "a little of many things but not the details".	The company's CEO promotes openness inside the company, as well as, towards the outside of the company. He sees openness as an important element of the company development. He also integrates his employees in decision processes in order to motivate them. Transparency, openness, and careful listening to customers are encouraged. The company also tries to have open dialogs with its customers. The company encourages its employees to take feedback and criticism from customers (technologies) through their networks; through visits at exhibitions, conferences, and competitions; through their sales forces; and through their education department. In addition, the company uses the internet (e.g. Facebook) and magazines in order to gather opinions, suggestions, answers to questions, and trends i.e. technologies. The company encourages working hand in hand with suppliers for product development.	The company has made openness (OI) a strategic asset within and towards the outside of the company. The company generates its own ideas but also importantly searches the market for getting ideas and needs (technologies) from customers. The company has an open approach towards their customers and treats them as experts because they use their product all year long. They listen carefully to what they say, think, and want. The company's employees go and meet customers in person at exhibitions and competitions, as well as at their own education center and when visiting them during sales. The company also uses its customers as experts in order to test their new products. In addition, the company gathers customers' opinions and suggestions (technologies) on the internet (e.g. Facebook). The company follows trends by searching the internet and specialized magazines. The company mainly collaborates with suppliers for physical product development. The company is the link between customers' ideas and need, and product development in collaboration with suppliers. The product development manager says: "we try to break down problem we got from our customers with our suppliers". In addition, the company often collaborates with university students and professor for product development; the CEO says: "in product development, we have had a lot of students here, and we can also go higher up in the hierarchy and find help from professor".
	Networking	The company is aware that it is important to get the right persons to get work done. The company knows that a good network of customers brings it unbeatable expertise. The product development manager says: "the customers have been using the products; they know how the products are supposed to work".	The company first seeks for contacts within the company; that is, employee's contacts are the first networks utilized when suppliers and/or users' expertise are needed. The company has a high rate presence at exhibitions, conferences, and competitions. The product development manager says: "That is one way to get into contact with good expertise". The company enjoys directly and/or indirectly highly knowledgeable users'	The company has made its list of potential partners to jump in projects. The CEO says: "so it is suppliers, users, consultancy, Facebook and then you have employees in the company, so it is a catalogue of people that we use". The company has built a rather stable users network that helps it through feedback, and testing (technologies). The company uses the internet (e.g. Facebook) in order to frequently keep in touch with users. The company has good, long-lasting relationship with its suppliers and other institutions; the CEO says: "we have good connections with steel industry here in Sweden" and "we are in contact with a company that belongs to the Swedish state

Company background		Unfreezing	Moving	Institutionalizing
	Networking	The company is aware that it is important to get the right persons to get work done. The company knows that a good network of customers brings it unbeatable expertise. The product development manager says: "the customers have been using the products; they know how the products are supposed to work".	The company first seeks for contacts within the company; that is, employee's contacts are the first networks utilized when suppliers and/or users' expertise are needed. The company has a high rate presence at exhibitions, conferences, and competitions. The product development manager says: "That is one way to get into contact with good expertise". The company enjoys directly and/or indirectly highly knowledgeable users' networks. The company uses the internet (e.g. Facebook) in order to reach more people with their question and for suggestions.	The company has made its list of potential partners to jump in projects. The CEO says: "so it is suppliers, users, consultancy, Facebook and then you have employees in the company, so it is a catalogue of people that we use". The company has built a rather stable users network that helps it through feedback, and testing (technologies). The company uses the internet (e.g. Facebook) in order to frequently keep in touch with users. The company has good, long-lasting relationship with its suppliers and other institutions; the CEO says: "we have good connections with steel industry here in Sweden" and "we are in contact with a company that belongs to the Swedish state that is specialized in testing product".
	Organizational structure	Some years ago, the company recognized that its product development was carried out "ad hoc" by random people in the organization. The CEO says: "we had a type of product development before but it was not as structured as now, and it was less systemized than how we are doing now". The company recognized that for sustaining its position on the market, product development was a crucial element; the CEO says: "the embryo for that (keeping market position) is of course product development to design the right product. So it is important".	The company decided to hire educated people; the marketing manager says: "that's the evolution, to have well educated people and have enough of them". The company decided to hire a technical engineer to be in charge of the new product development department.	The product development department now exists and is run by a knowledgeable, skilful, experienced technical engineer. Now the company contains all departments needed to sustain OI and growth. In addition, the different departments but specifically the product development department will be filled with more knowledgeable employees; the product development manager says: "I would like to hire more people because I see there are lots of things to do with product development".
	Knowledge Management systems	The product development manager acknowledges that it would be of great importance to have all knowledge digitalized; he says: "I would like to click on a file and get all the steps in	In order to increase formalization of knowledge in the company and especially in product development, the company hired an engineer who runs the product development department. He gathers all technologies related to product	(FUTURE) The company might be planning on formalizing interactions with customers through official pre-existing reports. The company might be thinking of signing confidentiality agreements with all suppliers

Company background		Unfreezing	Moving	Institutionalizing
	Knowledge Management systems	The product development manager acknowledges that it would be of great importance to have all knowledge digitalized; he says: "I would like to click on a file and get all the steps in front of me. That would really be good to have all that documents". In addition, the company realizes that formalized reports should be used rather than tacit knowledge. For instance, the company realizes that formal reports should accompany face-to-face interactions with users and suppliers in order to make everything more formal. The company is not afraid of confidentiality towards users and customers. However, they acknowledge that evil-minded customers or users could steal information and they are aware of that. The company is aware of the fact that suppliers could steal their ideas and their collaborative development works. Consequently, they are aware that even though they work with local suppliers, gentlemen's agreements are not enough anymore. The company is aware that their not patented products could be	In order to increase formalization of knowledge in the company and especially in product development, the company hired an engineer who runs the product development department. He gathers all technologies related to product development and has started to digitalize tacit knowledge (technologies) that is there and there in the company. He is the central person; other departments (marketing, sales, and education) that also receive information about products all report to him. The sales manager says: "they (sales forces) bring all feedback from others to others to the product development manager"; equally the marketing manager says: "if someone hears something somewhere that is wrong or wishes from the customers, they go to the product development manager". However, formalized reports still not exist in the company. Overall, due to the size of the company and the nature of exchanged information, the company's employees find it still manageable to have rather informal interactions and reports. The company uses the internet (e.g. Facebook) in order to integrate even more customers and users to product development. This is also a more formalized procedure to gather feedback, opinions, and suggestions. The company writes formal reports for some meetings with suppliers but not in most cases. The company does not disclose crucial information to users and customers; they	(FUTURE) The company might be planning on formalizing interactions with customers through official pre-existing reports. The company might be thinking of signing confidentiality agreements with all suppliers The company might question itself about patents.