

IMPLEMENTATION OF OPEN INNOVATION PRACTICES IN SWEDISH MANUFACTURING INDUSTRY

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ABSTRACT

The notion of open innovation has quickly gained interest of both practitioners and researchers. However, there is a lack on studies on this research topic. Thus, the main purpose of the study is to get a deeper understanding of how can large firms can implement open innovation practices. This purpose will be achieved by first, understanding the current innovation process and second, focus on critical aspects such as, partners, capabilities, and role of SMEs which can be important for implementing open innovation practices. The study is based on qualitative data from two companies from Swedish manufacturing industry. The results show that both companies don't fully practice open innovation approach. Moreover, partnering with customers and universities are highly preferred compared to having suppliers involved in the development process. The ability to absorb external knowledge and gain from inter-firm relationships were vital for effective open innovation practices. Finally, role of SMEs in the open innovation practices large firms was not clearly visible.

Keywords: open innovation, manufacturing industry, capabilities, small and medium sized enterprises

1 INTRODUCTION

Across industries and environmental settings, innovation is viewed as a source of advancing and maintaining firms' competitive position. By tradition, a dominating mode of managing innovation has been internally focused and built on in-house resources, capabilities and ideas. In this logic of "closed innovation" innovating large firms solely relied on their internal competencies, attempted to manage the entire process of development in order to be the first to market their products, and controlled the innovation process as well as its effects in terms of e.g. intellectual property rights (IPR). This logic however creates heavy overheads and failure to recognize the profitable opportunities in a modern economy, where organizations are focusing on their core competencies and where innovations to a larger degree are characterized by partnering, resources and capabilities from different actors are combined to produce an innovative output [1]. This is also why we today witness a shift towards more "open innovation" approaches and practices where firms cooperate and to a higher degree rely on external sources in their innovative work, and where the aim is to enhance innovation both inside and outside the borders of the firm. Henry Chesbrough was one of the first researchers to pick up and elaborate upon this new practice also in a normative way, noticed the essence in this shift to capture "the use of purposive inflow and outflow of knowledge to accelerate internal innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas, and internal and external paths to market, as the firms look to advance their technology" (from Chesbrough et al [2], p. 1).

Although several benefits with adopting open innovation practices can be identified, this requires considerable changes in the overall business model and processes. This naturally creates several challenges that hinder the transformation. There can be challenges associated with management, intellectual property, competitive issues, and others [3, 4]. The management challenges are important as they refers to people, for example the notion of "not invented here" syndrome i.e. related to a firm's culture to avoid the utilization of existing technology or product due to its different origin [5].

Firms might also lack the competence to identify potential external knowledge and employ it for product development [6].

These challenges can be overcome by developing specific capabilities that can support large firms to effectively and successfully implement open innovation practices. According to Enkel and Grassmann [7], firm's ability to develop and utilize inter-firm relationships and to adapt and exploit external knowledge for successfully transferring this knowledge to outside environment is critical in this context. In addition, a firm's ability to utilize information and communication technology (ICT) can support in developing the other firm capabilities and also provide a smooth flow of ideas, knowledge and communication [8].

In open innovation setting, small and medium size enterprises (SMEs) should also be viewed as vital for providing new knowledge and competencies. According to Audretsch and Thurik [9], research shows that SMEs are responsible for a large part of all new products and services in western economies. The most innovative large firms, such as 3M, Microsoft, Sun, Oracle, IBM, Procter and Gamble (P&G) and Cisco, etc, have not solely developed their innovations in-house, but have used an open innovation approach [2]. They have acquired, financed, and commercialized innovative ideas and products of other firms (SMEs). Thus, it is interesting to explore how SMEs can play a larger role in the open innovation practices of large firms.

Based on the above background, the main purpose of this study is to get a deeper understanding of how can large firms implement open innovation practices. This purpose will be achieved by first, understanding the current innovation process and second, focusing on critical aspects such as, partners, capabilities, and role of SMEs which can be important for implementing open innovation practices. The main contributions from this study are; firstly to address the literature on "*open innovation*", although several studies exist on this topic, but most of them are conceptual and lack practical inputs. By investigating large firms, practical insights can be gained which can further guide the development of the research topic. The second contribution is towards the large firms as they can get informed about possibilities and challenges of adapting the open innovation approach. Thirdly, identifying the capabilities which are integral for practicing open innovation can guide large firms to focus their resources in development of right competence. And finally, identifying the role of SMEs in large firms' innovation process can provide inputs on how to make this interface effective.

This paper has the following structure, after the introduction, the next section presents the research approach which states the steps follow during the study. The third section explains the theoretical perspectives on open innovation, different forms collaborations, capabilities and role of SMEs. The fourth section briefly presents the background on the case companies and respondents. The fifth section presents the results based on the interviews. Finally, the paper ends with discussions of the results and concluding remarks and proposes scope for future research.

2 RESEARCH APPROACH

As the purpose of the study is to get a *deeper understanding* of the research area, a qualitative research approach was considered most appropriate. Furthermore, according to Yin [10], a case study research strategy should be followed when researcher wants to *describe, explain, illustrate and explore* conditions related with research topic. Thus, case studies were performed on two companies from the Swedish manufacturing industry. These companies were selected due to the following reasons: first, they are considered to be more traditional industries and there is a lack of studies on them in relation to open innovation practices. Second, they are particularly important for the Swedish economy and investigating how they can be more innovative, would have positive impact on the national economy. Moreover, the authors are involved in a research project at their university, which provided them with the possibility to get access to the case firms and thus increasing the probability for gathering richer data. In addition, having multiple cases provides varying pictures of the studied phenomena and possibility to compare results [10]. The two selected companies are working in two distinct environments and hold different views on innovation processes, which make them suitable for multiple case studies.

The respondents were selected based on having long experience of working at different development projects within areas related to the innovation process. Thus, we contacted our contacts at the company and asked to suggest few names based on our requirements. This helped us in finding the right respondents for data collection. In total four respondents were selected for two companies.

The mode of data collection was semi-structured interviews. This method was chosen because it provides the respondents with the freedom to speak from their experiences [10]. The respondents' stories and examples from their experiences were important to capture in this phase of the study. The interviews were performed via telephone and all interviews were recorded so that they could be replayed later for increasing the reliability of data.

The atmosphere during the interviews was sensed to be quite honest as the respondents stated clearly when they felt that they could not answer the question. Therefore, the risk that they would be guessing or making up answers to any questions can be assumed to be low.

The content analysis was made by first transcribing the recordings of the interviews. These transcripts were sent to the interviewees so that they could agree, correct, and/or comment on the answers. At this point they also responded to further questions that the researchers developed during the initial screening and analysis of the interviewed material. Thereafter themes, originating from the purpose of the study, were used to classify the data. The data was later reduced, where relevant information and quotes were ordered in a mind map to have an overview of the contents. This was then the basis for the results that is presented later in the study.

3 THEORETICAL BACKGROUND

Several large companies in the past have been adapting the open innovation model for research and development. This gave them a unique advantage over their strong competitors, for example Cisco, which is regarded as one of the most innovative companies did very little internal research and obtained most of its technologies from external sources. In turn, Xerox did its research and development entirely in-houses and struggled to keep up with its competitors, even with its large funding bases and competent employees. Additionally, due to their closed innovation model they lost several brilliant ideas, which later formed successful spin-offs. Together the top ten spin-offs from Xerox (e.g. 3Com, Adobe, etc) had twice the market value of Xerox for the year 1999 [1]. This clearly highlights the troubles large firms face when they don't have an open attitude towards innovation.

Figure 1, illustrates both the closed and open innovation models. According to Chesbrough et al [2] "at its roots, open innovation assumes that useful knowledge is widely distributed and that even the most capable R&D organizations must identify, connect and leverage external sources as a core process in innovation" (Chesbrough et al [2], p.2). Thus, innovative project should be launched from either internal or external technology based. In addition, new technologies (in-sourcing) can enter into the process at different stages. The end result of the projects is to commercialize products in the current market or to the new markets through technology spin-offs or licensing [2].



Figure1. Closed innovation model (left side) and open innovation model (right side)

The roots of open innovation can be traced back to the software industry that focused on "open source" development [4, 11]. The main difference between traditional and open source development is regarding the motivation of developer to freely reveal proprietary information, sacrifice intellectual rights and allow others to freely access and develop the software code. Some examples of such development are Linux, Freemail, and Firefox. It can be argued that most of the examples of open innovation model are limited to "high technology industry" such as, computers, information technology, pharmaceuticals [1]. However, this model has also been adopted by other industries such as consumer product, sports industry, and others. In this study we particularly investigate the manufacturing industry which provide excellent context to test the open innovation model in a more traditional industry setting.

According to Chesbrough [2], there are several drivers to the open innovation model. The first relates to globalization in-terms of high mobility of resources/capital, higher utilization of ICT, lower logistic costs and increase in the homogeneity in the market. In additions technology intensity and fusions have considerably increased as firms struggle to keep up with developing new technologies in-house, and the technologies from one sector is adopted in other sectors and vice versa. Finally, the sharing of knowledge has become possible, which creates a favorable environment to practice the open innovation model.

An important aspect with open innovation has to do with identifying and connecting with appropriate knowledge owners in certain forms of collaboration [1]. In the early phase of the innovation process, external relationships can provide vital knowledge and reduce the risk and cost associated with new product development. There are number of possible forms of collaborations, however, in this study we have only focused on three forms of collaboration customer integration, supplier integration and university-industry cooperation [12]. Each forms of collaboration have particular advantages and outcomes in-terms of innovation. For example, collaborating with customers results in incremental innovation, whereas firms collaborating with suppliers tend to develop new to market products, and firms involved with universities develop radical innovations.

Customer integration: Involving customers in the early phase of innovation reduces risk with innovation and 75% of firms are engaged in integrating customers in their innovation process [13, 14]. Having customers' inputs helps firms in producing customized and commercially viable products. Firms might also co-develop products with customers such as in the case of open source software [11]. This practice has also been adopted by other industries such as car design, computer games, etc.

Supplier integration: The main benefits from supplier integration are related with reduction in production cost and improvement in quality [14]. Further, firms collaborating with suppliers invest more in the research and development as they require an infrastructure for collaborative behavior. Thus, supplier relationships have significant effect on firms' innovation performance and productivity [12].

University integration: According to Chersbrough [1], universities are an important source of knowledge and research which makes them particularly unique in the open innovation model. Collaboration with university researchers assists in avoiding unproductive development, identification of most promising opportunities and overall increase in the certainty with innovative development. University-industry collaboration also facilitates identification of prospective employees and training possibilities for current employees. Moreover, collaboration with university can be seen as non-risky strategy as university wants to produce knowledge and companies wants to produce products and make profit [15]. This creates a "win-win" situation for both sides, compared to collaborating with a firm.

3.1 Open innovation capabilities

Having explained about the open innovation model and different forms of collaborations, it can be argued that not all firms are able to equally implement or gain from their open innovation activities. The reason for this distinction might lie deep within firms' ability or capability. There is a growing body of literature on "resource based view" which focuses on firm capabilities. They define capabilities as "complex bundles of skills and accumulated knowledge, exercises through organizational process, that enable firms to coordinate activities and make use of their assets or resources" (from Day [16], p. 38). Firms' capabilities can have strong influence on their ability to innovative. When a firm uses their capability to combine different resources and competences, they can create new products and services. Two capabilities can clearly be seen as essential for open innovation model, they are absorptive capability and networking capability [7]. In addition an information and communication technology (ICT) capability can also play a supporting role in the development of these capabilities for open innovation practices.

Absorptive capability: In the studies on open innovation, the reference to "absorptive capability" has been widely recognized [4]. This holds particular value for open innovation processes as external ideas are considered critical. But firms' ability to understand and utilize the external knowledge is largely dependent upon firms' existing knowledge base. Thus, if firms want to successfully identify external knowledge, assimilate it and apply it for commercial development they need to develop absorptive capacity [17]. According to Cohen and Levinthal [6], a firm's "ability to recognize the value of new

external knowledge, to assimilate it and apply it to the commercial ends is critical for its innovation capability” (Cohen and Levinthal [6], p.128).

Networking capability: In the context of open innovation, firms need to have high level of collaboration with different partners at different stages of research and development (R&D) [18]. However, to support several collaborative partnerships, firms need to possess specific capabilities to initiate, develop and utilize the relationships. According to Walter et al [19], this ability can be defined as networking capability i.e. a firm’s ability to develop and utilize inter-organizational relationships to gain access to various resources held by other actors. There are five underlining dimensions of networking capability: 1) the ability to coordinate between collaborating firms, 2) knowledge of their partners, 3) relationship skills with other firms, 4) internal communication skills, and 5) building new relationships [19].

ICT capability: In this study ICT is defined as firm’s “*ability to mobilize and deploy IT-based resources in combination or copresent with other resources and capabilities*” (from Bharadwaj [8], p. 171). The role of ICT has become vital in open innovation, for example, simulation, modeling, virtual reality, data mining, and rapid prototyping are few of the activities, which support innovative development. Effective ICT system leads to smooth flow of processes and possibility to manage several ideas without losing them in the process. Moreover, ICT tools reduce the perceived distance between different partners such as, suppliers and customers. This constant connection with partner firms enhances trust, satisfaction and commitment, which leads to smooth flow information and knowledge [20].

3.2 Role of SMEs in open innovation model

Most SMEs do not possess any systematic process and mainly center their efforts on one or few technological developments. This is also reflected in their success in being best at generating technological innovations due to their highly specialized and deep knowledge [21]. SMEs usually lack of finance and resources which hinders them from following the similar strategies like their larger counterparts. However, they are also flexible, quick to respond to emerging market needs, short-term focus and closer to their customers, which makes them highly competent.

In the context of open innovation, SMEs can be viewed as an important player for larger firms. Several studies have shown large firms heavily relying on SMEs for feeding their innovation funnel, particularly in the biotech, IT, and high tech industries [22]. Usually SMEs would target niche markets, but when they collaborate with larger firm their reach can expand to larger markets and larger firms get access to pre-developed innovation. This would mean a “*win-win situation*” for both sides.

However, new ventures should focus more on collaboration with firms of similar size and organizational culture as it would reduce the probability of opportunistic behavior. When the technology becomes mature it is easier for SMEs to attract large firms to develop inter-firm relationships. These relations usually include higher coordination costs and can be overcome by promising a profitable future with investing in the technology. According to Christensen et al [21] there are at least three reasons for challenges with SMEs to collaborate with larger firms. Firstly, due to changing market needs and technological uncertainties the bargaining power of SMEs might diminish as they would need to redesign and make several changes in their products which would lead to high overheads. Secondly, due to opportunistic behavior from the large firm side, SMEs might face lower economic benefits from forming alliances. Finally, due to differences in languages, norms and traditions between large firms and SMEs the level of communication and trust would be low.

4 THE CASE COMPANIES AND THE RESPONDENTS

In this study, two companies from the Swedish manufacturing industry took part. These companies and their respondents have been anonymized in this paper and will be referred to as Company A and B, and Respondents #1, #2, #3 and #4 respectively. Below follows a short description of the two case companies and the respondents.

Company A is a developer and manufacturer of components for both civil and military aero engines as well as for rocket engines used for space applications and gas turbine engines. Further, they have a business in maintenance, repair and overhaul (MRO) of aero engines. And they usually work as tier 1 supplier or risk and revenue sharing partner to the main engine integrators of aero engines. Has a business philosophy of working very closely with their partners.

Respondent #1 is employed as an industrial PhD Student. He is educated as an engineer and has 13 years experience at the company. He has worked as a line manager at the company and several projects related to technology development. *Respondent #2* works as a project leader for a technology development project and holds a master in science and business administration. He has 16 years experience at the company, which involves working in different areas and locations (i.e. Sweden, USA).

Company B is a world-leading manufacturer of tools for the metalworking industry with products for areas such as turning, milling and drilling. They mainly develop their products in-house, but are heavily reliant on the cooperation with their customers to get the needs and problems to address.

Respondent #3 is a manager at the milling department and responsible for design and product development. He has been working since 1985 in the company. During this period he has had different positions as product leader, designer and developer in the company. *Respondent #4* is product development manager for drilling tools. His educational background is in mechanical engineering. He has 10 years experience at the company. During this period he worked as development engineer and later in various product management positions.

5 RESULTS

This section presents the view of respondents regarding open innovation practices. We start with a brief description of the companies' current innovation process and their view on the open innovation process. Thereafter, we focus on the importance of different partners, capabilities and role of SMEs in the open innovation process.

The innovation process of Company A is mainly driven by the needs of their industry (aerospace). The industry (network on several companies) decides upon the critical issues, which is addressed by all the companies involved in the network. As Company A hold the position of supplier in the industry most of the development efforts are centered around the identified issues and working in close collaboration with other companies. The cost and time for development tends to be high and long which also support this notion of joint development. In Company B, the need or voice of the customer is an important driver, together with the technological and market insights they guide their innovation process. The innovation process is divided into different projects and each project has its own goals. These goals can be aimed at solving a problem or match the customers' need or to develop something novel. The outcome from each project mainly decides if it can be seen as innovative or not. All projects have to run through different gate reviews, this can be seen as the internal validation process common to both companies.

Both company A and B highlight the importance of integrating external ideas and knowledge. They believe that having several ideas in the early phase can be vital as the company does not clearly know which idea will be preferred over another by their customer. However, currently most of these ideas are internally generated and the companies do not have a systematic way of integrating external ideas within their companies. The trend towards driving innovative development based on customers needs has been a recent development for Company B. The advantage of having internal ideas is mainly due to the simplicity of having discussions around it and the people usually have a better understanding about the company's needs and requirements.

Although interested in external collaboration Company B feels insecure about sharing their ideas. Respondent 1 further adds that the challenge is to find appropriate and valuable external knowledge. Most external actors' do not *"understand our problems, and if they do not do that, then they may get something and they come with a, what they think is a good idea, and it could be that we don't even understand the idea, because have not perhaps really understood what our problem is..."*. The respondent also highlights that in most cases when external ideas have solved Company A's problems they have been generated from companies they already have some forms of collaboration with.

Respondent 1 suggests that *"you need to have "gatekeepers" inside the company, who accept the idea, who thinks it's a good idea and tries to sell it inside the company"*, otherwise the real value of the idea is never fully realized. Also there is a stronger tendency from both companies regarding buying out those companies, which have a competent knowledge base or promising technology. In the past, several companies have been bought and their knowledge has been integrated with the mother company. Company B, however feels, motivated to openly collaborate with Universities and research centers as they are valuable sources of knowledge and the level of trust tends to be high.

Having high level of collaboration mainly deals with getting accesses to different perspectives. Also sometime partners have a technological product which does not hold value for them but can be licensed-out to the other company. For example Company A further developed a technological product of main engine integrator. The challenge here is to settle the intellectual property rights issues early in the collaboration. For example if Company A uses the technology of main engine integrator and add value to their competitors, why should main engine integrator share their knowledge and risk losing their business. Also during the innovation process it can be problematic to identify the precise customer need, otherwise the development would address only a niche market and would let to loss of profitable opportunities.

Neither company normally spin-off nor license-out their technologies. In the past, Company A had a position within the company for dealing with such issues but it is currently not staffed. This was due to the lack of tradition within the company for such exploration. When asked if they would like to have the possibility for spinning-off technologies in the future, respondent 2 felt that it can be something to consider based on the need in each case. Currently there is no need for any systematic process for such transformation. Company B feels that the option of spin-off or licensing out is not that common as they do not usually invest on those projects that can end up outside of the scope of the company. If it happens respondent 4 put it *"we keep it in here in the building, we don't let it out then"* because it is seen as competence of the company. However, respondent 1 states *"but I think there is definitely potential to do that if the company would like to do it, because there is a lot of technical knowledge which could be applied in other areas as well actually, I'm sure"*

Both companies give their customers' needs the highest priority, but the full integration of customers is kept at a limited level. For example when cost reduction was the main need from the customer side, several ideas were internally generated to resolve this problem and once a particular idea was chosen it was sold to the customer. As respondent 1 put it *"quite early actually the customer get involved in saying yes or no about the idea"*. Having customers involved early means their views are also taken into consideration before starting the development. Usually customers have *"different perspective, they have different issues, they have other concerns"* which needs to be taken care off. This not only helps in verifying the idea but also save unnecessary costs and further adds value. Company B aims their products at all sorts of customers (large firms and SMEs) but mainly uses the inputs from their large firm customers for developing products due to easy access to information. They test their products with few customers (driving customers) before the global launching.

On the other hand Company A does not view their suppliers as practically important for innovative developments. This is due to the low priority given their supplier side on research and development. According to respondent 4 usually the suppliers are specialized producers but they lack the knowledge about how they can improve our processes. However, respondent 1 suggests that they would like to see increased collaboration in future between them and their suppliers. Company B involves suppliers in discussion before development, this guides them regarding the feasibility of developing a certain product within the cost constrains. If the product development costs are high and the suppliers lack competence of developing similar product they terminate the project.

According to respondent 1 *"universities and research institutes play an important role in the innovation at company A"*. Several universities are working closely with them for product development because they have specialized knowledge. *"They usually have machinery, workshops for experimenting to develop the technology further, and furthermore they do not have any interest themselves to establishing themselves as a supplier in the business, they are merely interested in developing new processes for example, for industry. So there is kind of a win-win situation for the company,....and the research institute. We both get our objectives met somehow"*.

In response to importance of absorptive capability, Company A states *"being able to first of all finding external knowledge, and hooking up with it and trying to see how we could use that knowledge for our solving problem within our business. That is an important ability"*. Also *"gatekeepers"* at management and engineering level are particularly important in this scenario because they know about different sub-suppliers, SMEs and other actors who can provide this valuable external knowledge. However, these individuals are hard to find and are not clearly visible on the surface. Company B also feels that these experienced individuals are valuable facilitators for absorbing appropriate knowledge for innovative developments. Respondent 4 feels that they are not extremely effective in utilizing external knowledge they still largely rely on their internal knowledge base.

Networking capability is also viewed as vital for having effective collaboration. Firms need to find a common ground where both parties can benefit and develop healthy relationships. In this context Company A puts efforts in understanding their partner's needs and expectations and uses it for further development of relationships. Company B views networking capability as mainly practiced by top management and have preference towards networking with larger firms. It was also suggested that the processes within Company B are more secretive and not fully shared with collaborative firms even when there might be a possibility to benefit from open discussions.

On the other hand information and communication technology (ICT) capability is proposed to have a lower role in the innovation process. According to respondent 1, it would not matter to them much if their partner has low ICT usage, the main focus lies on the value of the product. Company A would not disqualify the partner based on the level of ICT capability and similarly they would not get disqualified based on these criteria. In the view of Company B, using ICT has also become essential as it helps in connecting with the outside world. In several cases they can save a lot of time and effort by performing environment scanning regarding technological developments and helps them in skipping the re-inventing of wheel. Moreover, using CAD-systems, virtual prototyping, and other tools are essential for innovative developments.

In terms of prioritizing these capabilities, Company A would regard absorptive and networking capabilities as equally important and also suggested that they are complimented to each other. Whereas ICT hold the third place in the context of open innovation. In Company B, absorptive capability was the most important capability which was followed by networking capability and finally by ICT capability.

In the current innovation process of Company A, SMEs are not seen as important stakeholders. However, Respondent 1 adds that there have been a few examples when SMEs have become valuable for the company and joint development was done due to their specialized knowledge. This collaboration led to generation of new knowledge and learning. If they find such an SME, which can offer them high value, then they usually buy the SME instead of having only a collaborative relationship. According to respondent 2 the main reason for such behavior is to secure a clear relationship for joint development.

There are several ways in which SMEs can get involved in Company A's innovative projects. If they have met a person from the company at a meeting or conference they can initiate the discussion with them directly about the idea. Another way can be to contact a person from the development unit which is doing similar development. Company A has a special unit called advanced engineering which is responsible for setting up the program, planning such developments and looking for funding. If people get interested in the offer of SMEs it can result in a joint development project. Although, feasible this has rarely happened in past. In additions respondent 3 suggest that *"when SMEs try to network with us than we are not interested ... but if they are networking via University"* this becomes more desirable and convenient.

Respondent 1 suggests that SMEs should focus on continuously developing specialized knowledge and come up with new ideas, which can support the product realization of company A. Thus, in a way become a good partner, who is trying to trying to *"foresee potential problems, and preparing for solving those problems, so they have already started looking into potential aspects which for example we have not considered"*. Finally a challenge with involving SMEs in the innovation process has to do with identifying the right SME. There are thousands of SMEs and how can the company find the most appropriate partner is problematic when they are the market leader.

6 DISCUSSION

The importance of being innovative is clearly visible from the interviews undertaken for both the companies. As proposed by Cooper [23], they have setup a *stage gate process* through which they strategically move an idea to finished product. Also efforts are made to have different departments work together for innovative development. In Company A, the industry goals guide the innovative development and Company B uses their voice of customers for guidance. Thus, they need to collaborate early in the process and indulge in joint development. But can this be regarded as *"open innovation"* practice? Not really, as the results show the scope of openness seems to be narrow and restricted. Although they highlight the importance of external knowledge, when developing ideas, they mainly rely on internal research and development. However, there are certain activities and

preferences, which can be found in the open innovation ideology. For example, customer involvement, integration of external knowledge, close collaboration with universities, and others.

Both companies highlighted the value of integrating external knowledge within the product development process. However, in the current scenario the reliance is entirely on ideas generated by internal research and development. To a large extent this can be seen as a transformation phase for these companies as they are aiming at developing a systemic way of integrating external knowledge. This transformation first of all requires them to find appropriate knowledge sources, and from their past experiences, usually firms with pre-existing relations provide higher value compared to new partners mainly due to better understanding of each others' needs and wants. Thus, it would be more advantageous in the open innovation setting to have broad networks of partners for getting access to a wide range of knowledge, competence and experience [12]. Also, maintaining "*strong and weak ties*" with other firms can facilitate in acquiring a wider knowledge base. Stronger ties represent long lasting relations where the level of trust is high and critical information can be shared. Weak ties represent distant relations from where new knowledge can be received. Studies indicated that firms possessing both forms of ties are best at gaining advantage from inter-firm relationships and reduce the probability to get locked in a particular relationship [24].

Another important consideration deals with identifying "*gatekeepers*" or "*innovation champions*", who can facilitate change within the organization and in the mindset of individuals. This is inline with literature, of Chesbrough and Crowther [3], which states, for ensuring full implementation of open innovation strategy the role of innovation champions are integral. These individuals are the engine which drives this transformation of using external technology into the existing product development processes, by providing inroads into the organization.

There was also a strong tendency from both companies to buy competent firms instead of having a collaborative relation. One argument for such intention might relate to the need for better control and reducing probability of opportunistic behavior. According to Fowles and Clark [18], open innovation approach requires firms to manage several relations and the main challenge here is to create a *win-win situation*. Another view on this can be from the "*transaction cost theory*" perspective, which argues that firms strive for those activities which can minimize their production and transition costs. The cost of transaction can include searching for a supplier or a partner or a customer, cost of establishing, monitoring and enforcing the implementation of the contract and all the cost necessary for coordinating the work of people and machines that are involved in the production processes [25]. Thus, evidently having collaboration with several firms (e.g. SMEs) can mean heavy transaction costs, which can be reduced by acquiring them. However, this logic of acquiring firms contradicts the open innovation approach and its sustainability over time can be questionable.

Intellectual property rights issues are central to open innovation. According to Henkel [11], an open philosophy might strengthen competitors' knowledge base that can lead to loss of revenues and competitive advantage. Both companies highlight these issues; however, they also suggested ways in which these can be overcome. For example, according to respondent 1, one solution to this problem is to develop a detailed contract which states the conditions regarding the development. Also, it is possible to decide on a time frame during which the technology developed in the collaboration will not be sold to third-party. On a similar note, both companies have rarely spun-off or licensed-out any technology. Company B even states that having projects that might not match the scope of current business operation were not appreciated and if it happened it was "*[kept] in the building*". This can be related with the example of Xerox research center, which lost several profitable opportunities due to a closed innovation model [1]. Not all projects or technological developments hold similar value; some projects might be built on domain knowledge whereas others might be application knowledge, meaning that some apply methods and techniques that by themselves are not core to the company's business. These methods and techniques can be applied in other business domains without interfering with the core business of the company. Dividing projects based on their sensitivity to the company can enable them to capitalize on profitable opportunities. The approach followed in open-source developers of "*protect and reveal*" can be of value, i.e. revealing only half of the code they have developed for keeping the ongoing process, but protecting the core knowledge [11]. This would support the feeling of respondent 1 "*there is lot of technical knowledge which could be applied in other areas as well actually, I'm sure*".

Customer integration is fairly common practice in this industry. In line with literature, both companies quite early involved their customers in the product development process as it leads to commercially

viable products [13]. This is another example of how external knowledge or perspectives can be valuable in the product development process. Furthermore, practicing open innovation requires firms to select between both external and internal ideas and basing their decisions on customer insights would be a beneficial practice. Integrating suppliers in the product development process is of interest to both companies. However, currently suppliers only provide specialized products and lack an understanding of how they can improve the processes. This would imply that in the open innovation setting, suppliers would need to offer more than competent products, and diversify their research and development horizon. Additionally, as suppliers aim for long lasting relations, providing added value would secure them competitive position in their current network. Universities are regarded as an important source of knowledge and research, which makes them particularly unique in the open innovation model [1, 2]. Both companies identify this advantage and involve several universities in their research and development activities. In addition, to have a deep knowledge base, universities are also a strategic choice due to their nature of aiming at other goals than the firms. They are interested in producing knowledge and companies want to produce products and make profit [15], this creates a *win-win situation* for both sides. However, there are some challenges with this cooperation; for examples short-term focus from the firm's side, difference in the culture (language, norms, etc) and management of projects.

Company A views the ability to identify external knowledge, assimilate it and apply it for product development as critical. However, the important role of competent individuals with information about valuable and relevant external knowledge was also established. As Cohen and Leventhal [6] suggest the ability of identify and absorb external knowledge largely depends upon firms' existing knowledge base. Thus, there should be support within the organization to increase the role and quantity for these individuals. A possible solution might be related with having regular rotation positions, which will allow them to learn more about each department and establish several contacts. For network capability also top management was largely responsible. They need to keep healthy contacts with others firms and also understand their requirement, which needs to be internally communicated. Coordinating several relationships and developing new relations was also a task highly valuable for effective open innovation practices. Finally, both firms believed ICT capability was the lowest priority in comparison to other capabilities, mainly due to its supporting role in the firm rather than being the critical capability. The expression of "*order winning or order qualifying criteria*" fits very well with the view on ICT capability within Company A and B.

The role of SMEs in the open innovation practices of Company A and B was not viewed valuable. This can be due to the lack of visibility by SMEs in the value chain of these companies. Thus, SMEs can be regarded as "*hidden*" behind the contact supplier and other service providers. However, in past when both companies collaborated with SMEs they learned a lot from their experience as SMEs tend to have specialized knowledge. The companies don't have any particular way in which SMEs can approach them if they have a new technology or some offering. They either need to find the most appropriate project leader interested in their line of technology or they need to have some form of established relations within the firm. Gatekeepers can also play vital role in this process due to their deep involvement in the firms. Respondents also highlighted that for any SME's external idea to be integrated in their Company, someone internally has to believe it and drive it. During the interviews there were discussions around how an SME can become an attractive partner for larger firms. Clearly having competent products was the core of any relationship. Additionally, SMEs were expected to have continuous research and development (R&D) initiatives and develop different technological products in their product-portfolio, which is usually lacking in SMEs. In many ways having an *entrepreneurial orientation* i.e. risk-taking, proactive and innovative were some of key characteristics which according to both companies made some SMEs attractive over another. Finally, a challenge for these companies was to identify the most appropriate SMEs for collaboration, particularly when they are the market leaders in their industry. In response to this SMEs collaborating with universities were highly attractive for collaboration as they represented some form of legitimacy [11]. Thus, there are several ways in which the role of SMEs can be increased in the open innovation process of large firms.

7 CONCLUSIONS

We started this study with the purpose of getting a deeper understanding of how large firms can implement open innovation practices. It is evident that open innovation practices are vital and most firms have started to shift from the closed innovation approach. However, the case companies barely

touch upon few of the underlining principles associated with open innovation, for example customer involvement, integration of external knowledge, close collaboration with universities, and others. Studying the current practices of the case companies helped us in finding important issues which needs to be considered for implementation of open innovation practices. First, external ideas have value in the product development process but identifying the partners that can provide this knowledge can be challenging. Thus, firms should aim at having several partners in their network with potential for contribution. Second, the “gatekeepers” can act as champions for the implementation of open innovation practices. Third, although the case companies preferred to buy competent firms instead of collaborating with them, the sustainability of this approach is questionable. In the long term, we believe it would lead to higher overheads and also problems of having their investments stuck in different firms. Fourth, intellectual property rights are central in any collaborative development but there is several ways in which they can be overcome, such as clear contracts and deciding upon a time frame of keeping the joint development information internal. Finally, even when spin-offs and licensing-out technologies were not common in the case companies, they could divide the projects on the bases of different criteria (domain knowledge or application knowledge). This would assist them in gaining from those opportunities which otherwise would have been lost.

Regarding the critical aspects, such as partners, capabilities, and role of SMEs that can be important for implementing open innovation practices. We would like to conclude that customer integration is common practice in industry. However, suppliers are not viewed as particularly important for the product development process mainly due to their lack of understanding in offering more than mere competent product. University cooperation was highly valued by both companies and they thought it will create a win-win situation for both sides.

Company A and B regarded both absorptive and network capability equally important and also suggested that they are complimentary to each other, whereas ICT capability was seen beneficial but not essential. For development of these capabilities, the role of individuals within the companies was imperative.

The role of SMEs was underestimated due to their lack of visibility in the value chain of case companies. Also, those SMEs that had collaboration with universities were easy to access and regarded as convenient for collaboration. Finally having entrepreneurial orientation could make the SMEs attractive partners for long-term relations.

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