

Open Innovation Activity for Product Development in SMEs

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Master of Science Thesis (1 yr),

Stockholm, Sweden 2012



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Abstract

Open innovation opens up organizational boundaries so that a company can use and combine internal and external knowledge to develop and commercialize its own innovations, and can take its internal knowledge to market through external channels to generate additional value.

There are many studies on large companies that use open innovation in order to develop their products, and keep up with rapid economic changes which affect their businesses. However there are not many studies on small- and medium-sized enterprises (SMEs) in terms of open innovation.

SMEs are crucially important in global economy and innovation. They account for a large proportion in the global economy and create a large number of employment opportunities. They are more innovative than larger companies due to their flexibility and ability to quickly and efficiently integrate inventions created by their development activities. Nonetheless they lack of resources and appropriate structures. Accordingly innovation processes and strategies used for product development by large companies may not be appropriate for them.

This study examines if SMEs should adopt open innovation activities for their product development and suggests that SMEs should adopt open innovation activities as complementary approaches to their internal R&D for their product development.

Keywords: Open Innovation, SME

Acknowledgements

The author would like to take this opportunity to thank for the help from the supervisor Pranpreya Sriwannawit for useful feedback and guidance throughout the thesis, Ingela Sölvell and classmates for the reflection of the ongoing thesis in both draft seminars, and my family for all the support to complete the study. Without them, this thesis would not be successful.

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1. Introduction

SMEs have gained interest in the global economy in which they have a strong influence through their innovative ability which drives economic growth and technological progress. However, the growing globalization, the fierce competition, the market uncertainty, the complex innovation process and the deficiencies of SMEs, such as few resources, less research and development (R&D), small innovation portfolios and lack of strong protection of their intellectual property (IP), bring about challenges to SMEs. It is undeniable that SMEs have to possess exceptional capabilities to overcome these challenges and constantly develop high quality and unique products to supply the market if they want to outperform competitors (Zeng et al., 2010). Nonetheless only few studies demonstrated that open innovation exists in SMEs (Van de Vrande et al., 2009). Moreover most empirical researches focused their studies on companies, including SMEs, which have gained positive results and have ignored companies which have failed from operating open innovation.

According to the lack of studies, the conclusion on whether SMEs should adopt open innovation activities for their product development cannot be drawn. This study aims to examine this issue by focusing on motives and challenges towards open innovation and open innovation activities. The study also illustrates case studies which show the implementation of open innovation activities for SMEs' product development. These concepts and case studies will then be analyzed and discussed.

The paper is structured as follows. The first section introduces the background, research objective and question, and scope of the study. The next section clarifies the methodology used for the study. The third section provides conceptual framework concentrating on 3 issues: the concept of open innovation, open innovation activities, and open innovation in SMEs. The fourth section describes case studies of open innovation activities in SMEs and provides discussion of the cases. In the fifth section, discussion is described. The next section provides the conclusion. In the last section, limitations and future direction of research are outlined.

1.1 Background

While innovation is the process of turning opportunity into new ideas, and of putting these ideas into practice (Tidd and Bessant, 2009, p.16), open innovation is a set of practices for profiting from innovation. It offers propositions for how such innovation should work (Chesbrough and Crowther, 2006, p. 286).

The initial researches on open innovation focused mostly on large companies in high-technology industries, such as information technology and pharmaceuticals, and showed that these companies have accepted open innovation as an effective approach in managing their innovations. This generated a question whether this new paradigm could be applied to smaller companies or other industries. Accordingly, empirical studies on different company sizes in various industries occurred (see e.g. Chesbrough and Crowther, 2006; Sarkar and Costa, 2008; Lichtenthaler and Ernst, 2009; Van de Vrande et al., 2009; Lazzarotti et al., 2010; Rampersad, Quester and Troshani, 2010). Nonetheless, only a few studies focus on SMEs. According to these studies, only some open innovation activities, mainly inbound ones, are in actual use. However, these companies have sharply increased their attitude towards leveraging external knowledge sources to complement their internal research and development (R&D) activities.

In today's complex, uncertain and competitive environment, companies of all size, particularly small companies, face their own limitations and have the urge to obtain external resources to compensate their weakness. The trend towards open innovation implies that this paradigm seems to be an effective method that can provide companies with their requisite resources and complementary assets, i.e. resources required to capture benefits associated with a strategy, a technology, or an innovation (Christmann, 2000).

Even though it seems that open innovation is appropriate more for small companies than large companies as small companies tend to rely more on external resources, with the limitation of small companies, together with difficulties and risks which could occurred from the adoption of open innovation, it is possible that open innovation, a potential means for large companies to benefits from external knowledge sources, may not be appropriate for product development in SMEs.

1.2 Research Objective and Question

Open innovation has mainly been researched in large companies and high-tech industries but rarely been studied in SMEs although SMEs have crucial role in innovation and worldwide economy. Lichtenthaler and Ernst (2009) mentioned that large companies are main drivers of open innovation. They approach their innovation processes systematically and have sufficient resources for implementing open innovation. In contrast, SMEs seem to have inappropriate structures and resources for implementing open innovation. Therefore it is possible that SMEs face more difficulties and risks, and gain fewer benefits from applying open innovation than large companies so internal R&D may be the better option for SMEs to develop their products.

The research question is “Should SMEs adopt open innovation activities for their product development?” To answer the question, it is important to get insights into motives which influence companies including SMEs to open up their boundaries, challenges including barriers and risks to implement open innovation, and the current practices of open innovation activities in SMEs’ product development. Considering and analyzing these issues allows SME managers to be perceptive and be able to decide whether they should involve open innovation activities for developing their products.

1.3 Scope

The scope of the study is limited to motives, challenges, and open innovation activities - network and outsourcing R&D - the main inbound open innovation activities which are implemented by SMEs for their product development, which do not require substantial human and financial resources, and which have increasing trend towards employing them. The growing rate of the adoption of these two activities in SMEs implies that by implementing these activities, advantages may outweigh disadvantages. Therefore these two activities seem to be appropriate for SMEs’ product development so they are focused in the study.

The study does not consider other open innovation activities, the degree of openness, i.e. the extent that a company conducts open innovation, the search process for external knowledge sources, the integration process of internal and external knowledge, the role of brokers or intermediaries, and any other issues.

2. Methodology

Qualitative methodology is defined as “any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification” (Corbin and Strauss, 1990, p.17). It also emphasizes on subjectivity and flexibility in the process of conducting research (Kohlbacher, 2005). Therefore this methodology is appropriate and is applied to this study in order to seek the understanding of whether open innovation activities is suitable for product development in SMEs which are considered subjective in the world of open innovation.

Document analysis and case study are used as research methods for this study. Case study method is suitable for this study because the research question of this study aims to explore the appropriateness of open innovation activities in SMEs. Moreover, the investigator, i.e. the author, has little control over actual events, and the focus of the research is on a contemporary phenomenon within a real-life context (Yin, 2009, p.2-14). Relevant cases for this study should show the usage of network and outsourcing R&D in product development in SMEs. Due to the lack of connection to exemplars of SMEs employing these two open innovation activities, resulting in the rejection to participate, and the limited timeframe, the author decided to use cases from secondary sources including academic journals and articles. Moreover document analysis is also applied in this study with the aim to provide more clarification on the research question by reviewing and analyzing both existing literature, which provides theories and knowledge in the research area, and case studies which demonstrate real practices of the relevant theories and knowledge (Bowen, 2009). Existing literature is gathered from secondary sources including academic journals, books, websites and articles.

In qualitative research, reliability can be thought of as trustworthiness of the research report (Seale, 1999). It is concerned with the extent to which the study results are repeatable in different circumstances (Bryman, 2001). As the discussion of this study illustrates the viewpoint of the author, different opinions constructed from different logic of thinking could be found. Therefore the reliability of this study is presumed to be relatively low. However as reliability of a research is decreased by the researcher’s bias and perceptions (Denzin, 1978), to avoid this problem, the author would not develop the research by following ideas of any particular researchers but would consider and analyze the literature and case studies, and provide opinion in an unbiased perspective.

Validity is defined as “the extent to which a test measures what it claims to measure” (Gregory, 1992, p.117). In the author’s point of view, the validity of this study is relatively high. As the study seeks to answer whether open innovation activities should be applied for the product development in SMEs, relevant literature and case studies are selected and analyzed. These literature and case studies are gathered from sources which are well researched and written by scholars and professionals so they are viewed as valid sources in this study. Moreover, even though only network and outsourcing R&D are taken into consideration, these are main activities which are currently used for product development in SMEs and have had increasing trend towards adopting them. The trend implies that at some points, these activities yield more positive effects than negative effects for the product development in SMEs so SMEs have increased their interests. Accordingly, these activities are presumed to be appropriate to be used as basis for the analysis of the study.

3. Conceptual Framework

Open innovation is a relatively new innovation paradigm. It emerges in place of the closed innovation paradigm which views that successful innovation requires control and which emphasizes the importance of internal R&D. Companies must generate, develop, build, market, distribute, service, finance, and support their ideas on their own. The closed innovation paradigm has been challenged by various factors which are related to the diffusion of knowledge, thereby knowledge is no longer proprietary to any companies. (Chesbrough and Crowther, 2006, p.208) Moreover globalization, technology intensity, technology fusion, knowledge leveraging and new business models drive companies to engage in open innovation (Gassmann, 2006). A company has to embrace the idea of openness that it cannot innovate in isolation. It has to acquire ideas and resources from external environment. If it can make the best use of internal and external knowledge in a timely and creatively manner for its business, it can become a leading company in the industry.

Before exploring case studies and discussing if open innovation practices are appropriate for SMEs' product development, conceptual framework to delineate the concept of open innovation is provided. The following issues are presented: the concept of open innovation including motives and challenges towards open innovation, open innovation activities including network and outsourcing R&D, and the concept of open innovation in SMEs including motives and challenges towards open innovation in SMEs.

3.1 Open Innovation

Open Innovation is defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough and Crowther, 2006, p.1). It is the paradigm that opens up organizational boundary so that an organization can use internal and external knowledge to develop and commercialize its innovations, and take its internal ideas to market through external channels to generate additional value (Chesbrough and Crowther, 2006). Open innovation happens only when a company works with external knowledge sources or partners (Lee et al., 2010).

Opening up a company's boundary requires significant organizational structure and cultural changes. Tidd and Bessant (2009, p.488-495) showed that characteristics of technology and company affect company's attitude towards acquisition of external knowledge. Characteristics

of technology include competitive significance, complexity, codifiability and credibility potential. Characteristics of company include strategy, capabilities and existing technical know-how, culture, and comfort of management with a given technology. Moreover the degree of company's openness seems to vary according to the company size, the degree of emphasis on radical innovation (Lichtenthaler, 2008), innovation need, time and organizational culture (Mortara and Minshall, 2011). Besides, companies with higher degree of openness tend to have higher level of innovative performance (Laursen and Salter, 2006).

Although external knowledge sources seem to be extremely important assets for companies, internal R&D still holds important value within open innovation. Companies need internal R&D to track and evaluate development outside their boundaries, to create and develop absorptive capacity, defined as "company's ability to recognize, assimilate and apply the value of new, external information to commercial ends" (Cohen and Levinthal, 1990), and to benefit from spillovers. Internal R&D and external ideas and resources are therefore complements rather than substitutes (Dahlander and Gann, 2010).

Open innovation practices differ across companies due to many reasons. One reason is that these companies have different strategic choices as they face different motives, barriers, and risks in implementing open innovation. Attending to these motives, barriers and risks brings useful insights to practitioners.

Motives towards Open Innovation

The primary reason that drives companies to adopt open innovation is the search for growth in revenues and new products (Chesbrough and Crowther, 2006). Other reasons include the sharing of risks and uncertainties, spillover, environmental pressure, the reduction of development time and cost, the reduction of time to market, the access to requisite knowledge and resources, concentration of core competencies, branding, standard setting, utilization of internal creativity, realization of learning effects, and guarantee of freedom to operate by establishing cross-licensing agreements with other companies (see e.g. Kurokawa, 1997; Gassmann and Enkel, 2004; Koruna, 2004; Chesbrough, 2006; Keupp and Gassmann, 2009; Van de Vrande et al., 2009).

Moreover, Innovation impediments also drive companies to adopt open innovation. These impediments include the insufficiency of company's current capability which require higher

skill to implement innovation, and the inappropriate risk management that a company tends to abandon high-risk innovatory activities (Keupp and Gassmann, 2009).

Challenges towards Open Innovation

The risks of open innovation which are frequently mentioned include loss of knowledge, control and core competencies, higher coordination costs, and higher complexity (Enkel et al., 2009). As open innovation leads to resource availability for partners to exploit, it generates difficulty for companies to protect IP and to appropriate the benefits of innovation (Dahlander and Gann, 2010). Joint technology development also creates a problem about the ownership of IP. Moreover, the increase of openness leads to worse timing to market, and slower and costly product development (Knudsen and Mortensen, 2011). According to innovation search, companies tend to restrict their searches to familiar and proximate areas. The search is not costless. It is time consuming, expensive and laborious. Over-search that a company uses too many external sources of knowledge can also negatively affect innovative performance (Laursen and Salter, 2006).

The significant barriers hindering the implementation of open innovation include the difficulty in finding the right partners, the difficulty in evaluating early-stage technologies, imbalance between open innovation activities and daily business, problems with contracts, and insufficient time and financial resources (Enkel et al., 2009).

West and Galagher (2006) showed that companies practicing open innovation face three inherent managerial challenges including maximizing returns to internal innovation, i.e. how to best use internal R&D capabilities of the companies to maximum advantage, incorporating external innovations, and motivating individuals and organizations to generate and contribute spillovers.

Company's culture also prevents the implementation of open innovation. It creates barriers called not-invented-here (NIH) and not-sold-here (NSH) syndromes, i.e. the employees' resistance to knowledge coming in and going out of a company, respectively (Chesbrough et al., 2006, p.17, 23). Additionally a company faces a challenge in sustaining the commitment of open innovation over sufficient time to realize the benefits.

3.2 Open Innovation Activities

Open innovation activities are distinguished into technology exploration and technology exploitation. Technology exploration, or inbound open innovation activities, implies innovation activities used to capture and benefit from external knowledge sources to enhance current product developments. Technology exploitation, or outbound open innovation activities, implies innovation activities used to leverage existing technological capabilities outside the organizational boundaries. (Van de Vrande et al., 2009) With technology exploitation, companies commercialize technology assets exclusively or in addition to their internal application.

At the heart of the open innovation paradigm, competitive advantage, i.e. the strategic advantage a company has over its competitors, often comes from inbound and outbound open innovations activities (Chesbrough et al., 2006). Previous studies found that companies, especially small ones, practice inbound more than outbound open innovation activities (see e.g. Chesbrough and Crowther, 2006; Lazzarotti et al., 2010; Bianchi et al., 2011). Reasons that outbound open innovation activities are not widely practiced include companies' historical reasons, the possibility to use existing relationships, and the fear of diffusing relevant knowledge and giving away their corporate 'crown jewels' (Huizingh, 2011).

Regarding the research of Van de Vrande et al. (2009), network and outsourcing R&D are the major open innovation activities currently implemented by SMEs for their product development and have received increasing trend towards adopting them. Moreover these activities do not require substantial human and financial resources. Therefore these activities are focused as the basis to consider if SMEs should apply open innovation activities for their product development.

3.2.1 Network

In a broad term, network is defined as a set of actors together with a set of links between these actors (Brass, 1992). It reflects various forms of formal collaboration, e.g. joint ventures, alliances, and R&D partnerships, and informal collaboration, e.g. collaboration between individuals built through past relationships (Simard and West, 2005).

Networking with external knowledge sources offers opportunities and threats in R&D processes. The opportunities are related to the role of knowledge in contributing to R&D success, accelerated speed and quality of product development. Threats are related to problems

of motivation, communication and cooperation, and challenges from utilizing external knowledge (Knudsen, 2005). Moreover networking generates costs which are related to network governance and maintenance.

According to Lin and Zhang (2005), main motivations of networking for R&D are:

1. Efficiency: reduce or share risk, reduce development cost and time, increase flexibility, and speed up organizational learning.
2. Competition: avoid direct competition, affect the structure of competition, and sustain competitive advantages.
3. Resources: obtain external resources including finance, expertise, knowledge and competences.

Moreover, network prevents the lock-in or competence traps occurring when a company focuses on its internal knowledge and learns only around known certainties and well-established competencies.

Nonetheless, network is inherently risky. Its potential risks, leading to conflict, include leakage of information, loss of control or ownership, and divergent aims and objectives. The problem of information leakage is greatest when networking with potential competitors (Littler, 1993). Closed relationship can lead to inertia and constrain innovation, which prevent the introduction of superior technologies or products. Moreover when discontinuous events occur, existing relationship to which members are committed can lead to bad performance. (Tidd and Bessant, 2009, p. 283-305) Besides, the lack of agreement between members can paralyze or delay the product development process (Garette and Dussauge, 2000).

Not all networks succeed. They need to be managed and nurtured. They require time to be mature. Reasons for failure include strategic divergence, procedural problems and culture mismatch. Moreover people factors, e.g. high levels of commitment, communication and trust are more important than strategic factors, e.g. technological, market or product fit. Besides economic, social, cultural and industrial factors should be taken into consideration to build a successful network (Lin and Zhang, 2005; Tidd and Bessant, 2009, p.478-499).

As different external knowledge sources or partners provide different benefits, it is crucial for companies to carefully select them. Many studies addressed that using a wide range of sources has a positive impact on innovation performance and the degree of innovation novelty of a company (Zeng et al., 2010). However Knudsen and Mortensen (2011) showed that higher

partner variety, i.e. more partner types and partner number, leads to increasing complexity and managerial difficulties.

Distributors: Due to their closeness to the market, distributors can offer manufacturers accurate description of the end consumer's current demands and dynamics as well as market intelligence on competitors and other agents.

Users: Collaboration with users for product development offers a company complementary knowledge, defined as "low degrees of redundancy in the form of dissimilar product development knowledge and skills" (Knudsen, 2005), helps strike a balance between performance and cost for the standard setting of product, and enhances company's understanding of customer behavior.

Suppliers: A company collaborates with its suppliers to consolidate and enhance its core competencies, reduce its development time and cost, shorten its innovation and market cycles, and improve the efficiency and the performance of its innovation.

Competitors: Cooperation with competitors is good at basic research and establishment of technical standards. Competitors can form strategic alliances without prejudice to their competitive advantage to share resources and product development costs and risks, as well as to access to economies of scale. In this way, they can develop and bring the products to market more quickly and compete with larger competitors.

Universities and research institutions: Companies work with universities or research institutions to complete a technological innovation. The beneficial resources that universities and research institutions provide include professionals, scientific equipment, knowledge and IPs, technical information, research methods and experience. (Li et al., 2010)

3.2.2 Outsourcing R&D

Outsourcing R&D is another useful means which can help a company to maximize innovation and performance, minimize risks and costs, bring in requisite resources and complementary knowledge from partners so the company can concentrate on its core competencies, and to prevent internal resistance to external ideas.

Howells et al. (2008) showed that companies of all size are active in outsourcing their R&D, and their decision bases on various factors including the type of R&D activity, the retention of

core competencies, their ability to reabsorb knowledge, the leakage of proprietary knowledge and IP, and the degree of uncertainty, task modularity and knowledge tacitness.

Outsourcing R&D may not increase a company's profitability or performance. There are some issues needed to be aware of. Firstly there are high levels of risk and uncertainty associated with the outcome of outsourcing R&D. Secondly outsourcing R&D can be undertaken only if gains from outsourcing partners' efficiency are higher than gains from internal efficiency. Therefore partner selection is significant as suitable partners can assist companies in lowering development costs and increasing financial performance. Thirdly the central importance of R&D relates to core competencies and capabilities of the company. Outsourcing wrongly can have a major impact on the long-term future of the company. Moreover there are hidden costs, related to the complexity of outsourcing R&D and the integration of external and internal knowledge, which significantly impact on the costs of outsourcing R&D. (Howells et al., 2008; Huang et al., 2009)

3.3 Open Innovation in SMEs

According to European Commission, SME stands for small and medium-sized enterprises and is categorized into medium, small and micro enterprises. Medium-sized enterprises are defined as enterprises employing fewer than 250 persons and whose annual turnover does not exceed 50 million euro or annual balance sheet total does not exceed 43 million euro. Small enterprises are defined as enterprises employing fewer than 50 persons and whose annual turnover or annual balance sheet total does not exceed 10 million euro. Micro enterprises are defined as enterprises employing fewer than 10 persons and whose annual turnover or annual balance sheet total does not exceed 2 million euro (European Commission, 2012).

SMEs are significant drivers of economic growth. In any national industrial system, the percentage of SMEs is close to 90% of the total number of enterprises, and the percentage of personnel employed in SMEs is greater than 60% of the active population (Villa and Antonelli, 2009).

SMEs are also important for an economy's innovative capacity. They have increased their R&D budget faster than large companies. According to the industrial R&D spending in the United States from 1981 to 2005, large companies decreased the spending from 70% to 38% while small companies increased the spending from 4% to 24%. In terms of the amount of

spending, it was increased by a factor of 4 by large companies, compared to a factor of 40 by small companies. (Chesbrough, 2010)

The smallness of SMEs makes SMEs unfettered by bureaucracy and provides various advantages for the competitiveness of SMEs. These advantages are described as following. Firstly, the small size of SMEs makes them interest in small markets which mostly are ignored by large companies whose overhead costs are too high to be cost-effective. This allows SMEs to exploit new trends sooner when entry costs are quite low. Secondly, SMEs have small range of products so they can focus on particular markets, customer types, expertise or technologies and can specialize their business more deeply in narrow fields that they can sell their capabilities to a wider range of customers and markets. These focus and specialization lead to a sustainable competitive advantage of SMEs. Thirdly, given the flexibility provided by the small size of SMEs, SMEs make and implement their decisions faster, react more quickly to input from customers or challenges from competitors, adjust their business models more rapidly, and in many circumstances learn faster than large companies. Consequently SMEs potentially have a competitive advantage in fast changing environments. Lastly, SMEs seem to attract more entrepreneurial R&D employees as product and market orientation in SMEs is higher than in large companies. This promotes extensive experimentation with alternative business models. (Chesbrough, 2010; Knight, 2001)

Due to these advantages of SMEs, larger companies increasingly partner with SMEs to economize their R&D, minimize their lead-time for new products and serve emerging markets (Matt and Ohlhausen, 2009).

Nonetheless, SMEs have higher degree of limitations than large companies. Consequently, different motives, challenges and open innovation activities between SMEs and large companies can be anticipated.

Motives towards Open Innovation in SMEs

Studies show that different open innovation activities in SMEs seem to have the same underlying motives that the most important motives are market-related. SMEs employ open innovation activities to keep up with market developments, meet customer demands, improve product developments, integrate new technologies, reduce costs, and prevent companies from being outperformed by competitors, which eventually results in increased growth and revenue, or increased market share. Moreover, SMEs use open innovation activities for the concentration

on their core competencies, knowledge acquisition and effective innovation process. Motives related to control, focus, and cost are not the main reasons to practice open innovation in SMEs. (Van de Vrande et al., 2009; Lee et al., 2010)

Challenges towards Open Innovation in SMEs

Although the small size provides various benefits to SMEs, it also provides deficiencies which impede SMEs from implementing open innovation. The primary deficiencies are the lack of resources including human, financial capital, knowledge and time, and the lack of well-structured innovation process of SMEs. Regarding the lack of resources, typical SMEs cannot afford dedicated resources to identify, search for and gather useful external knowledge, and to collaborate with external knowledge sources. Moreover, inappropriate structure of innovation process and the lack of resources of SMEs lead to SMEs' inability to effectively absorb external knowledge, combine external knowledge with internal knowledge and exploit the combined knowledge. Additionally the lack of expertise and market power to capture the value of external knowledge of SMEs leads to SMEs' inability to expect benefits from external knowledge and justify the investment in pursuing the knowledge. (Kaufmann and Tödttling, 2002; Chesbrough, 2010)

Moreover, due to their smallness, SMEs are often considered unattractive partners. Mostly, they lack of relations with innovation partners, specifically from science and technology, e.g. universities, and research organizations, which constrains positive external influences on the companies' innovation process. SMEs also rarely have available financial resources to provide funding to support promising academic research which may become a cooperative innovation project. (Kaufmann and Tödttling, 2002; Chesbrough, 2010)

In terms of managerial challenges, major barriers to implement open innovation are related to organization and corporate culture (see e.g. Van de Vrande et al., 2009; Villa and Antonelli, 2009).

Besides, most SMEs have limitation to protect IP and appropriate benefits of innovation because they lack of power, efficient method and financial capital to protect imitation and enforce patent infringement. If any companies infringe SMEs' patents, SMEs may decide not to act against them as this is not a viable option for SMEs. (Kitching and Blackburn, 1998; Chesbrough, 2010)

4. Case Studies

This section describes and discusses case studies related to the usage of network and outsourcing R&D for the product development of SMEs. These case studies show the importance of open innovation in both conservative and innovative markets, i.e. food market and IT market. As SMEs in these two cases have well-designed strategies for the implementation of open innovation activities, this results in the positive effects for SMEs in adopting open innovation activities.

The first case demonstrates the network of Italian SMEs and their various external knowledge sources. This case shows that even in the tough market, e.g. food sector, networking can help SMEs to improve their product development.

The second case illustrates how Taiwanese SMEs decide to develop technologies or products internally or outsource these technologies or products to other companies in order to handle the dynamic and competitive IT industry.

4.1 Italian SMEs in food sector: Network

The food market in general is not supportive for product development as the market is highly saturated, consumers tend to be conservative about their food preferences and the failure rate of new products is relatively high, 60-80%.

The study of Colurcio et al. (2012), which interviewed five Italian SMEs in food sector, showed that network can improve the product development of SMEs in this tough market. The study also showed the importance of various external knowledge sources which provide different knowledge to SMEs. This knowledge was then exploited effectively in SMEs' product development.

Italian SMEs see the product development as a crucial leverage of the companies' competitiveness. Their product development is conceived as a network affair and every company shows a well-designed network strategy approach. Their product development relates strongly to how companies engage in their dynamic network context. Their external knowledge sources are distinguished into retailers/distributors, business customers, suppliers, competitors, and universities and research institutes and are detailed as following:

Firstly, retailers/distributors are critical knowledge sources for SMEs' product development. They provide SMEs the description of customer demands.

An SME stated about its retailer as *“Thanks to the cooperation with [company name] we developed a new offer of pasta (new shape, new size and new characteristics). The channel relationship we built together was the beginning, for us of a path oriented toward the value creation for our customer.”* (Colurcio et al., 2012)

Another SME talked about its distributor as *“The partnership with distributors has allowed us to diffuse the knowledge about our innovation. After the first stage of a commercial partnership, we began a cooperative process to improve our products. Distributors provide us with input and information continuously. They are a fundamental source of market knowledge for the development of product innovation.”* (Colurcio et al., 2012)

Secondly, in many cases, business customers contribute heavily to the product development regarding techniques and knowledge assets.

An SME talked about its business customers as *“The things I learned from the customer and his agronomists are numerous and amazing things, but I showed them things about the field that they could not have ever imagined. Working together in the field, as in a laboratory, we can do great things.”* (Colurcio et al., 2012)

However this kind of relationship is customer-dominated. These customers often control suppliers, pressure suppliers into exclusivity, and control the new product development.

Thirdly, suppliers contribute to product development processes by providing different kinds of input including competencies, technology, and consultancy. Moreover, suppliers of equipment and packaging provide important input in the realization of new products through new materials and new applications.

An SME stated about benefits derived from its supplier as *“Our first partner in innovation is our packaging supplier: thanks to his proposal we have been able to develop a new cheese with great appeal. The supplier not only advised a new product (a window packet), but he helped us to use it as marketing tool. Through window packets, today we propose an offer of mozzarella cheese that is unique on the market.”* (Colurcio et al., 2012)

The relationship between SMEs and their suppliers is dynamic, continuous and systematic. Sometimes suppliers even financially support the development of specific products.

Fourthly, competitors are also a source of knowledge for these SMEs. The development of a competitive network can be beneficial because such relationships often lead to the acquisition

of strategic competitive information, which allows a better understanding of the company's opportunities.

Lastly, the involvement of universities and research institutes in the SMEs' network is very strong. Sometimes they collaborate only on specific projects. This can be seen from the following statement. *"We collaborated with a university just for the development of a new product. It was great, but now we are not in touch. There are a lot of ties to cooperation, first of all the lack of resource."* (Colurcio et al., 2012)

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Obviously, network helps Italian SMEs to get new opportunities and enhance their product development. SMEs derive different kinds of knowledge from different external knowledge sources, e.g. knowledge in customer demands from their retailers and distributors and knowledge in techniques and assets from their business customers, and exploit the knowledge in the practical way.

The reason that they can absorb external knowledge and can exploit it effectively seems to be from their well-designed network strategy and their perception of the importance of network, implying that the resistance to external knowledge of their employees is relatively low, if any. This is illustrated in the statements *"Italian SMEs see the product development as a crucial leverage of the companies' competitiveness. Their product development is conceived as a network affair and every company shows a well-designed network strategy approach."*

Moreover, different forms of collaboration have been used, e.g. informal collaboration with retailer, formal collaboration with distributor, and short-term collaboration to develop a new product with a university. This depends on product development projects and network strategies of companies which should be adapted overtime.

Nonetheless network does not always provide benefits to SMEs. This can be seen from the relationship between SMEs and their business customers that is customer-dominated. This can affect the innovativeness and the competitiveness of SMEs.

However, in the author's point of view, SMEs can just collaborate informally with external knowledge sources in their supply chains in their beginning phase of adopting open innovation in order to obtain knowledge from these sources to improve their product development and core competencies and in order to develop their network strategies. It is easier for SMEs to build relationship with external sources in their supply chains as they already have mutual business

benefits. Moreover, the informal form of collaboration does not seem to increase managerial complexity. Once relationships are stronger and trust is built, they can shift form of collaboration to be more formal, involve other external knowledge sources which are not in their supply chains and co-develop new products.

4.2 Taiwanese IT SMEs: Outsourcing R&D

Taiwanese IT industry is one of the world's leading suppliers of computer products. It is characterized as fragmented, dynamic, innovative, highly competitive, and quick learning. It mainly consists of SMEs. R&D sourcing, i.e. internal R&D and outsourcing R&D, plays an important role in maintaining the competitiveness of companies in the industry

The study of Huang et al. (2009), based on case studies and surveys of Taiwanese IT SMEs, illustrated that these SMEs often decide to internally develop products for which they possess sufficient technological competencies or products that are likely to generate substantial income, and outsource technologies that they do not currently possess or technologies that are easily codified for contracting out. This is manifest by the statements of two interviewed managers.

R&D manager from an SME stated: *“Our company has limited R&D staff and resources. Therefore, we must effectively utilize all our available resources on key projects and acquire external resources, when necessary, to develop other products. For example, SCSI chipset is our core technology and therefore, we have made long term investments on this technology. We have put in a lot of resources in designing and developing our core chipset technology and at the same time, have outsourced other less important subsystems to external contractors... We have manufactured and marketed many of these more profitable high-tech chipsets by ourselves in order to maximize our revenue... We have outsourced the low-tech subsystems and other related products to external contractors in order to lower our development costs.”* (Huang et al., 2009)

A senior project manager from another SME stated: *“At that time, the core competence of our company was hardware design and we were a bit weak in software design and engineering...But we found that MP3 player was an exciting new product and only a handful of firms were capable of manufacturing it. It would be a big profit generator for us. Therefore, we decided to outsource the software components to external contractors and as a result had significantly lowered the technical complexity of the product for us. This had enabled us to*

become one of the very few firms to sell the MP3 players in the Taiwanese market. We had made a handsome profit by using this R&D sourcing strategy.” (Huang et al., 2009)

Moreover, these SMEs tend to adopt both R&D outsourcing and internal R&D with a high degree of flexibility to improve their organizational capabilities and to reach their business goals, e.g. to minimize development costs or to maximize profits.

In summary, the study suggested that when selecting R&D sourcing strategy, the level of product innovation, e.g. low-tech, medium-tech, or high-tech, should be considered together with the level of technological determinants, i.e. technological codification and technological competence, to obtain the intended outcomes.

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This case shows that characteristics of technology and company have strong influence on the decision of companies to use internal R&D or outsourcing R&D to develop their technologies and products.

To effectively utilize their insufficient resources, SMEs need to thoroughly analyze characteristics of companies and technologies to be developed before deciding which technologies should be outsourced and which should be internally developed. For example, MP3 player was the product that the second SME interested and only a few firms were capable of manufacturing it. Accordingly MP3 player technologies, consisting of hardware and software technologies, were considered to provide competitive significance for the SME. As the SME was strong in hardware design and weak in software design and engineering, i.e. the company had sufficient capabilities and existing technical know-how in hardware technologies but not in software technologies, the company decided to outsource software components to external contractors and developed hardware components internally.

However the statement of R&D manager of the first SME *‘we must effectively utilize all our available resources on key projects and acquire external resources, when necessary, to develop other products.’* implies to the author that even for other less important products, if the company had enough resources, it would not acquire external resources. The reason may be because the technologies which SME considered less important may become highly-advantageous technologies. Moreover due to the nature of IT industry, which is highly competitive and quick learning, the company may be scared of losing its competitive position in the market as other companies could learn from its knowledge and become its fast followers, if it revealed the knowledge to external companies.

5. Discussion

To achieve in product development, it is important for SMEs to concentrate on their core competencies which are significantly important for the development of products and the competitiveness of the companies. To do so, SMEs have to continuously acquire new knowledge, which can be obtained from in-house development or from external knowledge sources, and effectively exploit the knowledge to develop their core competencies. Table 1 summarizes the advantages and disadvantages, which were elaborated under chapter three, of involving external knowledge sources for the product development of SMEs.

When considering the content in chapter three *“Although external knowledge sources seem to be extremely important assets for companies, internal R&D still holds important value within open innovation.... Internal R&D and external ideas and resources are therefore complements rather than substitutes.”*, case studies which show positive results in SMEs which derived from adopting both internal R&D and open innovation activities, as well as advantages and disadvantages of in-house development and external knowledge sources, the author suggests that, to obtain the best result, SMEs should adopt open innovation activities as complementary approaches to their internal R&D for their product development. The followings are implications for the adoption of both internal R&D and open innovation activities.

First of all, SMEs should use internal R&D as well as external knowledge, which can be derived from informal collaboration, to build and strengthen their core competencies and their main product development. Using the informal form of collaboration does not need the significant change of the companies' structures. Moreover, without revealing their core knowledge, SMEs can avoid the problems of IP protection, the appropriateness of innovation benefits, the loss of core competencies and other risks which could incur from exposing its core knowledge outside the companies. An example can be seen from the Italian SMEs case study that an SME informally collaborate with its retailer. This SME still internally developed its food process while used knowledge derived from its retailer for the development of new pasta.

However, obtaining only knowledge may not be sufficient. SMEs may lack of other resources necessary for developing their core competencies, e.g. equipments, expertise and financial capital. SMEs therefore have to increase their degree of openness by networking with, by means of formal or informal form of collaboration, or outsourcing to external knowledge sources to obtain these necessary resources. An example can be seen from the Taiwanese IT SMEs case that the second SME was weak in software design and engineering, core

components of MP3 player, and seemed to lack of equipment, expertise and knowledge to develop them. Therefore the SME had to outsource the software components to external contractors.

Table 1 – Summary of advantages and disadvantages of involving external knowledge sources for the product development of SMEs

Source: Kurokawa, 1997; Gassmann and Enkel, 2004; Koruna, 2004; Chesbrough, 2006; Chesbrough and Crowther, 2006; Keupp and Gassmann, 2009; Van de Vrande et al., 2009, Enkel et al., 2009; Dahlander and Gann, 2010; Knudsen and Mortensen, 2011

Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduction of risks and uncertainties • Increase of growth in revenues and new products • Improvement of product developments • Increase of current capability and performance • Reduction of development time and cost • Keeping up with market developments and customer demand • Access to requisite knowledge and resources • Concentration on core competencies • Prevention of lock-in or competence trap • Utilization of internal creativity • Speed up organizational learning • Spillover • Branding • Guarantee of freedom to operate 	<ul style="list-style-type: none"> • Loss of knowledge, control and core competencies • Increase of management difficulty • Difficulty to find right partners and evaluating early-stage technologies • Difficulty to protect intellectual property and to appropriate the benefits of innovation • Increase of development time and cost • Imbalance between open innovation activities and daily business

Nonetheless, by increasing the degree of openness, SMEs have to come up with structural changes and appropriate approaches to minimize threats to their knowledge and their co-

developed knowledge, e.g. by using informal (see e.g. Kitching and Blackburn, 1998) or formal IP protection.

Universities and research institutes are good sources in science and technology knowledge for SMEs to develop their core competencies and products. This kind of knowledge sources does not involve with business benefits of SMEs. Therefore SMEs will gain knowledge from collaborating with them and do not have to worry about problems from revealing their knowledge to universities and research institutes.

For other less important competencies, SMEs can outsource or network with external knowledge sources to develop these competencies so the companies can focus on their core competencies and can utilize their insufficient resources effectively. An example is derived from the case of Taiwanese IT SMEs that the first SME outsourced its other less important subsystems and other related products to external contractors to utilize its available resources on key projects and to lower its development costs.

The author suggests that SMEs should use open innovation activities for their core competencies only when necessary and can use these activities for their other less important competencies because SMEs specialize in small range of technologies and have limitation of the ability to protect IP and to appropriate benefits of innovation as mentioned in chapter three. If their core knowledge of these technologies is leaked and is imitated or utilized by other companies, it is hard for SMEs to act against these companies. This can also lead to the demise of SMEs.

Besides, by using internal R&D as a main approach to develop SMEs' core competencies and using open innovation activities to develop other less important competencies and to complement the development of their core competencies, the resistance to the incoming and outgoing knowledge of their employees should be minimal.

Moreover, SMEs, which have gained experiences in adopting open innovation activities and have appropriate IP protection mechanisms, can increase the degree of the involvement of external knowledge sources for their core competencies in order to increase more benefits from the external knowledge sources (see Advantages in Table 1). Additionally, the author suggests that SME should adjust their open innovation strategies overtime by taking risks and barriers of open innovation and its activities, presenting in chapter three into consideration.

6. Conclusion

In conclusion, the author suggests that SMEs should adopt open innovation activities as complementary approaches to their internal R&D for their product development.

SMEs should use internal R&D, together with external knowledge to develop their main products and core competencies while they should use open innovation activities for their core competencies, only when necessary, and can use open innovation activities for their other less important competencies. The reason is that SMEs have to protect the leakage of their core knowledge as the leakage can lead to the demise of SMEs.

Moreover, SMEs with experiences in adopting open innovation activities and appropriate IP protection mechanisms can increase the degree of the openness for their core competencies to gain more benefits.

Additionally, SME should adjust their open innovation strategies overtime by taking risks and barriers of open innovation and its activities into consideration.

7. Limitations and future researches

As the analysis of this study is based on secondary sources, empirical studies by means of interview or survey to confirm or reject the conclusion of this study should be carried out. Furthermore, other aspects, such as the search process for external knowledge sources and the integration process of internal and external knowledge, have not been taken into consideration. Future research should broaden the scope by including these aspects in the study as these aspects are believed to affect the decision of SMEs whether to involve open innovation for their product development.

Moreover, most researches investigated and outlined the positive effects of open innovation while only a few researches looked into the negative effects. The failure of companies implementing open innovation activities has rarely been studied. Therefore these negative studies should be conducted in greater details.

Finally, qualitative and quantitative researches about the effect and performance of various open innovation activities on short-term and long-term goals of SMEs could also be developed to reflect the appropriateness of these open innovation activities for each specific goal of SMEs.

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