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**How Open Innovation practises of SMEs in
in Baden-Württemberg can be advanced
through the use of value networks**

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Abstract

La presente tesi nasce a conclusione di un percorso di studi svolto in parte in Germania, dove nella Hochschule Heilbronn, è stata approfondita la tematica dell'Open Innovation e del networking. L'intento di questo lavoro è di analizzare come le piccole e medie imprese della regione del Baden-Württemberg si approcciano alle varie pratiche legate all'Open Innovation e al networking, quali sono i benefici che ne traggono, quali invece i rischi in cui potrebbero incorrere e i costi di tali pratiche.

La ricerca si svilupperà prima nel comprendere la teoria dell'Open Innovation nelle sue varie sfaccettature, procedendo poi con l'analisi di due piccole-medie imprese locali attraverso dei casi di studio. L'analisi è stata effettuata attraverso interviste ai manager responsabili, traendo e comparando successivamente i risultati ottenuti.

1. Introduction

Open Innovation as we know it today, was first introduced by Chesbrough in his 2003 book “Open Innovation: The New Imperative for Creating and Profiting from Technology”¹. Open Innovation assumes that firms can and should take and use external ideas as well as internal ideas originated in the firm in order to improve their innovations. Chesbrough and Bogers expanded the definition of Open Innovation describing it as “a distributed innovation process based on purposively managed knowledge flows across organizational boundaries”². It has become a popular area of innovation research and currently it is extending into a wide set of areas such as: small and medium-sized enterprises (SMEs); different high and low-tech industries; not-for-profit organizations; public policies to support open innovation processes³. In addition, through a number of collaborations and transactions, companies may create value and benefit from the so-called value networks⁴. Networking is an important way for companies to acquire additional knowledge and skills for innovation processes and to increase

¹ Keith G., Rick M. (2017). *Enlarge Innovation Management* (3rd Edition), Effective strategy and implementation, pp. 60-61.

² Chesbrough, H., Bogers M. (2014). Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *New Frontiers in Open Innovation*, p. 12.

³ Bogers M., Chesbrough H. and Moedas C. (2018). *Open Innovation: Research, Practices and Policies*, pp. 6-7.

⁴ Romero D., Molina A. (2011). *Collaborative Networked Organisations and Customer Communities: Value Co-Creation and Co-Innovation in the Networking Era*, pp. 1-2.

their innovation capability⁵. Collaborations and networks become a way to facilitate the innovation process, increase the likelihood of success in developing new products and services and cover the resource gaps of the companies⁶. Unfortunately, there is still some research gap on Open Innovation strategies and framework for SMEs, as well as in the existing literature about value networks for SMEs⁷.

This thesis examines the role of Open Innovation in SMEs by means of a complete literature review and, then, by performing a field study. The latter will focus on manufacturing SMEs in Baden-Württemberg, which is the third German most important Land (Federal state) for manufacturing, with approximately 99% of the firms being SMEs. Based on the Regional Innovation Scoreboard of 2019 it can be seen that the Stuttgart region, as well as the other regions of Baden-Württemberg are considered innovation leaders. It becomes then interesting to examine the SMEs' approach to Open Innovation and to collaborations with external actors. Moreover, the Baden-Württemberg Cluster Database counts roughly 110 cluster initiatives and state-wide networks, where around 76% of the members are small and mid-sized companies. Although the region is very engaged

⁵ Ye J., Kankanhalli A. (2013). Exploring innovation through open networks: A review and initial research questions, pp. 5-6.

⁶ Ndou V., Del Vecchio P. and Schina, L. (2010). Open Innovation Networks: The Role of Innovative Marketplaces for SMEs Value Creation. *International Journal of Innovation and Technology Management*, Vol. 8, No. 3, pp. 440-441.

⁷ Hossain M., Kauranen I. (2016). Open innovation in SMEs: a systematic literature review. *Journal of Strategy and Management*, Vol. 9, Issue 1, p. 67.

in innovative practices, some research is needed to better understand the phenomenon of collaborations between SMEs and/or with other institutions.

The thesis is organized in the following chapters. The second chapter will give a definition of Open Innovation, through the explanation of its characteristics, the evolution from the closed model to the Open Innovation paradigm and the various categories of Open Innovation.

The third chapter will take into consideration Open Innovation as a tool for SMEs, explaining the main benefits and challenges that may derive from it, the role of networking and how innovation intermediaries may take action helping SMEs.

The fourth chapter will first introduce the research gaps, questions and objectives of the empirical analysis and, then, the description of the economic context of Baden-Württemberg. After that the chapter will present the methodology used and the case studies of two SMEs located in the region. The analysis will show which Open Innovation practices they use, the role of networking and what are the main benefits, risks and costs of these practices.

2. Definition and Characteristics of Open Innovation

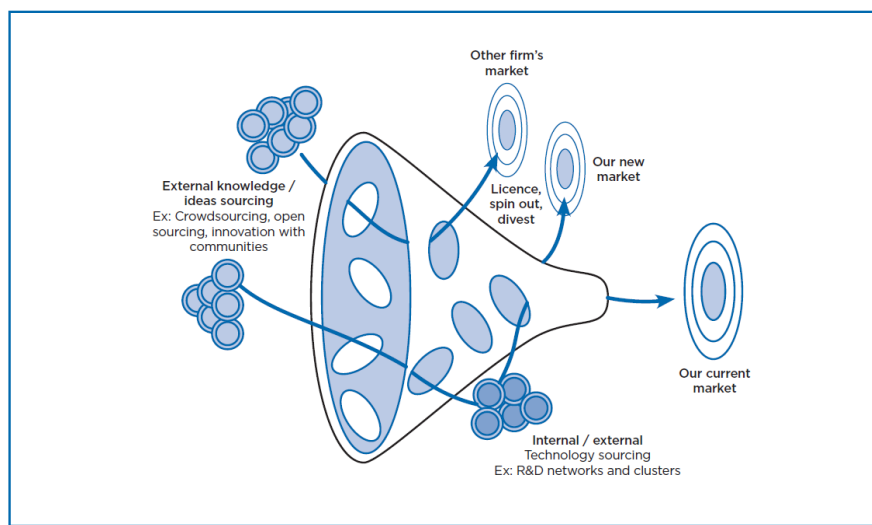
Through the decades social, economic, political and environmental factors have brought to change innovation models and companies' approach to innovation. The scholar Chesbrough, who coined the term "Open Innovation" explains in his book "*Open Innovation: The New Imperative for Creating and Profiting from Technology (2003)*" how companies have modified their approach to innovation from the so called Closed Innovation paradigm used for much of the 20th century to an open way of innovating. This open approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths to market during the Closed Innovation era. One of the main ideas behind the open innovation model is that not all good ideas are developed within the own company and not all ideas should necessarily be developed within the firm's boundaries⁸.

This could also be summarized by Joy's Law according to which most smart people work for someone else and embed the idea that the sources of knowledge of innovation are widely spread in the economic environment (Chesbrough and Bogers, 2014).

⁸ Chesbrough H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, pp. 43-44.

Open innovation can be seen as the overcoming of the traditional vertically integrated approach of closed innovation where internal R&D activities lead to

Figure 1: The Innovation funnel



Source: Wheelwright & Clark (1992) and Chesbrough (2003)

internally developed products that are then distributed by the firm. There are three main forms of open innovation: one is the “outside-in” aspect, where external ideas and technologies are brought into the firm’s own innovation process. The second kind is the “inside-out” part, where not utilized ideas and technologies in the company are allowed to go outside to be taken by other firms. Last we have the “coupled innovation process” which combines the inbound and the outbound

flows⁹. The business model becomes one crucial part in the open innovation approach since it enables the company to be more efficient in creating and capturing the value of the new idea or technology. A business model allows to use company's key asset, resources or position (Chesbrough, 2003).

⁹ Gassmann O., Enkel E. (2004). Towards a Theory of Open Innovation: Three Core Process Archetypes. R&D Management Conference, pp. 5-6.

2.1 Defining Open Innovation

The first definition given by Chesbrough of the term Open Innovation was in 2003 and it described companies' use of external ideas, technologies and R&D but at the same time also the phenomenon of making available internal ideas and technologies to other companies. The definition was then further enriched in 2006, describing open innovation as "purposive inflows and outflows of knowledge" (Chesbrough and Bogers, 2014). In fact, this definition recalls some literature on spillovers which could result from investment in R&D done by the companies itself. Indeed, these spillovers are unexpected outcomes of these investments in R&D which the companies can't always benefit from (ibidem). As cited in Chesbrough and Bogers (2014), Nelson and Arrow found between 1959 and 1962 that researches done in R&D by companies would not be able to benefit entirely from spillovers generated by these researches and that the one benefiting the most is the social aspect (social return) rather than the company with private return. Since spillovers are considered a big cost that is not easy to manage by the firms, the open innovation model had to be based on "*inflows and outflows of knowledge purposively managed*". In 2006 the definition of open innovation was further extended by Henry Chesbrough as "*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business*

model. These flows of knowledge may involve knowledge inflows into the organization (leveraging external knowledge sources through internal processes), knowledge outflows from a focal organization (leveraging internal knowledge through external commercialization processes) or both (coupling external knowledge sources and commercialization activities)” (ivi, p.12).

The last definition given to Open Innovation by Chesbrough and Bogers which is “*Open innovation is a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanisms in line with each organisation’s business model.*” adds a fundamental part of the open innovation process which is exactly the business model (ibidem). Through the use of a business model the firms can figure out what should be internally supplied and how to integrate both internal and external elements together into the company. The business model is a useful framework to organize the distributed innovation process and it describes not only how the value is created within the value network but also how it is captured by the involved companies and organizations.

2.2 From the Closed Model to the Open Innovation Paradigm

Since the 20th century companies have adopted the so-called Closed Innovation model which implied to create ideas and introduce them to the market controlling them internally¹⁰. The main idea of Closed Innovation is to develop and exploit internally R&D in order to profit from it and commercialize it and keep the IP internally. The Closed Innovation model suited well to the economic environment of the 20th century since there was a lack of involvement of universities and government in the research and development field of industrial and commercial activities (ivi, pp. 50-52). This phenomenon pushed the firms to develop their own R&D departments to internally control the product development cycle. Between the end of the 2nd World War and the 80s this model of innovation had a major success since many firms were obtaining big results from scientific research and R&D research. The development of internal R&D research was seen as a competitive advantage and a barrier for new competitors.

The Closed Innovation model is a traditional vertically integrated model (from manufacturing tools to after sale services) which means that the company has to count on itself for the supply chain. What was coming from the outside was

¹⁰ Rexhepi G., Hisrich R. D., Ramadani V. (2019). Open Innovation and Entrepreneurship. Impetus of Growth and Competitive Advantages, Springer, pp. 39-40.

suspicious and not reliable, from which derives the term “Not invented here” (Chesbrough, 2003). In the Closed Innovation Model there was a tension created between the Research and the Development departments since they both had different objectives and priorities. Research is about exploration of new frontier and discover something that can't be predicted or anticipated. The research centre is not likely to work with time constraint and research is generally structured as a cost centre with the goal of staying within the budget. Development instead implements and uses the output of research as an input for its own process. Development function with time and budget constraints and it's structured as a profit centre (ivi, pp. 32-34).

In order to make a compromise between Research and Development, many companies started to set buffer between these two departments storing a technology generated by the Research department and wait to be taken over by the Development (ibidem). The Closed Innovation model was successful because firms were able to invest in R&D and capture a significant fraction of the value of created technologies by putting them on the market. But in order to maintain this advantage their qualified people had to stay in the company and IP had to be carefully protected. Meanwhile, in various industrial sectors, several factors have contributed to the erosion of the closed innovation model paradigm (Chesbrough, 2003). There are four main erosion factors that contributed to the loss of success

of the closed model paradigm: the increase of the availability and mobility of skilled people, the increase of the number of Venture Capitals, the alternative to the “shelf” and the increase of qualified suppliers. Firstly, the improvement of the average level of education in the world and the increase of the investment in education brought positive effects to the mobility of highly educated work force (ibidem). Consequently, the increase of mobility and availability of skilled workers limited the possibility for companies to maintain their control over the human resources and keep their qualified people. The second main erosion factor was the major increase of venture capitals after the 80s which facilitated the creation of start-ups. The third erosion factor is caused by the first two ones: thanks to the increase of mobility and availability of skilled workers and the increase of venture capitals there are now alternative ways to access markets. Instead of keeping a new technology or invention on a “shelf”, it can now become property of its inventor, who can create a start-up. The appearance of venture capitals has facilitated the emergence of start-ups and has increased the risk for established companies to have an abandoned idea or technology leave the company with their inventors before being able to capture its value (ivi, pp. 36-39). The Open Innovation paradigm instead is in contrast with the traditional vertical integration model, which consists of utilizing internal resources related to innovation and develop them internally. Open Innovation claims that companies should glean both internal and external sources to create an R&D open system. Is

important to highlight that the Business Model has a central role in Open Innovation, since it is a tool to create value and evaluate R&D projects and it develops economic value from technological potential (Chesbrough, 2006). A business model mainly defines the value proposition that the company intends to offer to the consumers, determines the market segment, structures the value chain, estimates the cost structure, evaluates the position of the company in the value network and at the end defines a competitive strategy to gain an advantage over competitors (ivi, pp. 62-64). Innovation results to be one of the main drivers of growth in a company, but most of the time the one utilized by the organizations is the Closed Innovation, which from many researches results to be more limiting (Rexhepi, Hisrich and Ramadani, 2019). Open innovation is a concept that encourage companies to use as resources customers, competitors, universities and other organizations (ibidem). To summarize shortly the two concepts, the table that follows underlines the main differences between Closed Innovation Principles and Open Innovation Principles.

Table 1: Contrasting principles of closed and open innovation

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

Source: Yildirim and Demirbağ (2015)

Despite the contribution of some studies, there hasn't been enough discussion about the benefits and risks of Open Innovation processes in small and medium enterprises (SMEs) as mentioned before¹¹. Open Innovation affects smaller firms differently from large firms since smaller firms lack the resources and often lack strong protection of their intellectual property. Studies done by Lichtenthaler have shown that SMEs should establish a well-balanced degree of openness, that would not lead to unnecessary costs if over-used but at the same time would not lead to miss big opportunities if not exploited¹².

¹¹ Hossain M., Kauranen, I. (2016). Open innovation in SMEs: a systematic literature review, *Journal of Strategy and Management*, 9(1), pp. 67-68.

¹² Lichtenthaler U. (2008). Open innovation in practice: an analysis of strategic approaches to

Open Innovation can provide indirect benefits for SMEs, such as awareness, network and reputation. Even though there isn't yet an absolute empirical evidence which Open Innovation practises may improve innovation performance and which don't, studies confirm that as a whole, Open Innovation can affect positively the performance of SMEs. Hossain and Kauranen suggest to deepen what motivates the SMEs to shift to openness and how they should approach and level of engagement to networks, which are the benefits they can gain and therefore see which network suits better SMEs (Hossain and Kauranen, 2016).

2.3 Categories of Open Innovation

2.3.1 Inbound Knowledge flows

There are two main types of Open Innovation, called Outside-In (or Inbound), Inside-Out (Outbound) and the combined Coupled type. A large number of research investigates the Outside-In (Inbound) kind of Open Innovation, which deals with how companies can use external knowledge and technologies to speed up internal innovation (Gassmann and Enkel, 2004). This approach is usually based on collaborations with universities and consolidated partners, they involve less investment and risk but also have more modest results, while other less exploited actions, such as internal incubators and accelerators or the creation of Corporate Venture Capital, have a greater impact not only in terms of effort but also in terms of results (ivi, pp. 7-8). Collaborations with universities and research centres can give an access to inventions, patents and experimentation with new technologies and methodologies (ibidem). Some other initiatives aimed at collecting, through a competition, innovative ideas on a specific theme that the company may decide to implement or support in their development. Hackathons, datathons and appathons have quite the same principal, where developers from outside the company are involved in competitions during which innovative ideas useful to the company's business are concretely realized within few hours. Studies done by the scholars Hung K.P. and Chiang Y.K have stated that collaborations

with research institutes or universities can affect positively product innovation performance¹³. Universities and research institutes have systems and tools that can ease the access to new and more complex knowledge and information. At the same time studies done by Inauen M. and Schenker-Wicki A. have underlined also some negative effects of the role of external acquisitions of knowledge on innovation output of companies¹⁴. These negative aspects include the unsuitable or insufficient absorptive capacity of companies, meaning the ability to identify, assimilate, transform, and use external knowledge, technologies or the excessive use of resources that the acquisition of external knowledge may generates. In addition to impact the innovation performance, collaborations with research institutes and universities influence the efficiency of companies' financial performance (ibidem). The scholars Inauen and Schenker-Wicki (2012) claimed that openness towards universities in R&D processes can have a positive impact not only on product innovations but also on the percentage of innovative product sales over total sales.

¹³ Hung K.P., Chiang Y.K. (2010). Open innovation proclivity, entrepreneurial orientation, and perceived firm performance, *International Journal of Technology Management*, Vol. 52, No. 3, pp. 257–274.

¹⁴ Inauen, M., Schenker-Wicki A. (2012). Fostering radical innovations with open innovation, *European Journal of Innovation Management*, Vol. 15, No. 2, pp. 212-231.

2.3.2 Outbound knowledge flows

In the case of outbound flows, internal “stimuli” are outsourced to pursue innovation actions outside the company. This approach is much less widespread than the first, which is considered less risky. In addition, the most widely used Outbound solutions, such as joint venture and platform business models, are also the safest in their category because they allow greater protection of intellectual property. Joint Ventures are agreements under which two or more undertakings agree to collaborate on a joint project (whether industrial or commercial) or decide to jointly exploit their synergies, know-how or capital. Through licensing of your own products you can transfer from the author or right holder to another person the right to use the product or technology and benefit economically from it, such as licensed production (Gassmann and Enkel, 2004). Platform business models are instead business models that create value by facilitating the exchange between two or more interdependent groups, usually consumers and producers, through the use of certain platforms that facilitate interaction¹⁵. The practice of outbound OI is a strategic action which the companies can use to generate profit from their own innovations without investing in complementary assets. Through different contractual tools like out-licensing agreements, spin-offs, or technology

¹⁵ Saebi T., Foss N. J. (2014). Business models for open innovation: Matching heterogenous open innovation strategies with business model dimensions, Article European Management Journal, p. 9.

sales, companies can externally leverage their technological knowledge, generating added revenues. Previous empirical studies on outbound OI processes done by Lichtenthaler (2009) and Belderbos (2010) focus on the results of these activities on financial performance, especially on licensing revenues¹⁶. Another outbound solution, beside licensing out, is to sell any knowledge asset, increasing financial outcomes of the company. The disinvestment of company units includes beside the sale of a division, a business unit, a product line or an auxiliary of the firm also the transfer of knowledge. Disinvestments decrease inefficiencies and may improve financial performance (ibidem). Spin-offs are for instance specific types of disinvestment mainly used for technological reasons. As in the case of inbound, also outbound approaches can have negative effects on innovation performance (Gassmann and Enkel, 2004). Companies that decide to license out their IP (Intellectual Property) or disinvest knowledge assets may increase short term profits but in a long term may be negatively affected regarding the company's internal innovation processes (ivi., pp. 9-10).

¹⁶ Lichtenthaler U. (2009). Outbound open innovation and its effect on firm performance: examining environmental influences, *R&D Management*, Vol. 39, No. 4, pp. 317–330.

2.3.3 Coupled knowledge flows

Finally, in the coupled process companies combine the inbound with the outbound processes, to bring ideas to market and, in doing so, jointly develop and commercialize innovation (Gassmann and Enkel, 2004). Companies that take the path of coupled OI practices are involved in inter-company relationships, that enables to obtain and give complementary know-how (Saebi and Foss, 2014). A great number of scholars, such as Faems, Love, Mansury and Belderbos, researched about the relationship among R&D inter-company collaborations and their innovation outcomes. The authors Faems, D., Van Looy, B. and Debackere, K. (2005) claimed the importance of technological collaborative networks, R&D and manufacturing affiliations in achieving a high degree of novelty in product innovation¹⁷. Collaborative patents (co-patents) are defined as patents with more than one beneficiary¹⁸. Through the development of co-patents, companies can improve both innovative and financial performance since they allow to reduce costs and lead times of new patent development boosting technological quality and market adaptability of the outputs. Nevertheless, these inter-organizational collaborations may bring with them relational risks, due to opportunistic

¹⁷ Faems, D., Van Looy, B., Debackere, K. (2005). Interorganizational collaboration and innovation: toward a portfolio approach, *Journal of Product Innovation Management*, Vol. 22, No. 3, pp. 238–250.

¹⁸ Lin C., Wu Y.J., Chang C., Wang W., Lee C.Y. (2012). The alliance innovation performance of R&D alliances: the absorptive capacity perspective, *Technovation*, Vol. 32, No. 5, pp. 282–292.

behaviour, and increase coordination costs due to implementation of monitoring mechanisms.

Belderbos et al. (2010) reported, that the potential advantages of strategic alliances for technological activities such as access to complementary knowledge or the sharing of technological costs and risks, may not make up for the possible disadvantages¹⁹. The coupled processes imply that the company needs also to share the rewards with the collaborating partners, which means that even if the collaboration might increase the chance of generating new ideas successfully, it may limit the capability of the company to appropriate the value (ibidem). Table 2 shows how Outbound and Inbound Open Innovation practises may be classified. Some of them reflect the same concept but the flow of knowledge is reversed, as for instance in the licensing, whereby we can have an in-licensing or out-licensing. The Coupled practise is a combination of the two primary types.

¹⁹ Belderbos R., Faems D., Leten B., Van Looy B. (2010). Technological activities and their impact on the financial performance of the firm: exploitation and exploration within and between firms, *Journal of Product Innovation Management*, Vol. 27, No. 6, pp. 869–882.

Table 2: Definitions and dimensions of inbound and outbound of OI

Dimensions		Definition
Inbound OI	External consultants	Temporary recruitment of outside specialists
	Employee involvement	Using employee knowledge through programs such as suggestion systems and independent work teams
	Customers involvement	Involving customers in innovative processes through market research or product development based on their feedbacks
	Suppliers	Collaboration with suppliers in order to transfer customer needs to them or get ideas from them
	Competitors	Collaborate with competitors to exchange information and produce common products
	IP in and licensing	Purchase property rights include: License for the exploitation of technologies, patents, copyright
	Networking	Knowledge sharing with other firms and forums or events informally
	Universities	Contact with universities and colleges
	R&D in	Providing R&D services to other firms
Outbound OI	Joint venture	Joint venture investment with external partners
	Participations in standardizations	Participation in standardization and assessing activities formally and informally
	Venture capital with external partners	A venture capital investment with an ambiguous future
	Spin-off	Establishing new knowledge-based firms and supporting them through foremost firms
	R&D out	Getting R&D services from other firms such as research and testing centers
	IP out licensing and patent selling	Selling licensing right to use inventions and copyrights to other firms for more profit from intellectual properties
	Selling of market ready products	Selling of market-ready products to the third-party to sell to customers

Source: Rexhepi, Hisrich and Ramadani (2019)

2.4 Business Model

The key point in managing internal and external ideas and research consists in combining them and then eventually spreading them within the company or other companies. In *The New Imperative for Creating and Profiting from Technology*, Chesbrough argues that lead to understand what is missing and should be integrated into the company and therefore combine internal and external sources is the so called Business Model (Chesbrough, 2003). It is a useful framework usually applied to make technical decisions in order to get an economic outcome but moreover in this context it is crucial to turn technological potential into value for the company (ibidem).

There are three main ways to capture value from new technologies:

1. Incorporating the technology in the business;
2. Through licensing the technology to external companies;
3. Through launching a new venture which exploits the technology.

The negative aspect is that the economic value will remain unused until the technology will be put into commerce (ivi, p.64).

The company has to find the right business model suitable to capture the value of the technology otherwise that technology will lead to no further added value to the company. In that sense it is the business model that makes the difference between a successful technology and a mediocre one. The same technology combined with the right business model can be valuable and at the same time not valuable if

combined with a mediocre business model. Chesbrough and Richard Rosenbloom (2002) developed a definition for business model: it has the objective to define a value proposition, to identify the market segment to address the technology, to define the value chain of the company, to describe how the revenue is generated and the cost structure, to describe the position of the company in the value network connecting it to suppliers, customers and competitors and finally formulate the competitive strategy in order to reach and keep an economic advantage²⁰.

²⁰ Chesbrough H., Rosenbloom R. (2002). The Role of the Business Model in Capturing Value from Innovation, *Industrial and Corporate Change* 11, no. 3, pp. 529–556.

3. Open Innovation in SMEs

3.1 Characteristics of SMEs

In order to study Open Innovation related to Small and Medium-sized Enterprises (SMEs) we need to differentiate them from large companies that have completely different characteristics, needs and difficulties. We need first to explain what we mean by SMEs. The European Union defines them in the EU recommendation 2003/361 as followed, according to staff headcount, turnover or balance sheet total.

Table 3: EU definition of SMEs

Company category	Staff headcount	Turnover or Balance sheet total	
Medium-sized	< 250	≤ 50 € m	≤ 43 € m
Small	< 50	≤ 10 € m	≤ 10 € m
Micro	< 10	≤ 2 € m	≤ 2 € m

Source: Mention, Nagel, Hafkesbrink and Dąbrowska (2016)

However, for the purpose of this research, it will be used the German definition for KMU (Small-medium enterprises) given by the IfM of Bonn which defines it as a company with a maximum of 500 employees and an annual turnover of less than 50 million euros.

The most important issue to stress is that SMEs use Open Innovation tools differently from large companies. First of all, SMEs have certain limitations compared to big companies like lack of resources and less structured innovation processes. On the other hand, SMEs have the advantages of less bureaucracy, flexibility in decision making and specialization on certain market niches²¹. Moreover, as Spithoven has suggested, they are likely to be more dependent on external sources of knowledge and innovation than bigger and more structured companies²².

As established before about the existing gaps, Open Innovation in SMEs have received less attention from researchers.

However, among the few studies that have been carried out, Van de Vrande, De Jong and De Rochemont (2009) have found out that SMEs pursue open innovation primarily for market-related reasons. Many studies have stressed the potential of open innovation for SMEs finding motives for engaging in Open Innovation, indicating networking as one the most promising and effective way to improve the open innovation capacity among SMEs (ivi, p.297).

Indeed, the demanding environment affects especially small companies, since they tend to depend more than larger companies on technological developments

²¹ Mention A., Nagel A. P., Hafkesbrink J., Dąbrowska J. (2016). Innovation education reloaded, p. 290. Available at: <http://hj.divaportal.org/smash/get/diva2:1082650/FULLTEXT01.pdf>.

²² Spithoven A. (2013). Open innovation practices and innovative performances: an international comparative perspective, *International Journal of Technology Management*, Vol. 62, No. 1, pp.1-34.

outside the company to achieve new knowledge. The lack of economies of scale and scope bring SMEs to keep smaller parts of R&D in-house than larger companies. SMEs' possibility to spread risk among their small portfolios is much more limited²³.

It is important to mention that SMEs have different characteristics from large organizations and the following tables explain some of these differences. Table 4 describes some aspects of large and small companies, linked to specific perspectives of the Open Innovation approach depending of the size of companies. For instance, it is interesting to see that in SMEs decision-making is more flexible and fast, while in larger companies, decisions are slowed down by hierarchy in the organizational chart. In addition, it is worth to mention, as the table describes, that SMEs are easier to be focused on affordable losses rather than take risks. On the other hand, larger companies are rather risk adverse.

²³ Vrande, van de, V. J. A., Jong, de, J. P. J., Vanhaverbeke, W. P. M., Rochemont, de, M. H. (2009). Open innovation in SMEs: trends, motives and management challenges. *Technovation*, 29(6-7), pp. 423-437.

Table 4: An overview of challenges and solutions related to the facilitation of a design thinking workshop

Item	SME	Large Companies	Pro or contra Open Innovation in SMEs?
Speed of decision-making	Flexible and fast innovation	Slow decisions in organizational hierarchy	Pro SME OI
Allocation of resources	Fewer resources (time, money and knowledge)	More financial leeway	May be a motivator for SME OI, especially in the exploration phase
Attitude toward risk	The whole business is a risk, focus on the affordable loss instead of acceptable risk	Risk adverse, because the relevant business may only be "one project" out of many	Pro SME OI, since larger companies may be more reluctant
Business model understanding	Mutual understanding of what the company wants to accomplish. The manager/owner has the main control and is often the main liaison for relations	Much more fractured; More effort has to be put into generating a mutual understanding of the business model and creating complementary innovation activities together	Pro SME OI once the owner has experienced the benefits of OI
Management processes	Intuitive processes in place to drive innovation; chance for radical innovation, since the goals are more open	Well-defined processes and actions; because of this behavior large firms get involved in incremental innovation foremost	Pro SME OI, since goal definition may be part of the exploratory OI phase
Rules	SMEs break rules; they do not try to predict the future, but are more inclined to embrace opportunities as they come along	Large firms follow rules, they preoccupy themselves with competitive analysis and careful planning	Pro SME OI
Definition of innovation	No special teams; the whole company is involved in new developments	Special product teams in large firms are dedicated to their product development roadmap, searching for innovations that fit their roadmaps exactly	SMEs need complementary partners who are interested in the opportunities of their development and not partners who search for innovations that fit their roadmaps exactly
Contribution to earnings from OI	OI practices in SMEs contribute to their earnings from new innovations, mostly based on IP. Earnings from new innovations affect their total turnover considerably	More effective in generating new products and services through OI than SMEs, but relatively less impact on the total turnover	Motivator for SME OI

Source: Mention, Nagel, Hafkesbrink and Dąbrowska (2016)

Open Innovation practices can then of course vary in certain types of SMEs based on their technology intensity. Indeed, in external knowledge sourcing, R&D sources such as universities, research labs or suppliers seem to be more relevant sources for companies working as high tech entrepreneurial companies, rather than for a demand-oriented SME that mainly interacts with customers and users²⁴. The innovation performance can also vary depending on technology sourcing (for radical innovation) and technology scouting (for incremental innovation). Especially when doing technology sourcing, SMEs can improve their internal innovation processes integrating technologies from external sources already completed and use it to fill the gaps in the market. SMEs in the high-tech sector are for obvious reasons generally more open to Open Innovation than SMEs in low-tech sectors, since it is their main way to deal with the lack of internal sources and resources for innovation (Mention, Nagel, Hafkesbrink and Dąbrowska, 2016).

²⁴ Brunswicker & Vanhaverbeke (2014). Open Innovation in Small and Medium-Sized Enterprises (SMEs): External Knowledge Sourcing Strategies and Internal Organizational Facilitators, p. 50.

3.2 Benefits and challenges of OI

Open innovation offers a wide range of opportunities for SMEs. Open innovation practices, for instance, can offer alternative and more viable strategies to access companies' resources at a lower cost, in order to deal with obstacles such as technological, internal financial and human resources that make difficult the development of new products and the ability to enter new markets (Gassmann and Enkel, 2004).

Moreover, open innovation allows to access easily to information, technologies and laboratories that require time and great R&D investment to acquire in-house. As we have already explained early on, there are three ways SMEs can implement open innovation, namely, 'in-bound', 'outbound' and 'coupled' processes (ivi., p. 6).

The 'inbound open innovation' (outside in) allows the acquisition and transfer of external technologies, ideas and knowledge into the firm through, for example, R&D contracts, university collaborations, and in-licensing. These opportunities enable SMEs to fill technological and knowledge gaps²⁵.

²⁵ Wynarczyk P. (2014). Exploring the benefits of open innovation in SMEs, Newcastle University Business School UK, pp. 1-3. Available at: <http://www.isbe.org.uk>.

Open Innovation can be for SMEs, that use it, a huge source of also other benefits like knowledge, it can increase customer satisfaction, the decrease of time to market and the costs of product introduction²⁶.

There are however challenges and risks that follow these opportunities. Some challenges regard the difficulty to adjust to the frameworks and their conditions and there are also some hurdles concerning cultural and structural changes to adopt (Rexhepi, Hisrich and Ramadani, 2019). The cultural challenges implicate for instance the so called not-wanting and not-knowing. The not-wanting concept translates in the refusal to share intellectual properties, outflows of knowledge or the loss of competencies (ivi., p. 92). The concept of not-knowing instead refers to the lack of knowledge of the company regarding technical or administrative competencies concerning open innovation like for instance managing unknown processes, dealing with new technologies, market needs, partners and networks (ibidem). The not-wanting approach reflects in the so-called not-sold-here syndrome, meaning the instinct to not want to give away a company's insights, knowledge and patents through strategic licensing. Especially SMEs show an excessive amount of concern about possible outflows of potentially marketable ideas.

²⁶ Stanisławski R. (2020). Open Innovation as a Value Chain for Small and Medium-Sized Enterprises: Determinants of the Use of Open Innovation, Article, p. 2.

Another factor is the classic not-invented-here syndrome, which is the tendency to avoid using or buying products, research, standards, or knowledge from external origins.

In order to introduce Open Innovation strategies, the company has to implement new processes and there are of course also bureaucratic and administrative obstacles, regarding mostly intellectual property. Instead the not-invented-here syndrome can be defined as the tendency for companies to avoid external ideas that weren't created and developed inside the company itself²⁷.

Further challenges are the implementation and the managing of specific methods and tools for the integration of partners in an open innovation project in addition to the difficulties that comes with innovation communication which describes the communication put in place in innovation processes, especially between different stakeholders (Rexhepi, Hisrich and Ramadani, 2019). Regarding SMEs there is still some research to be done concerning how Open Innovation practises may affect SMEs, consequently what motivates them to approach to these practises and what instead inhibits them due to risks and challenges; looking more specifically into other sector that are not high-tech and see what challenges SMEs face (Hossain and Kauranen, 2016).

²⁷ Gassmann O., Enkel, E., Chesbrough, H. (2010). The future of open innovation, R&D Management, Vol. 40, No. 3, pp. 213-221.

3.3 Definition of value network

The idea of *value network* was introduced by Norman and Ramirez in 1993²⁸.

Value network is a concept that has been defined by many different scholars and researchers like Clayton Christensen, Fjeldstad and Stabells, Cinzia Parolini, Verna Allee, which gave different definitions based on their point of view. Norman and Ramirez defined in 1993 value network as “a value creating system in which all involved stakeholders co-produce value”²⁹.

Christensen instead defined the term value network in 1995 as: "the context within which a firm competes and solves customers' problems"³⁰.

The value network in which the companies operate is what determines whether they will succeed or not. Further authors, Fjeldstad & Stabell defined in 1998 the concept as a configuration which emphasizes that the value being created is between customers when they interact facilitated by the value networks³¹. They wanted to highlight the limitations of Porter's value chain model, the most used one for value configuration of companies.

²⁸ Normann R., Ramirez R. (1993). From value chain to value constellation: Designing interactive strategy, *Harvard business review*, 71(4), pp. 65-77.

²⁹ Fajsi A., Morača S. (2017). Integrating SMEs into value networks: Benefits and limitations, p. 270.

³⁰ Archibugi D., Filippetti A. (2011). Innovation and Economic Crisis: Lessons and Prospects from the Economic Downturn, p. 39.

³¹ Stabell C. B., Fjeldstad Ø. D. (1998). Configuring value for competitive advantage: on chains, shops, and networks. *Strategic management journal*, pp. 413-437.

They introduce two models for value configuration: the value shop and the value network. They claimed that the value chain is a fitting value configuration more for companies producing physical products. While for companies delivering customer services, the value chain doesn't seem to fit in order to capture the logic of value creation (Stabell and Fjeldstad, 1998).

Verna Allee (2008) provided a more modern explanation and interpretation of the notion including the concept of networking³². According to this author value network is “any set of roles and interactions in which people engage in both tangible and intangible exchanges to achieve economic and social good”³³.

One aspect of value network regards internal relationships between individuals, within and between groups in the company. On the other hand, we have the external facing value networks which are linkages between organization, its suppliers, its investors, strategic and business partners and finally customers (ibidem).

Therefore, summing up, value network is defined as a set of interrelated activities among all network participants and the meaning of this concept is to co-create value for all network members, resources and communication between participants with the chance of getting feedback in any moment.

³² Allee, V. (2008). Value network analysis and value conversion of tangible and intangible assets, *Journal of intellectual capital*, pp. 5-24.

³³ Fajsi A., Morača S. (2017). Integrating SMEs into value networks: Benefits and limitations, p. 270.

Engagement in a mutually beneficial relationship with different stakeholders can help SMEs to first improve and then integrate their management skills, knowledge and technology into international business networks overcoming the main barriers (ivi., p. 272).

In SMEs, value networks may be source of interesting opportunities giving hat they are characterized by scarce resources compared to bigger and more structured companies. Based on the findings presented, the author suggests that value networks may be useful to use the core competencies of small firms in a wider context and, in order to fill the existing literature gap about the SMEs value networks, some research should be done regarding this phenomenon between SMEs.

In order to understand how value networks may benefit SMEs, it may be necessary to look how to exploit and manage them, from the point of view of SMEs (Rexhepi, Hisrich and Ramadani, 2019).

3.4 The role of networking

The nowadays economy and business has become more and more knowledge-based and this has impacted also the competitiveness, which has become more dependent on the necessity to acquire new knowledge, ideas and technologies, not only about products but also about production processes³⁴. That been said this knowledge comes most of the time from outside the company, which in the meanwhile has become more and more specialized and focused. Therefore, networking and inter-firm collaboration have become one of the most essential way to share knowledge and exchange ideas as also technologies.

What becomes crucial, in order to acquire these know-how and new knowledge are collaborative agreements, market-mediated relations (for instance purchase of tools and equipment or licensing) and networking. These kinds of linkage can take place not only between companies but also between company and other institutions such as universities, further high education institutions, research laboratories (private or public), consultants and regulatory bodies (ibidem). As already mentioned before, SMEs can depend on external knowledge and sources even more than bigger companies, regarding their innovation growth, achievement of expertise and success. All SMEs, regardless the differences between them, need to be connected with any kind of knowledge sources and

³⁴ OECD (2004). Networks, Partnerships, Clusters and Intellectual property rights: Opportunities and challenges for innovative SMEs in a global economy, pp. 11-12.

expertise (OECD, 2004). This can be done either directly or through linkages created in a network, which can be not only at a regional but also at a national or global level. OECD studies (2001 a) have underlined how collaborating companies are more innovative than the one that aren't collaborative at all. Although is interesting to see that they also show how with the decrease of firm size the propensity to take part in knowledge-based networks decreases (ibidem). That may be one of the reasons why many SMEs are less innovative than bigger companies.

Even though networks can allow companies to overcome certain market failures such as internalization of transactions in acquisitions, mergers and so on, collaborations can also generate market imperfections. This requires the company to assess its economic rationale before engaging in networks and collaborations. The main advantage that derives from networking, over market transactions and internalization, is associated to two attributes of the assets, which are mainly the nature and the diversity of the assets and the feasibility and cost of production or the cost of buying them. The value of networking has been boosted by the increase of specialization of the factors in production and the complexity of production processes interdependent from each other (ibidem).

The increasing development of innovative networks is already part of the structural changes in the micro-economics basis of economic growth. That is mainly for two reasons: firstly, networking has become a prerequisite for

technological innovation since it's necessary to get by the everyday technical changes, cut the risks on investments and meet the change in demand; secondly, networking generates added value and increases flexibility, above all in the service sector. Networks can be distinguished based on the type and partners, the innovation mode, the geographic scope and the organisation and relations between partners. Regarding the differentiation in partners, networks can connect individuals and functional areas of the organization rather than connect them through a traditional vertical chain, exploiting in a synergic way the various individual and organizational skills. Networks include a wider range of participants such as suppliers, clients, consumers, research laboratories etc.

Networks are usually more focused on a specific sector, but recently have expanded widely their field of action across different areas (OECD, 2004). As mentioned before networking can be observed at a local level as much as at a regional, national or global level.

Interactions between actors of a network can vary from a more informal, flexible and trust-based relationship to a more formal, arrangement-based one (for instance partnerships, research co-operations, joint ventures).

SMEs often need to build these external networks and establish close collaborations. As for the value networks, is still not fully complete and clear the literature on how SMEs should manage these networks (ibidem).

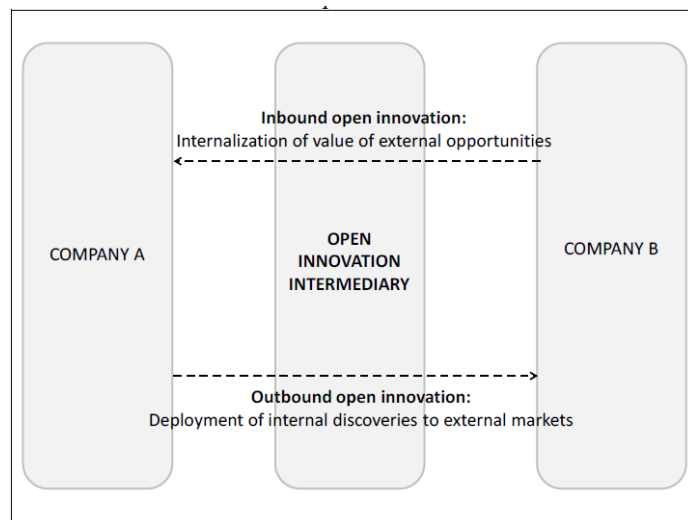
In order to fill these research gaps a useful framework or strategic model should be organized for the purpose of understanding the value of inter-industry and outside industry networks for SMEs, as suggested by Hossain and Kauranen (2016).

Finally, SMEs may strongly benefit from networking and collaborations in increasing the chance of launching products and services, but also in sharing costs and risks through collaboration agreements. For SMEs the learning part is also very important since smaller companies may not always be quick to follow changes of market or technology. In addition, networks facilitate exchange of all sorts of knowledge on the basis of mutual trust, including between large and small firms (OECD, 2004). It has to be said that SMEs with higher levels of innovativeness have stronger incentives to develop connections with other companies and knowledge institutions and they may face difficulties such as devising and implementing their networking strategy. Moreover, many SMEs lack certain competencies to manage innovation, especially when it involves developing and mastering external linkages (ivi, p. 16).

3.5 Innovation intermediaries and participants

Intermediary markets behave as facilitators of interactions between companies that don't have the good fortune to participate in a structured model in order to capture value from external networks. Open innovation intermediaries can provide to the company access to new ideas (inbound) or help to deploy internal resources and knowledge to external companies.

Figure 2: The logic of open innovation intermediary in regard of inbound and outbound open innovation



Source: Järvi, Schallmo and Kutvonen (2018)

Figure 2 illustrates interactions between two companies thanks to an Open Innovation intermediary: for instance, it may allow the internalization of value of external opportunities or the deployment of internal discoveries. Open innovation intermediaries can help to develop and enhance potential business models of customers, they promote inflows and outflows of ideas and technologies to commercialize, examine and identify external markets for potential start-ups, analyse and build paths for technology, develop and combine knowledge and articulate demand³⁵.

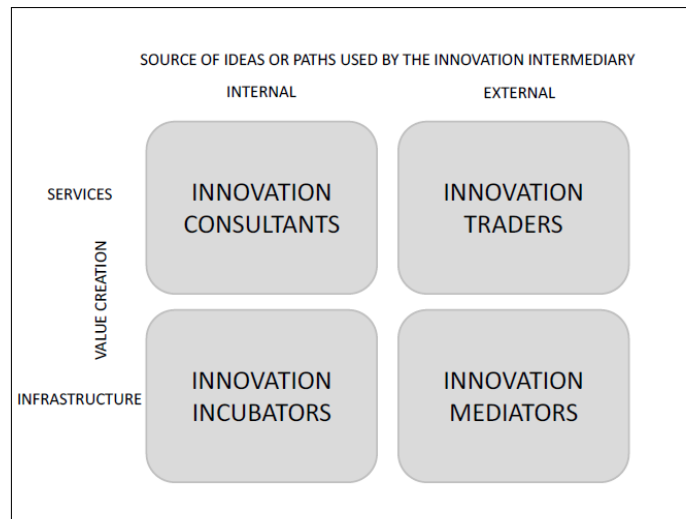
Based on different business model components two scholars, Lopez-Vega and Vanhaverbeke (2010), identify 4 different types of innovation intermediaries: innovation consultant, innovation trader, innovation incubator, and innovation mediator³⁶.

³⁵ Chesbrough H., Vanhaverbeke W., West, J. (2006). *Open Innovation: Researching a New Paradigm*, Oxford University Press. p. 400.

³⁶ Lopez-Vega H., Vanhaverbeke W. (2010). *Connecting open and closed innovation markets: A typology of intermediaries*, MPRA Paper, University Library of Munich, Germany, [PDF document], p. 15.

Available at: <http://econpapers.repec.org/RePEc:pra:mprapa:27016>.<http://mprapa.ub.uni-muenchen.de/27017/>.

Figure 3: Typology of innovation intermediaries



Source: Järvi, Schallmo and Kutvonen (2018)

These four categories are classified according to value creation (based on services or infrastructure) and source of ideas or paths used by the innovation intermediary, internal or external (Lopez-Vega and Vanhaverbeke, 2010).

All the interactions illustrated in Figure 3 are essentially exchanges between the different participants. Lopez-Vega and Vanhaverbeke (2010) delineate as follows the four categories:

1. Innovation consultants: providers of innovation services, which aim to settle specific innovation problems or requests, based on internal sources of knowledge.

2. Innovation traders: provide access to an extended amount of external ideas and technologies for customers and innovation solution providers.
3. Innovation incubators: they furnish infrastructure for companies inclined to conduct science, technology or business activities and boost the internal exchange of ideas and knowledge among these companies.
4. Innovation mediators: they perform similar tasks but these tasks can target users, entrepreneurs and R&D institutes as well. (ivi, p.27).

It is important to observe that innovation consultants are not direct intermediaries and don't operate through platforms between two sides of the market, thus not enabling the actual interactions or providing the platform for them. On the other side they provide complementary services needed for the actual platform and allow the two-sided market to succeed. Instead innovation incubators, innovation mediators, and innovation traders have the main role to offer a common meeting place and to facilitate interaction between groups of customers and innovation actors³⁷.

The role of intermediaries can be analysed also in the building of an effective network, which results to be much harder for SMEs compared to bigger companies, since they have a narrow access to information sources, lack of

³⁷ Järvi K., Schallmo D. R. A., Kutvonen A. (2018). The Business of Open Innovation Intermediaries, pp. 2-7.

financial resources in order to obtain them. Since SMEs have more difficulties regarding the development of a network, they usually build strong and long-lasting connections in order to organize a network (ibidem).

A collaboration model has been created as a way to overcome the hurdles in finding fitting partners which highlights the role of the intermediary as a key support for the SME. The intermediary sustains the SME in the maximisation of the possibilities in innovation and development of technologies, products and services.

Many public authorities have adopted the role of intermediary realizing the importance of this role in supporting SMEs innovation development³⁸.

An intermediary has three main objectives which consist in three direct activities:

1. Create a network database in order to identify the collaborative partners and share the information with the SME;
2. Help in the construction stage of the network, through transfer of technology to improve the strategic technology management, assessment of the companies to contact, suggest a network organization and boost the development of clusters. Moreover, an intermediary can analyse important information about each SME and provide to the other SMEs the final outcome of their evaluation, rather than hand in the original technological

³⁸ Leea S., Parkb G., Yoonc B., Parkd J. (2010). Open Innovation in SMEs – An Intermediated Network Model, p. 293.

information (since many SMEs are reluctant to exchange sensible information to competitors and on the other hand potential partners could hesitate to collaborate if they don't have enough data to evaluate the expertise level).

3. Manage the network.

To these three direct activities are added two indirect activities:

1. Development of collaboration culture;
2. Facilitate collaboration (ibidem).

The evidence presented suggests that a big role in Open Innovation approaches is played by the connection of different parties which are industrial companies, universities and research institutes that support innovation. The connection of these parties may be supported by intermediaries that can help SMEs to connect and facilitate the flows of knowledge; small and medium companies could be supported by intermediaries in filling the structural and cultural gaps which characterises them with respect to large enterprises (Järvi, Schallmo and Kutvonen, 2018). The crucial role of an intermediary is also to minimize transaction costs, to reduce costs through the elimination of duplication and to allow value-creating exchanges.

Indeed, the findings indicate that small firms are in need of help to manage their innovation process while approaching to networking and collaborations (ibidem).

Is important to remember that large companies' approach to OI is extremely different compared to SMEs one where large firm are simply better prepared for it, and that innovation intermediaries are still a phenomenon less researched.

4. SMEs case studies in Baden-Württemberg

4.1 Research gaps, questions, and objectives

The literature review done has been relevant to amplify the knowledge on the topics related to Open Innovation and value networks and the SMEs approach to both issues.

First of all, in order to understand which are the main Open Innovation practises used and why, the theoretical framework elaborated by different scholars have been examined, focussing on how Open Innovation activities are categorized and what the subjects involved are.

In an Open Innovation context companies may be able to organize value networks through the establishment of collaborations and transactions. Networking becomes a resourceful tool to acquire additional knowledge and skills for innovation processes and practices. Therefore, the concept of value network and the role of networking have been clarified, as both aspects are crucial in the analysis of SMEs behaviour.

The benefits and challenges of Open Innovation identified in the literature have been explained with the intention to analyse the possible factors responsible for the engagement of SMEs in OI practises and the willingness to shift to this kind of innovation strategies.

In general, there is a lack of studies on Open Innovation in SMEs as much of the literature has focused on the frameworks and strategies for large companies, which do not fit to companies with smaller size. Accordingly, it appears particularly important to expand the research on SMEs opportunities and challenges.

Regarding the benefits underlined throughout the literature review, openness to external sources allows SMEs to get new ideas from outside to deepen their knowledge about the technological opportunities available to them.

OI may also offer some indirect benefits, such as connectivity, awareness, and reputation. Moreover, the literature pointed out the possibility of having easier access to human, financial and technological resources. On the other hand, the literature review has highlighted the barriers to Open Innovation which are likely to affect SMEs as opposed to their larger counterparts. Resource scarcity for R&D, unsystematic innovation activities, complexity of scientific fields, inadequate coordination of innovation activities with operational functions, and lack of sufficient access to scientific excellence are considered as the main challenges of SMEs for OI.

From the primary research done, it has been outlined that the inclination to exchange sensible information is one of the main variables to consider by an SME while deciding whether to adopt Open Innovation practices or not. Other crucial

variables that came out are the need to fill gaps in resources and the great dependence on their environment due to their small size and market share.

Even the local context, the public policies on innovation, the sector in which an SME works has an impact on how it may perceive Open Innovation practices.

The previous considerations bring us to the research questions that follow:

1. What (if any) open innovation practices are SMEs using?
2. What (if any) level of engagement with value networks do SMEs have?
3. What motivates or inhibits SMEs to shift towards openness?
4. What are the risks and costs for cooperation?

These questions have the purpose of understanding the level and nature of Open Innovation engagement, the reasons behind the need of SMEs to approach to Open Innovation practises, the benefits but also the barriers, in particular risks and costs of collaborating with other institutions or firms.

In attempting to answer to the above questions, the research will proceed considering the analysis of case studies of two manufacturing SMEs located in the Baden-Württemberg Land (Federal state): Seleon and Beyerdynamic. The first is a company working in development and production in medical technology consulting in QM and Regulatory Affairs, while the second is a manufacturer of microphones, headphones, wireless audio systems and conference systems. These two companies were chosen mainly because they represent two different sectors of manufacturing, which helps the research to have a wider view on the various

ways a SME may behave related to Open Innovation practises and networking. Moreover, one company is bigger than the other, and the size factor could be relevant to explain their different behaviour and strategies.

Before moving to the case studies, the next section describes the economic context of Baden-Württemberg and the business clusters present in the region

4.2 Economic overview of Baden-Württemberg

To describe the context where the research will take place, a general overview of the economy and the manufacturing sector of the region will be given. Baden-Wuerttemberg is placed in the south-west part of Germany and, with its around 11 million inhabitants, it is the third most populated state of the Federal Republic. Baden-Wuerttemberg is composed of four administrative districts: Stuttgart, Karlsruhe, Freiburg and Tübingen. The region is characterized by a developed and highly competitive manufacturing sector with a strong export propensity. This sector is mainly based on SMEs, and some of them are market leaders not only in Germany but also at international level. Along with manufacturing industries, the

economic development of Baden-Wuerttemberg is shaped by the presence of strong knowledge-intensive services³⁹.

In 2018, about 35% of the employees were occupied in the industrial and construction sectors, while 64% were involved in the service sector and only 1% in agriculture (Eurostat, 2019). Based on the Statistisches Bundesamt of 2019, in 2018, 17.8% of German manufacturing SMEs were located in Baden-Württemberg, and approximately 99% of the firms in the region are SMEs.

Around one quarter of Baden-Württemberg industrial revenue is generated by the automotive engineering industry and all the supplier network connected to it, followed by the mechanical and plant engineering (around 20%) and the metal and electrical industry. Then, the chemical, pharmaceutical and optical industries also play a remarkable role in the regional economy. It is worth mentioning that Baden-Wuerttemberg represents one of the most developed regions of the European Union, as its per-capita GDP (about 47 thousand euros in 2019) is 29% above the EU per-capita GDP average.

Baden-Wuerttemberg is also classified as a highly innovative region: 5% of its GDP is invested in Research & Development and such investment is associated with a high propensity to patent applications and registered patents. The EU Regional Innovation Scoreboard of 2019 shows that the four districts of Baden-

³⁹ This and most of the following data and information are taken from Baden-Wuerttemberg.de, (2020). Home to commerce and industry, Available at: <https://www.baden-wuerttemberg.de/en/our-state/business-location/>.

Wuerttemberg (Freiburg, Stuttgart, Karlsruhe and Tübingen) are considered innovation leaders⁴⁰. All four districts have outstanding performance in most innovation indicators except in terms of SMEs collaboration for innovation.

The regional environment contains many research institutions like the Institutes of the Max-Planck Society, the German Cancer Research Centre in Heidelberg, the German Aerospace Centre, the Centre for Solar Energy and Hydrogen Research Baden-Württemberg and the Institutes of the Fraunhofer Society⁴¹.

As already mentioned, exports represent a large share of Baden-Wuerttemberg's economy, and around 50% of them come from the automotive and mechanical engineering industries.

The manufacturing sector is not only a long-established one in Baden-Württemberg but is struggling to keep a leading position by promoting advanced manufacturing (European Commission, 2020). The Ministry for financial and economic affairs published in 2014 a study called "Industrie 4.0 für Baden-Württemberg" (Industry 4.0 for Baden-Wuerttemberg), which concluded that the region has a high and strong potential in advanced manufacturing and public institutions should provide support to both large companies and SMEs to face the new challenges.

⁴⁰ Regional Innovation Scoreboard (2019). Region profile. Available at: https://interactivetool.eu/RIS/RIS_2.html#b.

⁴¹ European Commission, (2020). Internal Market, Industry, Entrepreneurship and SMEs. Available at: <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/baden-w%C3%BCrttemberg>.

As stressed in section 3.5, public intermediaries can play an important role in helping SMEs in networking activities. They can bring together a system of technology providers and users, with a view to devising, developing and implementing technological solutions and to matching the needs of the different organisation.

The Ministry of Economic Affairs of Baden-Wuerttemberg promoted the foundation of the Allianz Industrie 4.0, which started in 2015, with the aim of positioning Baden-Württemberg as a lead provider and lead market for the Industry 4.0. This Allianz Industrie 4.0 collects almost 60 partners including the Ministry itself, firms' networks and clusters, research institutes, universities, industrial associations, chambers of industry and commerce and trade unions (ibidem). Baden-Württemberg has also developed its own programme related to the EU Regional Structural Funds. The regional innovation strategy focuses on key innovative industries such as nanotechnologies and micro-technologies, which can be considered as advanced manufacturing industries. Moreover, the Baden-Wuerttemberg wants to focus mainly on the improvement of four areas:

- Sustainable mobility;
- Environmental technologies, renewable energies and resource efficiency;
- Health care and information;

- Communication technology, Green IT, and intelligent products⁴².

4.3 Business Clusters in Baden-Württemberg

According to Michael Porter's definition, "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a network of neighbouring countries."

Two main cluster approaches can be distinguished: those based on similarity and those relying on interdependency⁴³. The first ones are rest on the assumption that economic activities clusters since they are performed by similar companies in terms of products, production processes and labour skills. Instead, those based on interdependency assume that economic activities get together because dissimilar actors, to operate with commercial success, need to exchange goods, services, and competences.

Aside from the above distinctions, economic clusters do not include business companies only but often also involve governmental institutions, universities and

⁴² European Commission, (2020). Internal Market, Industry, Entrepreneurship and SMEs [online]. Available at: <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/baden-w%C3%BCrttemberg>.

⁴³ Porter M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy, pp. 16-17.

public research laboratories, standards-setting agencies, vocational training providers and trade associations.

In the case of Baden-Württemberg, the cluster policy represents a key element of the regional industrial policy with particular reference to SMEs. Such a policy focuses on strengthening the innovative capacity of companies and on increasing the competitiveness of the region. Thanks to clusters, companies' innovative capacity, and especially that of SMEs, can be improved and international competitiveness in the long-term can be boosted⁴⁴.

As stated in the Regional Cluster Atlas of Baden-Wuerttemberg of 2019, the main goal of the Baden-Württemberg state cluster policy is to further improve cluster management and increase the quality of it. The Cluster Atlas captures 110 cluster initiatives (which often are cross-sectoral), the nationwide networks and the State agencies.

The principal targets of the cluster policy defined in Baden-Württemberg are the following:

- Boosting the economic competitiveness of BW;
- Accelerating the innovation processes;
- Creating a cooperating and collaborating culture;
- Combining competences and strengthening horizontal cooperation;

⁴⁴ Baden-Wuerttemberg Ministry of Economic Affairs, Labour and Housing (2019). Regional Cluster Atlas Baden-Wuerttemberg [online], pp. 18-19. Available at: [file:///C:/Users/User/Downloads/Cluster-Atlas_2019_englisch%20\(1\).pdf](file:///C:/Users/User/Downloads/Cluster-Atlas_2019_englisch%20(1).pdf).

- Developing cross-industry and cross-technology projects and promoting new fields of application;
- Developing new products and services;
- Positioning Baden-Württemberg as an international economic strength (European Commission, 2020).

The public support delivered for cluster initiatives and networks in the region can be divided into three types:

1. tools for promoting clusters, network development, and cluster excellence;
2. grant programmes for cluster initiatives which offer financial support to projects and actions focused on innovation and networking;
3. measures for integrating the cluster initiatives in the regional innovation policy.

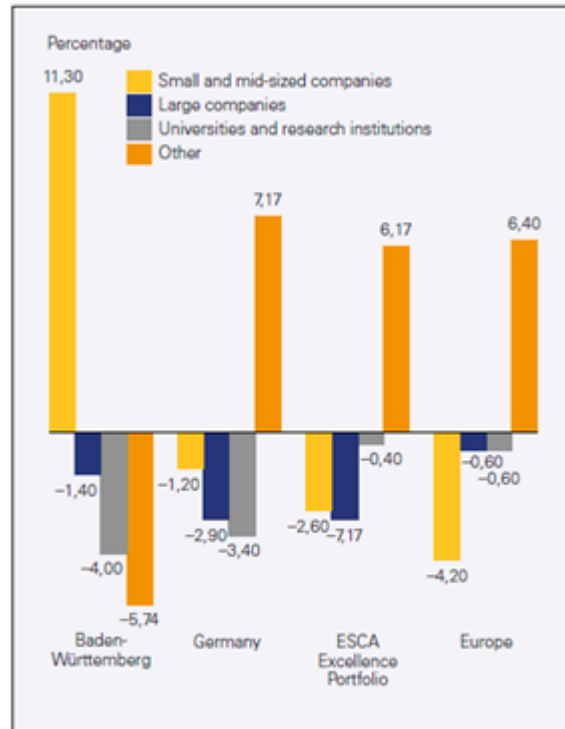
Figure 5: Average composition of actors in cluster initiatives and state-wide networks, comparison



Source: Baden-Wuerttemberg Ministry of Economic Affairs (2019)

The Baden-Württemberg Cluster Database lists around 110 cluster initiatives, state-wide networks, and state agencies. About 76% of the members of cluster initiatives and state-wide networks in Baden-Württemberg are SMEs. As shown in Figure 5, this percentage is remarkably higher than that recorded in Germany (60%) and Europe (64%).

Figure 6: Percentage changes in the composition of actors in cluster initiatives and state-wide networks: 2015-2018



Source: Baden-Wuerttemberg Ministry of Economic Affairs (2019)

The clusters in Baden-Wuerttemberg appear to be particularly focused on the SMEs target. Indeed, as Figure 6 shows, between 2015 and 2018 there has been a remarkable increase of SMEs as members of cluster initiatives and state-wide networks in Baden-Württemberg.

An articulated and differentiated cluster scene has developed in Baden-Wuerttemberg over the last years and many companies, research institutes and universities are involved in regional cluster initiatives or state networks. Around more than 130 clusters and cluster initiatives are active in the region.

The main sectors supported by the government and therefore crucial for the competitiveness of the region are the following:

- E-mobil BW (electric mobility)
- Umwelttechnik BW (environmental technologies)
- MFG Innovationsagentur für IT und Medien Baden-Württemberg (media development and film funding)
- BIOPRO Baden-Württemberg GmbH (biotechnology)
- A newly established agency for lightweight construction.

It is worth mentioning that the emerging industries of the regional economic structure are: ICT (Stuttgart, Karlsruhe), electronics (Stuttgart), logistics, biotechnology (Heidelberg, Mannheim, Freiburg); then, the industries associated with environmental protection and sustainable energy (Freiburg, Karlsruhe). These emerging industries are a fundamental source of stimuli for innovation (by both supplying new technologies and creating the demand for innovative solutions). The progress of these sectors affects positively also other industries;

for instance, the modernization of production technologies, microelectronics and new solutions in the IT industry have influenced positively the traditional automotive industry (ibidem).

4.4 Case study methodology

4.4.1 Research design

The case study analysis is an effective methodology to investigate and understand real and complex issues related to companies and entrepreneurial reality⁴⁵. Case study research is described as a flexible and resourceful form of qualitative research, very suitable for an in-depth examination of an articulated issue in a certain context, especially when it is difficult to tell the line between the context and issue and there are many variables to take in consideration.

The present research will be conducted with two case studies. The most important benefit arising from a multiple case study is that it gives more representativeness. In our case, we have the possibility to compare two companies from the same region but characterised by some important differences. The selection of suitable cases for the research was done by looking at the SMEs active in the manufacturing sector of Baden-Württemberg and with a size included in the range of 50 to 500 employees. The two selected companies, belonging to different industries and having different sizes as well as approaches to Open Innovation, are Seleon and Beyerdynamic.

The case study used for the research will be an exploratory one since the topic has been examined by few scholars and there is still qualitative research to be done

⁴⁵ Creswell J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage, pp. 27-30.

regarding SMEs attitude with respect Open Innovation and value networks. Exploratory case studies fit researches that have not deepened the object of investigation and are structured to explore phenomenon, whereby general questions are meant to open the door for further examination of the observed phenomenon⁴⁶. Accordingly, by following such an inductive approach, we will try to build up from some specific empirical observations a more general set of insights useful for further research.

⁴⁶ Yin R.K. (1984). *Case Study Research: Design and Methods*. Beverly Hills, Calif: Sage Publications. pp. 22-23.

4.4.2 Data sources and collection

The exploratory research design implies the use of data sources coming mainly from direct interviews⁴⁷. These interviews are based on a set of questions which according to the literature, help to shed light on the main issues under investigation. In addition, secondary data sources will also be used for the analysis, such as company web pages, patent databases and journal articles.

The interview mode chosen for this research is the semi-structured interview, which is often the only data source for a qualitative research project and is usually scheduled in advance at a designated time and location outside of everyday events. Semi-structured interviews are generally organised around a set of open-ended questions, with other questions emerging from the dialogue between interviewer and interviewees. The latter are the most widely used interviewing formats for qualitative research and can occur either with an individual or in groups.

⁴⁷ Baxter P. E., Jack S. M. (2010). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers, Article in Qualitative Report, pp. 547-548.

4.4.3 Pilot interview

A pilot interview is intended not for data collection but as a help to the design of the further research. The idea is to see whether the full-scale research that is proposed will actually investigate what it is intended to. It will be checked if there are problems with wording of questions, interview techniques, data analysis and the matching of intentions with available data.

For the pilot interview, it has been taken a company which the author knows from previous work on a University project in collaboration with Campus Founders in Heilbronn.

The company chosen was IDS- Imaging Development Systems, an Electronics manufacturer in Obersulm, Baden-Wuerttemberg. Since 1997, the company has been developing and producing solutions for industrial image processing. By company counting 300 employees and a turnover of 62 million €, the company can be considered as a SME for the German standards.

The person interviewed was the head of Business Innovation and Ecosystem in the company and responsible for:

- Cooperation and collaboration with start-ups;
- Entrepreneurship topics;
- Implementation of new business models
- Research implementation

- Events like corporate challenges with start-ups or students, hackathons, start-up day
- Cooperation with innovative networks / innovation departments of other companies.

The reason why this company has been chosen is not only because of a previous connection and because it has all the requirements to be defined as a SME, but also because is a well-known and successful company in the area of Heilbronn, with good connections with the University of Heilbronn as well as with other companies and organizations.

The interview lasted 1 hour since there have been some extra comments on the questions and feedbacks from the interviewed. In general, questions related to Open Innovation may be difficult to be understood by managers of SME since the topic is relatively new. One of the feedbacks coming from the pilot interview has been to give a short explanation about the topic of Open Innovation to the interviewed before proceeding with the following questions:

Q.1 What kind of Open Innovation practises do you use? In-bound, out-bound or coupled?

Q.2 Does your company engage in collaborating with external entities? Which ones? (e.g. customers, suppliers, universities, ...). If yes, which are the benefits and/or the risks of networking for you? In which way you collaborate?

Q.3 Do you think collaboration (networking) pays off and it is worth it?

Q.4 If your company adopt Open Innovation practices, what are the motivations?

Which are the benefits and the negative aspects of them?

Q.5 If your company adopt Open Innovation practices, was the stimulus internal to the company or coming from external actors (including public institutions, such as cluster coordinators, national and/or regional governments, UE)?

Q.6 If your company adopt Open Innovation practices, which kind of costs does your company have to support?

Along with the already mentioned need of introducing the topic of Open Innovation before starting the interview, what has been learned from the pilot interview is that during the interview itself most of the questions were very articulated and they required to be more clear and concise. Regarding the rephrasing of the questions, the fourth question has been split into two distinct questions, in order to have more clear and direct answers:

- If your company adopt Open Innovation practices, what are the motivations?
- Which are the benefits and the negative aspects of Open Innovation practices?

Question number 2 instead has been reduced to:

- Does your company engage in collaborating with external entities? Which ones? (e.g. customers, suppliers, universities, ...).

Indeed, since the benefits and risks are the objects of a subsequent question, the rest of the question was redundant.

4.5 Case Study: Seleon

4.5.1 Company profile

Seleon GmbH has been developing and producing complex equipment for customers in the medical technology field since 1998, growing into a leading medical technology service provider. It develops solutions in partnership with customers around the world. Seleon counts 85 employees and the company's team is made of experienced physicists, engineers, computer scientists, process engineers and consultants. Opposed to the other company which will be analysed in the next section, Seleon may be considered as a smaller company: thus, it will be interesting to see if the number and/or the type of employees may influence the companies' behaviour.

The company has already realised more than 200 projects with the customers and applied for 53 patents since its founding⁴⁸.

The core competencies of the company lie in these three business areas:

- Product development for complex medical technology systems;
- Production of medical devices according to international standards;
- Consulting for all regulatory matters related to product developments, international approvals, and company certifications.

⁴⁸ See ESPACENET and the website of Seleon.
Available at: <https://www.seleon.de/en/company/about-seleon.html>.

The person in the company interviewed was the sales manager of the consulting division. In the following sections, I will analyse her responses on the topic of Open Innovation practices and Networking.

4.5.2 Inbound and Outbound Open Innovation practises

A first important result coming from the interview, is that Seleon takes advantage mostly from Inbound practices (see Section 2.3 in the second Chapter). Seleon mainly collaborates with customers that come with ideas on prototyping and the company supports them with the development of the product or the prototype on the early stage. For the kind of technical work the company is involved with, it is not only important the involvement of customers but also that external consultants and experts, mainly for projects, software development and in general in order to fill knowledge gaps on technical matters.

Concerning events and networking, the med tech (medical technology) sector collaborates strictly through the participation to events and associations like Technology Mountains and MedTech Pharma. The membership to these kind of associations helps the companies in this sector to have access to webinars, events, newsletters, and other services. For Seleon it is important to be in contact with these associations since most of the huge manufacturer in the medical field in

Germany, and especially in Baden-Württemberg, are also members and part of that networking. Suppliers too are relatively fundamental to the work of the company for the developing and production of medical devices, software, electronic components, hardware and system integration teams. Suppliers are therefore crucial for development of the components which may be customized or standardized, depending on the development status.

The companies with whom Seleon cooperates are mainly Start-ups, one of them, for instance, is Campus Founders, an entrepreneurship and innovation centre in the region of Heilbronn-Franken. The connection with Campus Founders witnesses the importance of having linkages with universities and especially university graduates (both local and foreigners).

Moving to Outbound practices (see, again, Section 2.3 in Chapter 2), Seleon is involved in the licensing of Intellectual Property Rights (IPRs) and patent selling. What comes out from the interview is that the company develops IPRs inside and sells the rights to the customers. The reason behind this decision lies in the excessive costs of holding patents, which remain unused throughout the years. Especially SMEs, which don't have huge financial resources, may prefer to profit directly from IPRs.

Looking at the worldwide patent database ESPACENET, it emerges that Seleon has applied for 53 patents since its foundation, which reflects an active attitude of the company towards patenting and innovation. The fact that Seleon is proactive in terms of licensing and selling patents shows that the company has not fear to outsource knowledge and information in general, which - as we have seen in Chapters 2 and 3 - is one of the main obstacles to Open Innovation, especially for SMEs.

Other Outbound practices do not play a relevant role. No joint venture has been considered yet, but a cooperation with two firms. One of them is a larger company which Seleon would like to support in terms of knowledge and expertise-

4.5.3 Value networks and collaboration

As we mentioned above, collaborations seem to be very important for Seleon. Networking and valued partnerships are essential for companies in the medical tech field, since expertise in the sector and the scientific and technical knowledge are fundamental.

For this reason, Seleon is in contact with several organisations which are an important reference, especially for the introduction of new technologies.

Seleon maintains partnerships and contacts with the following organisations:

- Johns Hopkins University Hospital

- Freiburg University Medical Centre
- Kiel University Medical Centre
- Freiburg University
- Zentrum für Schlafmedizin und Schlafstörungen, Dortmund
- SLK-Kliniken Heilbronn
- Fraunhofer Institute for Toxicology and Experimental Medicine ITEM,
Hanover
- Valtronic Technologies (Suisse) SA, Les Charbonnières
- AC Aircontrols GmbH, Kempen
- HSG-IMIT – Institut für Mikro- und Informationstechnik der Hahn-
Schickard-Gesellschaft e.V.
- Fraunhofer Institute for Industrial Engineering IAO
- HOHENSTEIN LABORATORIES
- BIOPRO Baden-Württemberg
- TechnologyMountains e.V.
- VDE Verband der Elektrotechnik Elektronik Informationstechnik e. V.,
Frankfurt am Main
- BioLAGO e. V. – Das Gesundheitsnetzwerk
- avasis AG
- PFIF – Partner für Innovation & Förderung & FuE-Zuschuss GmbH & Co.
KG

- StartupCity Heilbronn
- M3i GmbH, Munich
- Life Science Nord Management GmbH, Hamburg⁴⁹.

From the interview came out that two years ago the company was still more focused on customer orientation rather than networking. Recently, the attention shifted towards some Start-ups in the region. This kind of cooperation may function well since the Start-ups lack of financial resources for quality management system and for investment in production, while this can be offered by Seleon in exchange for support in the early stage of prototyping and introduction of new products. The Start-ups pay a fee for using the production area and Seleon remains the legal manufacturer.

Collaborations with research centers are particularly important for Seleon since they provide support for clinical studies, which are crucial in the med tech sector. Regarding collaborations with competitors, Seleon has had just some minor interactions with small competitors of the med-tech field, which need production support, without establishing a real cooperation.

As already mentioned, collaborations are crucial for companies in the med-tech field, given the continuous research advances and the high level of required specialisation. Since collaborations have an important role for Seleon, it is

⁴⁹ See the website of Seleon. Available at: <https://www.seleon.de/en/company/partners.html>.

interesting to stress that, according to the manager interviewed, the input to collaborate with clusters and other companies is mainly coming from the company itself. The person interviewed expresses her personal interest to invest time and resources on collaborations and Open Innovation activities, since for Seleon the future is networking, getting new inputs from other companies, start-ups and even competitors, but also from research centres and experts.

4.5.4 Benefits, risks and costs of Open Innovation

What emerges from the interview is that Open Innovation practises are mainly a source of benefits for Seleon. The opportunities that derive from networking are various. One of them is given by the chance to enhance the visibility of the company through the different kinds of events and display of Open Innovation. In addition to the visibility and benefits for marketing purposes, the interviewed underlines that what Seleon appreciates the most are the benefits deriving from networking with start-ups. This kind of cooperation is fundamental to keep up with the new trends and researches in the field, since start-ups are particularly active in experiencing and testing prototypes and new products, and in developing new ideas on product management. These connections can give new perspectives to the company which, in the past, has mainly focused on customers.

From the knowledge point of view, networking is essential to experiment and learn new concepts, enlarge the company know-how, and catch new technological trends.

Coming to the negative aspects of Open Innovation practises, the manager interviewed underlines the difficulty to manage complex organizational issues and the high costs in terms of time and highly qualified personnel.

4.6 Case study: Beyerdynamic

4.6.1 Company profile

Beyerdynamic GmbH & Co. KG is a German manufacturer of microphones, headphones, wireless audio systems and conference systems. Beyerdynamic was founded in 1924 in Berlin. It wasn't until the 1950s that it became known as BEYERDYNAMIC and relocated to Heilbronn. Recently it has been developing into a global consumer electronics company⁵⁰.

Beyerdynamic designs, develops and produces audio products that boast maximum user-friendliness, cutting-edge functions, an extremely attractive design and the best materials. It has 420 employees world-wide and a turnover of 83 million €. Thus, compared to Seleon, the company is much larger in size.

The person interviewed for this company is the Director Audio Consumer Products, who is responsible for product management, product design, R&D conceptions, and other operations involving the development and launch of new products.

⁵⁰ See the website of Beyerdynamic. Available at: <https://global.beyerdynamic.com/company>.

4.6.2 Inbound, Outbound Open Innovation practices and networking

From the interview done to the manager of Beyerdynamic it results that many are the Inbound practices used by the company, as much as in the case of Seleon. One of them is the involvement of employees, mainly through Open Innovation events organized in the company, as much as presentations of new ideas and papers.

Customer involvement is also a frequent practice, more related to get product insights, plans for product development and in general to get new inputs in problem solving. From the customers the company can get important feedbacks, pains and gains and expectations, which enable the company to introduce new concepts and ideas.

Suppliers are also seen as an important inbound sources, especially for new platforms and new developments in terms of market and technology trends.

Regarding the management of IPRs, the data base ESPACENET shows that Beyerdynamic has applied, since its establishment, for 15 patents only, which seems a small number when compared to those of the younger Seleon (53 patent applications).

Unlike Seleon, from the interview doesn't come out that Beyerdynamic is involved in IPRs licensing or patent selling, which may be seen as a signal of a

lower openness. Instead Beyerdynamic mostly buys software solutions, offered by the suppliers, to adapt to their products.

Networking is a practice that Beyerdynamic has just started to practise few years ago, mainly with connection with universities and start-ups in the Heilbronn area, linked to universities, like Campus Founders. The company is networking with the SMEs connected to the Dieter Schwarz Foundation which supports a wide range of forward-thinking opportunities and programmes in the fields of education and science.

Together with other SMEs of the area of Heilbronn, Beyerdynamic organises hackathons and designs sprint-like events in which computer programmers and other actors involved in software development (e.g. graphic and interface designers, project managers, domain experts) can collaborate.

For the Outbound practices, the manager of Beyerdynamic mentions some joint venture investments in start-ups. The company works also with suppliers for the development of joint R&D projects: the suppliers' knowledge combined with Beyerdynamic's long-lasting competences can lead to remarkable results.

From the interview it emerges that collaborations with start-ups are quite frequent: indeed, the latter are important sources of new technologies, whereby Beyerdynamic invests on the development of these technologies or collaborate to get the end solution. Universities, on the other hand, can provide also useful knowledge coming from government programs.

In the case of Beyerdynamic the input to get involved in Open Innovation practices comes from both inside the company and outside, especially from Universities. In this case we are talking about research requests from universities or other entities collaborating with them, such as Campus Founders.

In conclusion, for matters related to knowledge and research the company is mainly stimulated by external entities. In this case, for instance, universities may act as innovation intermediaries giving the possibility to SMEs, like Beyerdynamic, to be involved in research projects. At the same time, universities can create connections with graduate students, other universities, start-ups and SMEs. On the other hand, when it comes to create and design a specific new product it is the company itself that asks external partners to collaborate in order to solve a certain problem.

4.6.3 Benefits, risks and costs of Open Innovation

The interview done with Beyerdynamic manager shows that the main benefit that derives from Open Innovation is the different perspective that the company can get and the involvement of external knowledge.

The knowledge flows from different actors seems important to get better solutions and alternative approaches to the problems. Several insights on a specific problem may lead to solution the company itself may not come to. In this case

collaborations make problem solving much easier and may help in saving time and resources. The main motivation to collaborate for Beyerdynamic is therefore the possibility to get in touch with different external experts, mainly to get inputs on the product development, but also for developing new business models.

The main negative side of Open Innovation is the possibility that connections with suppliers and the exchange of information with them may advantage other competitors in contact with the same suppliers. The risk to see other competitors getting the same results after a collaboration with a common supplier is a risk to take into account. However, it seems that this kind of collaborations pay off, since there is still a first mover advantage of getting insights on technical matters.

From the interview it emerges that some minor costs that arise are related to events, such as hackathons, which require time, resources, and personnel. Instead, the main costs are linked to collaborations with start-ups. In this case, in fact, high and risky investments on the co-development of prototypes and new products are necessary.

5. Concluding remarks

In the first part of this thesis it was emphasised that there is a need for further research on the topic of Open Innovation and networking for SMEs, especially because most of them are not fully aware of the potential benefits that can be derived from a more open attitude towards innovative activities. In the last chapter an attempt was made to provide a contribution to fill this research gaps. Obviously, being based on the case-studies of two small and medium-sized enterprises located in Baden-Württemberg, such a contribution must be considered as both partial and tentative. Nevertheless, some interesting insights emerged from the analysis carried out

Comparing the two SMEs, it is possible to stress the presence of similarities but also of some important differences in their approach to Open Innovation practises and collaborations, as well as, in their vision on the main challenges, barriers and costs.

The two companies taken into consideration, Seleon and Beyerdynamic, have a different size (85 and 420 employees, respectively) and work in two different manufacturing industries: Seleon is a full service company producing and selling medical devices and providing technical assistance to customers, while Beyerdynamic is a manufacturer of microphones, headphones, wireless audio systems and conference systems. This implies, of course, differences in the

approach to innovation taken by the two SMEs, according to the different internal resources and market conditions.

On the basis of the interviews, the main results of the research done comparing the answers of the two company managers are the following.

1. What open innovation practices are SMEs using?

With respect to the first research question, it can be said that both companies mainly resort to Inbound practices for Open Innovation, i.e. they make an intensive use of external sources of knowledge and information to speed-up internal innovation. This is consistent with the approach followed especially by SMEs while large companies adopt it to a lesser extent. The companies have emphasised the importance to collaborate with start-ups which are quite active in both the med-tech and the audio electronic industry and help them to keep up with new ideas and trends. However, also suppliers and customers give important inputs to the companies, since in both sectors there is a need for continuous technical and scientific stimuli and insights coming from the demand side.

Moving to Outbound practices - that is the outsource of internal activities to perform innovation outside the company - Beyerdynamic does not appear to be particularly involved in them. This could partly due to its relatively low propensity to patent. Indeed, although being smaller than the former, Seleon has a

wider patent portfolio and, instead of let them unused, prefers to licence and sell its IPRs.

2. What level of engagement with value networks do SMEs have?

What emerged from the analysis is that both companies have numerous collaborations with customers, suppliers as well as with universities. Seleon has strict connections with the latter since for companies in the medical technology field scientific and technical knowledge are fundamental. Moreover, universities can play the role of medium to other networks, since they are also connected with different business associations, start-ups and incubators, and research centres.

For Beyerdynamic networking seems fundamental too, for getting inputs and insights, especially from start-ups, involved in the audio electronics. Networking, especially in the form of events, such as hackathons and webinars, are one of the main used practices by both companies, since they have a smaller impact in terms of costs and may benefit them also from a marketing point of view. Accordingly, these kinds of networking activities provide relevant advantages to the companies with a few downsides.

3. What motivates or inhibits SMEs to shift towards openness?

4. What are the risks and costs for cooperation?

The barriers associated with Open Innovation, stressed by the two SMEs analysed, appear to be related mainly to the cost of qualified personnel and time management. In the case of Beyerdynamic, some other costs were related to the investment for Joint ventures. These types of costs are of course much heavier to sustain by a SME, but in that case the company will evaluate in depth the pro and cons, in order to decide whether to continue the investment or not. As mentioned before, the costs related to networking events are not viewed as barriers since, even if they may not pay off for innovation purposes, they still give rise to marketing benefits and have a positive impact for the company in terms of visibility. From the interview to the manager of Beyerdynamic came out, as a particular risk, that of sharing knowledge and information with suppliers since other competitors collaborating with the latter may get some advantages. However, as far as the company will be able to exploit first-mover advantages such a risk could be substantially reduced.

Both companies have stated that Open Innovation practices and networking in general have more benefits than negative sides. The motivation to shift towards openness lies on the possibility to get different points of view on product developments and new business models as well as to achieve higher visibility for marketing purposes. In both the sectors involved, medical technologies and audio electronics sectors, there is a high necessity to fill knowledge gaps on new market

trends (especially for Beyerdynamic) and new scientific developments (especially for Seleon).

5. Where does the input to practise Open Innovation come from? Is it an input coming from external institutions or from the company itself?

In the case of Seleon the main input towards openness comes from the person responsible for Open Innovation matters. There is a personal will, curiosity, and interest in participating to events and spending working time on networking. In this case there is no evidence of external inputs but there is mainly a company intention to be proactive. For Beyerdynamic the input to get involved in Open Innovation practices comes from both inside the company and outside, especially from suppliers. However, when it comes to create and design a specific new product it is the company itself which searches for external partners.

In neither of the two companies the input to Open Innovation is coming from governmental institutions or agencies, such as those operating in the Baden-Württemberg region. However, this does not mean that public policies cannot play a more proactive role for other types of SMEs, characterized by lower knowledge and autonomous innovative capacity. Moreover, even the two examined companies may have taken advantage from regional innovation policies in an

indirect way, for instance by participating in networks of universities and firms created thanks to the impulse of public supporting measures.

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APPENDIX: The semi-structured questionnaire

Q.1 What kind of Open Innovation practises do you use? In-bound, out-bound or Coupled? (Choosing from the options below)

Inbound OI:

- External consultants: Temporary recruitment of outside specialists
- Employee involvement: Using employee knowledge through programs such as suggestion systems and independent work teams
- Customers involvement: Involving customers in innovative processes through market research or product development based on their feedbacks
- Suppliers: Collaboration with suppliers in order to transfer customer needs to them or get ideas from them
- Competitors: Collaborate with competitors to exchange information and produce common products
- IP in and licensing: Purchase property rights include: License for the exploitation of technologies, patents, copyright
- Networking: Knowledge sharing with other firms and forums or events informally
- Universities: Contact with universities and colleges
- R&D in: Providing R&D services to other firms

Outbound OI

- Joint venture: Joint venture investment with external partners

-Participations in standardizations: Participation in standardization and assessing activities

formally and informally

-Venture capital with external partners: A venture capital investment with an ambiguous future

-Spin-off: Establishing new knowledge-based firms and supporting them through foremost firms

-R&D out: Getting R&D services from other firms such as research and testing centres

-IP out licensing and patent selling: Selling licensing right to use inventions and copyrights to

other firms for more profit from intellectual properties

-Selling of market ready products: Selling of market-ready products to the third-party to sell to customers

Q.2 Does your company engage in collaborating with external entities? (Customers (i.e. retailers), Consumers, Suppliers, Competitors, Companies operating in other industries, Universities and research centres, Innovation intermediaries)

Q.3 Do you think collaboration (networking) pays off and it is worth it?

Q.4 If your company applies Open Innovation practices, what motivates your company to apply them? Which are the benefits and the negative aspects of it?

Q.5 If your company applies Open Innovation practices, was it because of inputs given by external institutions, e.g. universities, cluster organisations, government, region, UE?

Q.6 If your company applies Open Innovation practices, which kind of costs does your company have to support applying collaboration and/or the Open Innovation practices mentioned before?