USING OPEN INNOVATION TO GAIN KNOWLEDGE AND TECHNOLOGY

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Abstract

The topic of this thesis is “Using open innovation to gain knowledge and technology”. Open innovation as a topic has been researched quite much but the different researches have not gathered all the most used obtaining methods to one research. I saw it fitting to gather the most used inbound methods together. The other researches usually focus on one or two methods and the advantages and disadvantages of different methods have not been gathered under one study. This bachelor’s thesis is a literature review in which I write about all inbound open innovation methods and what advantages and possible disadvantages they might have. The main findings in this research is how the different methods work and what kind of open innovation business models each method supports. This bachelor’s thesis could help companies to determine what kind of obtaining method to use if they would like to implement open innovation to their company’s business model.

Keywords
Intellectual property, Open innovation, Research and development

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Contents

1. Introduction

Open innovation is getting more relevant and many companies have adopted it to their business models. There has been research on open innovation since 1960s (Trott & Hartmann, 2009) but the term "open innovation" was first used by Henry W. Chesbrough. After 2003 and Chesbrough's book *Open Innovation: The new imperative for creating and profiting from technology* the research on open innovation became more wide spread. The previous research on obtaining knowledge and technology has focused on just one or two methods of how to obtain knowledge and technology through open innovation.

Companies have viewed their research and development (R&D) process from a closed innovation perspective where everything from innovation to research to development to marketing happens inside the company. The companies are now shifting more and more towards open innovation business models where technology and knowledge can come from external sources. This trend is becoming more relevant and businesses have start adapting their business models to the quickly shifting market. There are no clear rules of adopting open innovation to a business model but the obtaining methods a company can use are quite constant.

This bachelor's thesis reviews how companies can gain knowledge and technology through open innovation using pecuniary on non-pecuniary methods. This thesis' focus is on the inbound open innovation methods and what kind of advantages and disadvantages the methods have when viewed from a business angle (Herzog, 2011). The readers of this thesis should get an outlook on the obtaining methods and how they work and what kind of advantages and disadvantages the different methods have. This thesis could be useful for companies that wish to explore the advantages and disadvantages of different open innovation obtaining methods, if they wish to implement open innovation to their company's business model.

There are studies on how different methods work and how they affect the company's business model. The previous studies usually focus on just one method. The studies that are reviewed in this thesis are studies on large companies and small and medium-sized enterprises (SMEs) that have adopted open innovation to their business models (Lee, Park, Yoon, & Park, 2010; Van de Vrande, De Jong, Vanhaverbeke & De Rochemont, 2009). The previous studies usually focus on how the companies use these methods and how they choose the methods for their businesses. Some of the studies are case studies of companies. This thesis focuses on most used inbound methods and reviews what kind of advantages and disadvantages every method has. The object of this thesis is to review studies about open innovation obtaining methods from various conference papers and journal releases.

The second chapter is about the differences of closed innovation and open innovation and it also introduces the open innovation business models. The obtaining methods and their advantages and disadvantages are presented in the third chapter. The fourth chapter is discussion where I write my own opinions about the obtaining methods. The conclusions are presented in the fifth chapter. The conclusions were made from reviewing the presented obtaining methods.

2. Open and closed innovation

Open innovation means that the innovations to the company can come inside the company or from external sources. The product containing the innovation can then go to the company's existing market or to a completely new market (Chesbrough, 2003 p 43). With this type of innovation companies have the opportunity to improve their market place and start completely new markets on the industry. In open innovation the knowledge coming from external sources is as important and usable as the knowledge and technology invented in closed innovation. In contrary the closed innovation means that there is no knowledge coming from external sources and everything is done by the company itself.

2.1 Closed innovation

Companies using the closed innovation model have no inflowing knowledge from external sources or outflowing information to other companies. Closed innovation companies have their own R&D facilities that create their own ideas. The ideas from these facilities are rarely sold to another company unless they can't be used by the owner of the R&D facility. In closed innovation model it is thought that the inventing company should hold on to their knowledge and control it as much as possible. The closed innovation companies own the rights to sell, product, support and service the product they have invented (Figure 1), (Chesbrough, 2003). Closed innovation model was used much in the 1900s as the science community wasn't as mobile as it is today and didn't share ideas to each other. Most of the scientific community were at universities but they were not trying make money with their inventions and breakthroughs. The scientist couldn't conduct proper tests with the university funding and that led to creation of the patent system. This allowed scientists to patent their inventions and sell them to a buyer that had the resources to test it and use it. The availability of the inventions led to the byers of the technology had set up their own R&D laboratories that tested the new technology and coming up with new ways to use materials. In the 1900s the industry was not as technical as it is today so it allowed the largest companies to become monopolies in their own field of technology (Chesbrough, 2003 p 24).

When the technology got more advanced, the largest companies could split their company into separate research divisions and development divisions. The research centers became hard and expensive to maintain and the creation of new technology was hard to predict and time. The development centers then became the way the companies made money utilizing the technology invented in the company's own research center (Chesbrough, 2003, p 32). Largest of these internal research at the time were Xerox's PARC (Palo Alto Research Center), IMB's T.J. Watson Laboratories, RCA's the Sarnoff labs and HP labs (Chesbrough, 2003 p. 28). According to Chesbrough (2003) these companies had monopolies in their own fields and in order to compete with these giants, the competitors had to make as large long-term invests to their own laboratories as these companies had done. As the competitors tried to mimic the market leaders' actions and some companies used some external parts in their products the NIH (Not Invented Here) term was coined (Chesbrough, 2003. p30). The term had a negative sound and this led the large companies to use their own R&D departments to create the needed components or parts to their products. In closed innovation model the R&D process was just integration of earlier own innovation as the companies made their own products better and better.

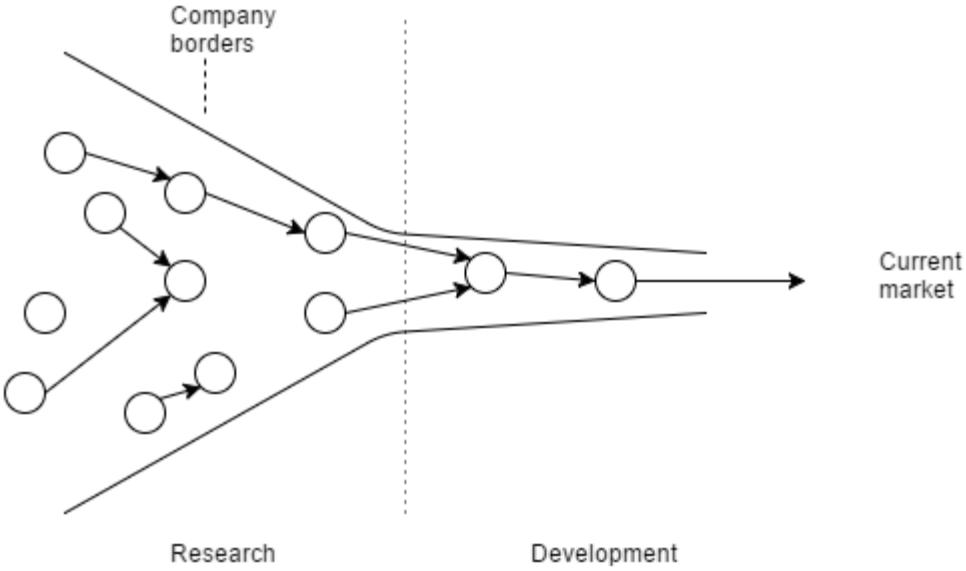

Figure 1. Closed innovation paradigm (Chesbrough, 2003, p.31)

The companies then realized that there is another way to cut the losses from internal R&D facilities as the workforce became more available and had the mobility to better positions as the job market got larger. As the best and brightest workers left changed jobs or started their own companies they took some of the workers with them. They then used their smarts to come up with new products. This led that the industry leaders had their best innovators hired away from them. These actions made the industry leaders' R&D process more difficult. Venture capital companies created a real risk to the closed innovation companies as the venture capitals had money to hire people from internal R&D laboratories. Closed innovation companies couldn't match the stock option packages from venture capital start-up companies (Chesbrough, 2003, p 38). As the technology got more advanced the product life-cycles got shorter and closed innovation companies had to start selling their ideas that had been sitting on the self as other firms could come up with the same ideas. Consumers wanted more but the closed innovation organizations couldn't match the rising demand of new products. Rising amount of external suppliers made the work for large companies harder as some other companies would acquire technology from external sources and utilize it quickly (Chesbrough, 2003 p. 40).

These factors led to the erosion of traditional closed innovation model as the inventions couldn't just be stored on the shelves of the R&D facility. The companies now had to come up with inventions faster and get them out to the market to create value for the company. The larger companies which had invested a lot of money into their R&D departments had to start selling and buying knowledge in order to stay in the business. This led the organizations to adapt to the open innovation model.

2.2 Open innovation

According to Chesbrough (2003), it is assumed that through open innovation companies can and should use external and internal innovation paths to the market, as the companies is trying to advance their technologies. Chesbrough et al., (2006 p.2) said that using purposive inflows and outflows of knowledge to accelerate internal innovation and expanding the markets for external use of innovation is open innovation. Thus it can be

assumed that open innovation is a way for companies to market and develop new technologies through inflowing and outflowing knowledge.

Open innovation model differs from closed innovation model quite much. In closed innovation model the R&D process is all internal. The companies come up with idea, develop it and put it to the market themselves. In open innovation model the ideas can come from inside or outside the company boundaries. The ideas can be then sold to an external developer or if the has been acquired somehow it can be developed inside the company. In open innovation model the developed idea then can be sold as a new idea to external markets or the company itself can sell it as its own product thus adding the "not invented here" badge to it if it has been innovated somewhere else.

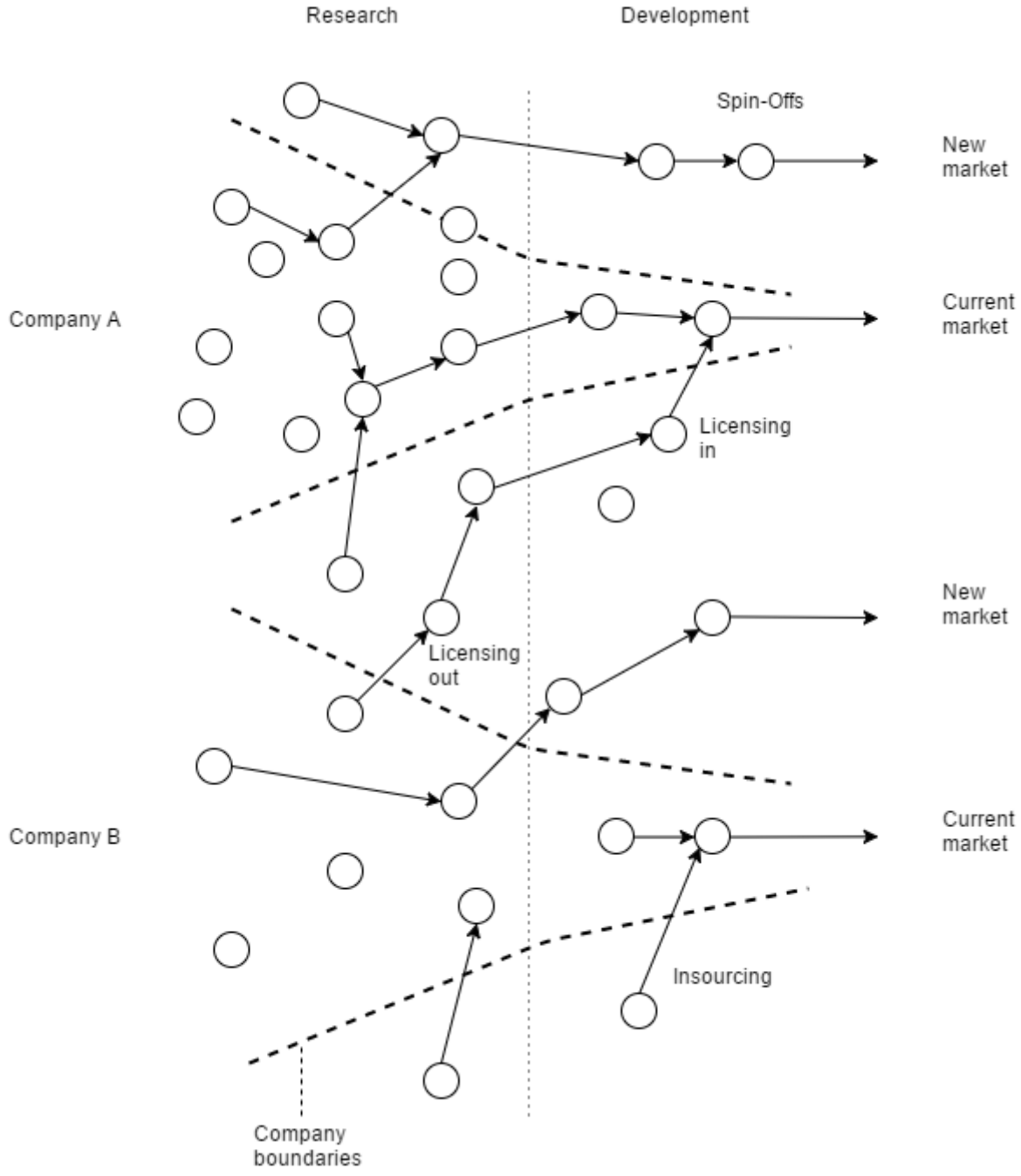

Figure 2. Open innovation paradigm, Adapted from (Chesbrough, 2003, p. 44; Nedon, 2015, p. 10)

In open innovation model the product modularity is high and in closed innovation model the product modularity is low. Open innovation model suits better to high speed industry such as high technology and closed innovation model to slower less competitive industry. In open innovation the companies have to have more explicit knowledge than in closed innovation. Open innovation companies' have more complex interfaces to other companies than closed innovation companies and open innovation companies create more positive external links to other companies than closed innovation companies, see Figure 2 (Gassmann & Enkel 2004)

2.3 Open innovation business models

Companies can use three different types of business processes for open innovation model (Gassmann & Enkel 2004). The types are outside-in process, inside-out process and coupled process, see Figure 3. All these methods work with the companies' own R&D process. According to Gassmann & Enkel (2004) in the outside-in process the knowledge comes from outside the company's boundaries and the company then develops the newly acquired knowledge into to marketable technology and sells it on its own market, see Figure 3. Acquiring a lot of innovation increases the company's knowledge intensity and can create internal spin-offs by uniting the purchased knowledge. These companies may also function as knowledge brokers.

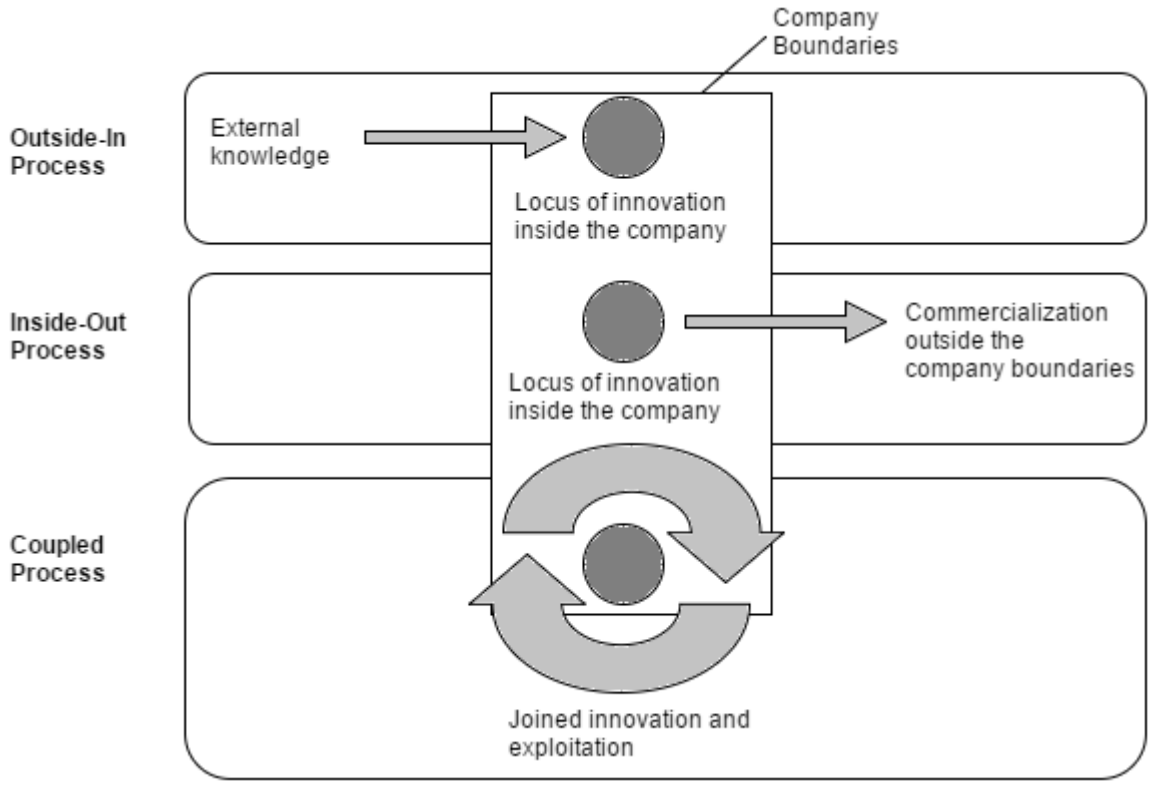

Figure 3. Open innovation business processes (Gassman & Enkel, 2004)

The inside-out method is profitable when company sells their IP, brings ideas to the market or multiply technology by transferring ideas to the outside environment (Gassmann & Enkel 2004). These inside-out companies may try to decrease their fixed R&D costs by selling their knowledge, see Figure 3.

The coupled process is combination of inside-out and outside-in processes, see Figure 3. The company can acquire knowledge and use it as it wishes or sell it to the next buyer. The company may also sell the knowledge gained from their own R&D process. Using coupled process some companies work in alliances with their competitors. (Gassmann & Enkel 2004)

Open innovation model is forcing firms to reassess their leadership positions, which reflect the performance outcomes of their business strategies (Chesbrough & Appleyard, 2007). Traditional business strategies guide companies to develop defensive positions against competitive companies and thus creating barriers against the opposing companies. This affects to the organization's openness.

IT companies have experimented with new business models that harness the collective creativity through open innovation. Some organizations have been successful with the open innovation models but some haven't been able to capture the value created by open innovation model. Adopting a new method to create value to the business will affect the value capturing abilities of the company if the transition to new open innovation strategy is not carried out correctly. Companies wanting to make strategic sense of innovation communities, ecosystems, and networks and their competitive advantages, have to take a new approach to strategy (Chesbrough & Appleyard, 2007). Chesbrough and Appleyard (2007) call this approach "open strategy".

Open strategy uses traditional business models and strategy with open innovation. According to (Chesbrough & Appleyard, 2007) open strategy embraces the benefits of the openness as a means of expanding value creation for organizations. Using the open innovation model forces companies to co-operate more with the innovation communities such as universities and research labs etc. Open strategy balances with value creation and value capture and doesn't only focus on the innovation, see Table 1.

Table 1. Open and closed innovation business model principles, adapted from (Chesbrough, 2003; Trott & Hartmann, 2009)

Closed innovation principles	**Open innovation principles**
The smart people in the field work for us	Not all smart people work for us → We have to tap into the knowledge of the smart people outside our company
To profit from R&D we have to discover, produce and sell it ourselves	External R&D can create value but internal R&D is needed to capture some of that value
If discover a technology ourselves we can get it to the market first	We don't have to make the initial research to profit from it
If we are the first to commercialize the innovation we will be the market leader	Building a better business model is better than getting to the market first
If we create most of the best ideas in the market we will be the market leader	If we make the best use of internal and external ideas we will be the market leader
We should control our IP so our competitors cannot profit from our ideas	Our company should profit others' using our IP and we should buy others' IP when it advances our business model.

Companies' business models have to adapt to the competing open innovation scene. Companies have to capture the value quickly before their competitors gets to it. They

have to develop the product fast and get to the market fast to get the best value for their investment, because product life-cycle is short in open innovation technology. Adding the open innovation principles (Table 1) to a company's business model doesn't mean that the company has to get rid of their internal R&D the internal R&D should be used with the incoming knowledge.

A part of company's business model can be strategic alliances. Strategic alliances between companies improves the companies' access to capital and new business and increases the critical mass of technologies. With these alliances the companies share risks and liabilities. This business model allows joint R&D so the costs for it lowers. Strategic alliances also benefit the business model by getting new perspective to the business (Trott & Hartmann, 2009).

2.4 Four ways of openness

Dahlander and Gann (2010) differentiate between four different ways of using openness in companies' innovation process: two are pecuniary ('acquiring' and 'selling') and two are non-pecuniary ('sourcing' and 'revealing'). Acquiring is basically buying inventions and input to the innovating process through informal and formal business relationships. This allows the company to gain access to resources and knowledge of their partners. Acquiring innovation is hard to manage if there are many different business partners and it has a risk of outsourcing critical parts of the organization. (Dahlander & Gann, 2010)

'Selling' is an outbound pecuniary method. It is out-licensing or selling products on the market. Advantages of this methods are that the products are usually on-the shelf products and the partner you are selling the product is more equipped to commercialize the product to the mutual interests of both companies. Overcommitting to own product may make it hard to license it out. (Dahlander & Gann, 2010)

According to Dahlander and Gann (2010) obtaining innovation in non-pecuniary way is sourcing. With this method the company sources external ideas from public researchers. Sourcing has wide array of ideas and knowledge and there are radical new solutions to problem solving. Many sources can create attention problems to the company and some of these ideas may end up not used. It may be quite hard for the company to choose between so many ideas and the ideas might be hard to combine together. (Dahlander & Gann, 2010)

Dahlander and Gann (2010) call the outbound non-pecuniary method 'revealing'. By that they mean that the company reveals its' internal resources and ideas to external environment. Its' advantages are mobile resources and the innovation gains legitimacy from external environment and helping with incremental and cumulative innovation. With revealing it is hard to capture the value of the product and company's internal resources can leak to the competitors. (Dahlander & Gann, 2010)

3. Inbound open innovation methods

In this chapter the advantages and disadvantages of different methods of gaining knowledge and technology through open innovation model are reviewed. These methods are used to increase the inflow of knowledge and technology to companies. The three first methods are inbound pecuniary ways of acquiring knowledge or technology. These methods have money involved in the acquiring process. The second two methods can either be pecuniary or non-pecuniary. The last two methods are fully non-pecuniary methods.

3.1 IP in-licensing

In-licensing is one of the most used ways to gain use of IP (Herzog, 2011, p31). Licensing is the exploitation of others firms' IP within a certain frame (Herzog, 2011, p31). IP licensing is a contract that allows the company that buys the license to use the IP owned by some other company. (Schaarschmidt, 2012, p 56). Normally the IP is protected and it cannot be used by anyone without a permission from the patent owner. In IP in-licensing the buyer company writes an agreement with the company whose IP it is. Usually the licensee company has to pay fee and a royalty based on sales to the licensing company (Herzog, 2011, p31). Different ways of payment can be a lump sum payment, fixed payment per sold unit or fixed fee per year (Bogers, Bekkers & Granstrand 2012, p.42).

Licensing the IP doesn't automatically mean that the license buyer owns the patent. This contract allows the buyer company only to use that technology or knowledge. The buying company cannot make any changes to it unless it has been specified in the licensing contract. Some of the features can be limited by the selling party (Schaarschmidt, 2012, p 56). In IP in-licensing the owner of the patent can withdraw the buyer's access to it if they violate the terms of the contract. IP licensing is usually for a fixed term. The licensee uses the IP as long as the contract states and pays royalties for as long as they sell the product they used the licensed technology in. IP in-licensing can be adjusted to any open innovation business model which I have presented in the previous chapters. In open innovation business model's processes the IP comes from outside the firm and the buying firm pays the selling firm (Gassmann & Enkel 2004).

Advantages of IP in-licensing are fast technological access, lower development costs, less technology and market risks and low commitment and high reversibility. IP in-licensing can be done by all sized companies (Brant & Lohse, 2014) tough it is more practiced by larger companies that have larger revenue. IP can be licensed from companies that are willing to let others use their patents in order to make revenue. The licensee gets the opportunity to manufacture, sell, import, export, distribute and market various goods and services which it couldn't normally do, without the license to do so. Open innovation model has this advantage over closed innovation model as closed innovation model doesn't allow external knowledge flowing in from external sources. IP in-licensing can also lead to several new technology spin-offs including parts from firm's own products and the licensed technology.

Disadvantages in IP in-licensing are loss of decision making due to contract constraints and competitive advantage is not realizable unless the contract is exclusive (Herzog, 2001, p31). Too complex contracts may make the IP unusable in a manner the licensee wants and thus restricts the potential of licensees. If the licenses are not exclusive there may be more competition on the market than at the time of the licensing. As we can see

IP in-licensing through open innovation model has more advantages than disadvantages and thus is a valid for a company to gain access to knowledge or technology they want to use.

3.2 Contract R&D services

Contract R&D services can either be joint R&D agreements or outsourced R&D activities (Herzog, 2001, p31). Contracted R&D services are usually medium or long term. This type of acquiring can be used in coupled business model as both companies give their knowledge and human resources to other company's disposal. Companies in this kind of agreement usually carry out the whole process from R&D to marketing. They create the market for the product and set standards for that particular technology (Dittrich & Duysters, 2007). These contract R&D services are usually conducted in centralized R&D centers and joint R&D agreements allow the companies to absorb very specialized knowledge and transfer it to their members in a way that allows the information to be more applicable (Spithoven & Clarysse & Knockaert, 2009). Outsourced R&D activities are usually between SMEs and larger corporations and larger corporations usually benefit from it more than SMEs as the larger company provides all the R&D activity and have the chance to exploit the technology before the SME (Lee & al, 2010).

According to Lee & al (2010), SMEs have strategic alliances with larger corporations in order to benefit from their R&D departments but in the process they lose the chance to compete with the bigger companies as some contracted services oblige the SME to share their technological competence to the partners. The joint R&D contracts allow the risk to be shared but doesn't reduce the development time (Gassman & Enkel, 2004). SMEs can benefit from outsourced R&D if they outsource it to universities or commercial R&D centers who have no desire to market their technologies (van de Vrande & al., 2009). According to van de Vrande & al. (2009) R&D outsourcing is done more by companies that manufacture goods than companies that produce services. R&D contracts can focus on any area of the R&D process like market discovery and planning, development and testing, production and sales, distribution, marketing and services (Yoon, Shin & Lee, 2016). According to Yoon & al. (2016) most companies use the contracted R&D services most for development and testing.

Advantages of contract R&D services are the chance to explore emerging technologies, chance to define and establish standards, possible access to public funding, reduced risk with partners, exploitation of established technologies and possibility to develop system solutions (Brant & Lohse, 2014). Possible disadvantages from contract R&D are possibility of limiting the flow of knowledge, chance of knowledge leakage and the risk of opportunism as the other partner may cross the other partner and claim technologies as their own (Brant & Lohse, 2014). Contract R&D services are useful to companies that want to use open innovation in their business model. Best open innovation business models for contract R&D are the coupled process and outside-in process if the company outsources their R&D processes.

3.3 Specialized open innovation intermediaries

Open innovation intermediaries are technology brokers who buy and sell open innovation and help the buyers to implement it to their own business model and companies utilize these intermediaries to search and solve innovation problems (Hossain, 2012). Main focus of these intermediaries is to analyze the characteristics of possible open innovation

partners and bring them together (Yoon & al., 2016). Open innovation intermediaries can be used in all open innovation business models. Companies can sell or buy innovation through these brokers.

Intermediaries can help buying companies connect to companies that are selling their innovation (Hossain, 2012). Though the company buying the innovation is in charge in the buying process the intermediaries help the company in the process as they might have expertise on completely different area as the selling company (Chesbrough, 2003, p. 69). The intermediary will help the buying company by consulting them in the process. (Hossain, 2012) Open innovation intermediaries are usually used by SMEs as their own R&D departments lack the capacity to absorb knowledge (Hossain, 2015). Acquiring knowledge and technology through these open innovation intermediaries can be used with the previously presented contract R&D services. Intermediaries can help companies to find their partner that allows them develop their business model further.

The other way to gain innovation is to make a deal through the intermediaries (Katzy, Turgut, Holzmann & Sailer, 2013). The buying company tells the intermediaries what they have come with and the intermediaries then propose the deal to a compatible R&D service. The service then comes up with price and it is presented to the buying party which can be an established company, corporate venture capital or a spin off. The buying company then makes the deal with the R&D service and the intermediary takes a cut from the deal. (Katzy & al., 2013) With these intermediaries it is possible to gain knowledge and technology that matches the company's needs.

Advantages from open innovation intermediaries are access to wide range of audience, easiness of connecting with potential partners, intermediaries cut some of the costs of finding a suitable partner and lower the costs of exchanging information and the connection with a partner company is quick (Hossain, 2012). There are also some disadvantages such as: large amounts of information can create a problem of attention, there are time constraints to inspect the given information and if there is a lot of it might be hard to asses it and unusable ideas may waste every time and money from every organization (Hossain, 2012).

3.4 Crowdsourcing and idea competitions

Crowdsourcing is outsourcing innovation problem solving to external organizations and individuals to submit ideas (Chesbrough & Brunswicker, 2014). Idea competitions are a means of crowdsourcing. There are many more crowdsourcing methods but I will be focusing only on idea competitions as it is the most used crowdsourcing method in open innovation model.

Idea competitions are tasks which are published to the partners and inviting them to submit related ideas in a clearly identified timeframe (Guertler, von Saucken, Tesch, Damerau & Lindemann, 2015). Idea competitions take part in the early phases of the development (Blohm, Bretschneider, Leimeister & Krcmar, 2010). Guertler & al (2015) also state that invited partners can rate and comment others' ideas and use these ideas for their own innovations. The best ideas are usually rewarded with money prices or some other awards given by the organizing party of the competition. In idea competitions the ideas come through open innovation as the participants give out ideas and the host company can choose the best for their and pay money in exchange. Idea competitions can also be competitions for smaller businesses that seek funding. Venture capital companies

can give the smaller companies this funding if their suggested idea is good enough. In exchange the venture capital then gains the right to use innovation in collaboration with the company which came up the innovation (Chesbrough & Brunswicker, 2014).

These competitions usually have as many participants as possible and the main goal for organizing party is to pull knowledge from these participants (Guertler & al, 2015). The suggestions that come up in these competitions can be radical and effort to determine and interpreting the best ideas is high. Idea competitions can take up to months in time and use lot of organizing party's resources (Guertler & al, 2015).

Idea competitions can be online competitions, where the participants are everyday people and users or focus group workshops. In online competitions there are more participants as the subject is online and available for everyone (Schweitzer, Buchinger, Gassmann & Obrist, 2012). The focus groups are for selected individuals who are usually experts in the related problem (Guertler & al, 2015). According Schweitzer & al (2012) there are more ideas presented but less ideas presented by one person and the ideas presented online are more unconventional than the ideas presented in the focus groups. Idea competitions take more time than focus groups, as it takes time to gather and evaluate all the ideas, and usually cost more to have as you have to pay prizes to the best ideas and the jury that evaluates the ideas (Schweitzer & al, 2012).

The advantage of idea competition is that there is a lot more ideas presented but on the contrary the ideas might not be as good as ideas presented in the focus groups. Crowdsourcing can widen the base of potential collaborators (Brant & Lohse, 2014). Focus groups may give more viable and possible ideas than the idea competitions, but they don't necessarily capture the end users' needs as well as the idea competitions, which are open for everyone and usually focused on the possible end users. (Blohm & al, 2010)

3.5 University research grant and publicly funded R&D consortia

First one to obtain knowledge and research from universities was the Intel with their Intel labs which they built near elite university research groups where the knowledge flowed openly between both parties (West & Gallagher, 2006). If the innovations from the university research were promising Intel hired the top researchers to help and commercialize and aid the production of the innovation (West & Gallagher, 2006). The pecuniary aspect of this obtaining method comes from companies that fund external projects which are conducted by researchers and scientist in universities. In return the funding company gain access to external knowledge (Chesbrough & Brunswicker, 2014). Companies that want to co-operate with universities can find the perfect partner through intermediaries (Katzy & al., 2013). Universities can used as partners in coupled or outside-in business model where the university gives knowledge and innovation to the company and the company gives money to the university or problems to solve.

The publicly funded R&D consortiums are related to the universities. Companies can form R&D consortia with other public or private organization. The consortia's R&D activities are partly or fully funded by government organizations (Chesbrough & Brunswicker, 2014). Universities which are partly funded by government can be a part of the consortia and company which is involved in the deal gains knowledge from the joint R&D effort. This method gives the company advantage as they don't have to invest that much money in to their own R&D facilities but it has to big enough to have proper

capacity to absorb the knowledge and collaborate with other researchers (de Jong, Vanhaverbeke, Kalvet, & Chesbrough 2008).

Company based public R&D centres try to get fast to the markets and gain commercial advantage over their competitors and university based R&D centres aim for codification, knowledge creation and technology transfers (Young, Hewitt-Dundas, & Roper, 2008). According to Young & al (2008) public R&D centres give bonuses based on patents but local companies don't have any pecuniary incentives. So public R&D centres can be a pecuniary or a non-pecuniary way to obtain knowledge but it depends on the size of the company involved in the R&D centre.

IP management in the university based R&D centres is carried out by the sponsoring organizations. In public R&D centres the large corporations also used the sponsoring organization to manage the IP but smaller firms did the management in the public R&D centre internally (Young & al., 2008). In university based centres some companies use technology transfer office to sign nondisclosure agreements if the IP goes to the company which wants to commercialize the innovation and the company pays the university for getting the IP (Young & al., 2008). In public research centres and university grants the IP rights have to be agreed at the start of co-operation so every party involved can avoid unnecessary legal disputes.

The advantages from university grants and university based R&D centres is the knowledge gained from external university researchers. The downside with universities is that universities usually make their research public and it may deteriorate the involved company's market advantage. In public research centres advantages for SMEs is the possible knowledge spill overs where the SME may gain knowledge that helps their own R&D. Risk in publicly funded R&D centres is the possible costs of defending existing patents and recently acquired patents (Young & al., 2008).

3.6 Customer and consumer co-creation

The customer and consumer co-creation happens in the early stages of the R&D process. Customers usually take part only on the innovation process. Customer co-creations doesn't mean that it is customer focused but it is about joint creation of value by the company and the customers involved (Prahalad & Ramaswamy, 2004). According to Chesbrough & Brunswicker (2014) customer and consumer co-creation is the involvement of consumers or customers in the generation, evaluation, and testing of novel ideas for products, services, or business models. Companies gain innovation through the consumers' ideas and suggestions.

Customer co-creation can be divided to three modes of interacting with the customers in the innovation process. The modes are the listen into process, the ask process and the build process (Piller, Ihl & Vossen, 2010). In this process the company gets only innovation and new ideas not technology or expert knowledge. In the "listen into" method companies ask the feedback from sales people, analyse sales data or research reports to identify the customers' needs (Piller & al., 2010). This allows the company gain valuable information about existing products and improve their products accordingly. The "ask" process includes the customer or consumer into the innovation process (Piller & al., 2010). Companies can get valuable innovation through surveys and thus make the product more suitable for users. The third mode is "build" mode. This method includes the customer to the innovation and design and development process (Piller & al., 2010). With this method the company gives the customer a chance design solutions by themselves or

implements methods to efficiently transfer innovative solutions from the customer to the company (Piller & al., 2010).

Advantages for companies using co-creation is that its value created is hard for competitors to imitate (Lee, Olson & Trimi, 2012). Co-creating unique experiences with the customer can help discover new sources of competitive advantage (Prahalad & Ramaswamy, 2004). The disadvantage in this kind of open innovation is that the product life cycles get shorter and thus the life span of competitive advantage becomes shorter (Lee & al., 2012).

3.7 Informal information networking

Information networking is a method of obtaining knowledge and technology while networking with other organizations without formal relationships. Possible ways to access gain access to the knowledge are conferences and events. (Chesbrough & Brunswicker, 2014) Information transfers from these networks don't require formal agreements or contracts. Informal information transfer networks work more like social networks than organizational networks. (Kang & Kang, 2009) Kang & Kang (2009) say that these informal networks don't require large transactional, managerial or maintenance costs so companies are motivated to develop large networks for information transfer to survive. Informal networks being so cheap or no cost to maintenance, companies can create more ties to external knowledge sources. (Kang & Kang, 2009)

Advantage in these informal information networks is the low cost to maintain the connections and possibility to access external information easily and react faster to changing market situations. The disadvantage in these networks is that the information gained may be invaluable for the company's purposes. (Kang & Kang, 2009)

3.8 Summary of the inbound methods

This chapter is to summarize the inbound methods introduced in the previous chapters. From Table 2 can be seen what kind of advantages and disadvantages each inbound method has and whether the method is pecuniary or non-pecuniary or possibly both.

Table 2. Summary of the inbound methods

Inbound method	Pecuniarity	advantages	disadvantages
IP in-licensing	Pecuniary	-fast technological access -lower development costs -less technology and market risks -low commitment -high reversibility (Brant & Lohse, 2014)	-loss of decision making due to contract constraints -competitive advantage is not realizable unless the contract is exclusive (Herzog, 2011)
Contract R&D services	Pecuniary	-chance to explore emerging technologies, -chance to define and establish standards -possible access to public funding	-possibility of limiting the flow of knowledge -chance of knowledge leakage -risk of opportunism (Brant & Lohse, 2014)

Inbound method	Pecuniarity	advantages	disadvantages
		-reduced risk with partners -exploitation of established technologies -possibility to develop system solutions (Brant & Lohse, 2014)	
Open innovation intermediaries	Pecuniary	-access to wide range of audience -easier to connect with potential partners -intermediaries cut some of the costs of finding a suitable partner -lower costs of exchanging information (Hossain, 2012)	-large amounts of information can create a problem of attention -time constraints to inspect the given information -unusable ideas (Hossain, 1012)
Crowdsourcing and idea competitions	Both	-more ideas presented (Blohm & al, 2010).	-ideas may be unusable (Blohm & al, 2010)
University grants and public R&D consortia	Both	-knowledge gained from external university researchers (Young & al, 2008)	-universities usually make their research public and it may deteriorate the involved company's market advantage (Young & al, 2008)
Customer co-creation	Non-pecuniary	-value created is hard for competitors to imitate (Lee & al, 2012; Prahalad & Ramaswamy, 2004)	-shorter product life-cycle -shorter life span of competitive advantage (Lee & al, 2012)
Informal information networking	Non-pecuniary	-low cost to maintain the connections -possibility to access external information easily -react faster to changing market situations (Kang & Kang, 2009)	-information gained may be invaluable for the company's purposes (Kang & Kang, 2009)

4. Discussion

The focus of this literature review is the different ways to obtain knowledge and technology through open innovation. The ways can be pecuniary or non-pecuniary. The specific methods are IP in-licensing, contract R&D services, open innovation intermediaries, crowdsourcing and idea competitions, university research grants and public R&D consortia, customer co-creation and informal information networks.

4.1 Most used methods

The three most used methods in obtaining knowledge or technology are consumer and customer co-creation, informal information networking, and university research grants (Chesbrough & Brunswicker, 2014). Why these methods are used more than the others might be the cause of them being relatively low cost to maintain and obtain knowledge. According to Chesbrough and Brunswicker (2014) the least used methods are crowdsourcing and open innovation intermediaries. I would think that crowdsourcing is not that used as it requires quite a lot of effort from the organizing party but I think that the open innovation intermediaries are not working in their full potential to satisfy the needs of larger companies.

It is clear that the non-pecuniary or low cost methods are favoured by the larger companies but I would have thought that at least IP in-licensing was one of the most used ones. I think that IP in licensing is the easiest method to acquire technology but it might be all the IP management and patent rights bureaucracy that drives larger companies from it. They might not have the time for it or they have the capacity to purchase the whole company owning the rights for desired IP so they don't "waste" their time to licensing just one technology.

According to Chesbrough and Brunswicker (2014) the only methods that have increased their significance between 2008 and 2011 are customer co-creation, university research grants and idea competitions. The one obtaining method that has been presented in this literature review, which importance has decreased, is the open innovation intermediaries.

4.2 Suitability for companies

The Chesbrough and Brunswicker (2014) study was made on larger companies so the significance for SMEs could be different. I think that SMEs use more methods that connect them to some R&D organization. The methods suitable for SMEs could be contract R&D services, open innovation intermediaries, and university research grants for the methods that require money and customer co-creation, crowdsourcing, public R&D consortium and informal networking for non-pecuniary and low cost methods.

According to van de Vrande & al (2009) the most used methods in smaller companies tend to focus on R&D activities. This might be the cause of SMEs not having such potential to have their own R&D units as the larger companies have. SMEs could use more networks and public R&D to gain knowledge. SMES have smaller capacity to absorb knowledge so they might even use intermediaries to find R&D contractor to utilize the obtained knowledge.

In my opinion these obtaining methods can almost all be used with other methods. One SME could be involved in many informal networks and be a part of pubic R&D consortia at the same time. The same thing is for larger companies of course but larger companies tend to have more capital and man power to host idea competitions and utilize customer co-creation.

4.3 Method suitability for business models

In my opinion the methods that I have presented in this literature review could be used in both outside-in and coupled business models. The company can for example use their own R&D department to utilize an idea that comes from outside and develop it a bit further and then sell it to an organization that only does marketing or carry out the whole process themselves. It is a possibility for larger companies to send their own researchers to e.g. universities to take a part in a researches that can help the company to gain value from new technologies. The outside-in method just takes the knowledge or technology in the company and the company then uses it which way it sees suitable or how they can use it according to contract. The coupled method takes innovation but it also gives something back. The public R&D consortia, university research grant and informal networks are prime examples of coupled innovation process. I think the coupled business model is used more with non-pecuniary methods and the outside-in process is more in the pecuniary obtaining methods. Of course all these methods and business models can be combined.

Like stated in the end of the 2nd chapter some or all of the open innovation principles come true in these knowledge obtaining methods. The aim for these methods is to make the company's business model better and gain knowledge that cannot be from own employees. According to Chesbrough & Brunswicker (2014) the most important sources of knowledge and technology in large companies are still the own employees and customers. Universities and other communities that are used a lot in the innovation process come after these two and that explains why customer co-creation and networks and universities are the most used methods of obtaining knowledge.

5. Conclusions

This thesis is a literature review on how can companies obtain knowledge and technology through open innovation using pecuniary on non-pecuniary methods. The methods are IP in-licensing, contract R&D services, open innovation intermediaries, crowdsourcing and idea competitions, university research grants and public R&D consortia, customer co-creation and informal information networks.

This literature review could have practical implications for companies that are thinking of adding open innovation to their business model and improve their business model with open innovation. The companies that use this literature review could be information technology companies that need packed information about different open innovation obtaining methods. As stated in the literature review many of the methods fit many of the business models and every company has to adjust their business models to survive in the highly competitive business.

For example companies that don't have their own R&D departments could work together with universities and outsource the whole innovation process. The universities can come up with solutions for specific problems and the company buying the R&D services can just sell and market the product or service. The new products can go to the company's existing market or to a completely new market. These obtaining methods could almost all be used with other methods. One SME could be involved in many informal networks and be a part of pubic R&D consortia at the same time. The same thing is for larger companies of course but larger companies tend to have more capital and man power to host idea competitions and utilize customer co-creation.

The limitation of this thesis is that this is a literature review and it contains no empirical data and it only focuses on inbound methods. The continuum for this thesis could be the adding of outbound methods and how to use them. Another possible research view could be what kind of companies use these methods in their business model and how does including open innovation obtaining to the business model affect the company's internal R&D and innovation process.

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