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OPEN INNOVATION PRACTICES IN A CLUSTER CONTEXT: A MEDICON VALLEY CASESTUDY

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1. Introduction

Innovation can be described as consisting of two aligned activities: first a technological research and development (R&D) or new product development (NPD) activities; and secondly a more strategic approach, formulated in the business model [Davila et al. 2005].
In a global market of continuous development, the demand for new and improved products is high and the aspiration for competitive advantage is desirable for many companies [Grant 2008]. This is aligned with Chesbrough's statement, that companies that do not innovate will not survive [Chesbrough 2003], and whose innovation research has led to his definition of two paradigms: *closed* and *open innovation*.
Open Innovation (OI) is a paradigm based on the assumption that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technologies [Chesbrough 2003]. OI also combines internal and external ideas into architectures and systems, whose requirements are defined by a business model. In recent years, OI has received increasing attention from the academic world; however most studies are carried out in large multinational companies. The role of SMEs in OI practices is either poorly documented or tends to focus on very specific issues [Henkel 2006], [Lecocq and Demil 2006]. Recently, Van de Vrande et. al. carried out a study on OI in the Netherlands [van de Vrande et al. 2009] where the authors explored practices, trends and challenges of OI practices in Small to Medium sized Enterprises (SMEs), and examined differences between service and manufacturing companies. [Lichtenthaler 2008] has focused on medium-sized and large manufacturers in Germany, Switzerland and Austria; however smaller companies were not surveyed [Lichtenthaler 2008]. Building on the results presented by Van de [Vrande *et al* .2009], this paper aims at investigating trends barriers and drivers for OI practices in Medicon Valley (MV), a life-sciences cluster in Scandinavia. Furthermore the paper discusses the influence of the cluster on the adoption of OI within the firms from the cluster, before drawing a general overview. The conclusions are based on results obtained from a survey database of 28 companies and four in depth interviews.

2. Paradigms and factors of innovation

We begin by briefly describing the difference between Open and Closed Innovation in order to frame the findings presented in the paper, as well as the context in which OI is studied, particularly in terms of technology development and geographical situation.

2.1 Open vs closed innovation

According to [Chesbrough 2003] the closed innovation model creates a circle, starting with companies investing in internal R&D, which leads to innovative discoveries. These discoveries enable the companies to create new products and services for the market. In order to obtain more sales and higher margins, more is invested in internal R&D, leading to further breakthroughs and a continuation of the circle. An outcome of the internal R&D in the form of intellectual property is usually heavily guarded, so others cannot benefit from one's ideas. OI differs from Closed Innovation as here, companies actively combine their internal knowledge with compatible external knowledge, from institutions and other companies, in order to exploit all the technological possibilities within the firm (technology exploitation) and outside the firm (technology exploration). Companies therefore have to constantly identify, understand, select from, and connect to the wealth of available external knowledge. Key to OI is the creation of alliances, within and between internal and external parties. In this paper we concentrate on the use of the OI paradigm in a Scandinavian medical/life-science cluster, known as Medicon Valley.

2.2 Exploration and exploitation of technology

The focus for OI depends on the objectives of the company steering the process. The objectives can focus on an inside-out movement - *technology exploitation* - or an outside-in movement - *technology exploration* [van de Vrande et al. 2009].

We have adopted this framework for this research, in order to understand the variety of OI activities as well as the motives for participating in OI. With this we build on Hoang and Rothaermel's work, which distinguishes between alliances that are motivated by the need to explore new opportunities, and alliances that are formed to exploit known opportunities [Hoang and Rothaermel 2010].

This framework also fits well with Chesbrough's definition of OI, where the characteristics of exploration are highly consistent with the discovery phase and the early stages of the development process (R&D-value capture). Similarly, exploitation maps well onto activities that occur later in the value chain and which tap a firm's existing knowledge, including clinical testing, regulatory affairs, distribution and marketing/sales.

[Li et al. 2008] describe how the main activities and the motives to enter an alliance are defined by the innovation being either exploratory or exploitative [Li et al. 2008]. On the one hand, explorative alliances are usually established in order to explore new technological opportunities (technology search), and thus these alliances inevitably have an R&D component [Rothaermel and Deeds 2004]. On the other hand, exploitative alliances are those that lever complimentary competencies across the alliance partners. Exploitative alliances therefore include activities such as manufacturing, marketing or supply agreements, which are typical product market knowledge [Rothaermel 2001]. Therefore a firm's choice of activity can be distinguished by its motivation to either explore new or exploit existing opportunities.

To conclude, while the new paradigm of OI it might be very positive for a company, it is still much more complex to manage, from both managerial and innovation process points of view, when compared to the traditional closed format that generally assigns innovation to R&D.

2.3 Geographical clusters and innovation

Geography influences the process as well as the possibilities for facilitating OI, as it is crucial for the OI process that knowledge can flow between companies. According to Vanhaverbeke, an optimal innovation strategy would exploit multiple ties to multiple types of institutions [Vanhaverbeke 2006]. Business clusters are therefore very important in the context of OI, as they are the embodiment of the geographical dimension of it.

What is a cluster? Porter introduced the term of business-clusters and defined them as follows: *"Clusters encompass an array of linked industries and other entities important to competition"* [Porter 1998]. Clusters can provide companies the optimal environment for facilitating the process of OI as within a cluster lies the opportunity to interact with other companies of the same business field, thereby utilizing each other's specific core competencies in terms of exploitation and exploration of technology. Therefore, it is the interconnections and the relationships within the cluster that define the innovation process, but simultaneously they represent some limitations. In cooperation the partners must recognize each other's objectives and motivations. An effective management of externally

required knowledge necessitates the development of complementary internal networks to access and integrate the externally acquired knowledge [Chesbrough et al. 2006].
The closeness to competitors, both geographically and through cooperation, raises the issue of management of intellectual property rights (IPR). When engaging in OI, the question of the firm's management of IPR must be addressed, as well as how the firm identifies the potentially useful external technology sources [Chesbrough et al. 2006]. These topics will be addressed in our investigations, as the OI practices are investigated in terms of barriers and drivers in a technological cluster context.

2.4 Scope of the research

The scope of this research, Medicon Valley (MV), is one of the largest clusters in Scandinavia and comprises companies within the life-science industry. MV is a bi-national cluster that spans the island of Zealand in Eastern Denmark, and the Skåne region of Southern Sweden. The cluster is connected by the Øresund Bridge, which makes commuting between Denmark and Sweden an easy everyday task [Alliance 2010]. A few facts about the MV cluster:

1. Of companies with R&D and/or production in MV there are: 80 biotech companies, 20 pharmaceutical companies and 100 medtech companies.
2. Of international companies with affiliates in MV there are more than 200 pharmaceutical companies and around 170 medtech companies.
3. There are 12 universities, five of which offer life-science related education programmes, and 32 hospitals, of which 11 are university hospitals. Furthermore, there are seven science parks with a significant focus on life-science in the region.

These dimensions and stakeholders will be used to assess the partners in the questionnaire. It is worth noting that MV Alliance is the Danish-Swedish cluster organization representing human life sciences in MV. As a non-profit member organisation, MV Alliance carries out initiatives on behalf of the life science community in order to create new research and business opportunities within the region.

3. Methods & data collection

The purpose of this research is of an explanatory nature, offering results and insights into if, why and how MV companies use OI and which obstacles they might encounter in adopting a more open approach to Innovation. In the next sections the methods applied in this study are presented.

3.1 Methodology

The empirical work has been carried out through both quantitative and qualitative data collection. The quantitative data collection was carried out via an online survey and measured by the number of responses to the survey's questions. The main purpose of using a survey is to assess the importance of the selected criteria from product development managers in MV. Using familiar and accepted terminology enforces uniform definitions on the participants, which makes the measurement and consequently the interpretation of results more precise and comparable.
The qualitative data collection was carried out via four semi-structured interviews of people involved in product or process development from different organisations. The interviews were used to elaborate on outcomes from the survey and develop a deeper understanding of the incentives for OI practices, described from the participants' point of view.

3.2 Unit of analysis and sampling

The units of analysis for the study were biotech, pharmaceutical and medtech companies in MV. The companies were approached primarily via email with a cover letter explaining the purpose of the survey and containing a direct link to the online survey. The survey sample was an expert sampling as the intention was to mainly approach R&D or business development managers with knowledge of the firms' innovation strategies, as we expected them to be able to share expert knowledge on the subject.
The companies contacted were derived from a list of Danish companies, listed under the Danish Region's official inward investment agency, Copenhagen Capacity. Their list was cross-referenced

with lists extracted from the MV database found on their websites for Denmark and Sweden. The final list represented the theoretical population for our study. In order to narrow it down to a study population, a review was carried out of the websites of every company on the list, seeking for names and contact information for R&D or business development managers. An email invitation was sent to the firm or where possible, directly to the relevant manager. This invitation was sent out to a sampling frame of approximately 130 Swedish companies and 100 Danish companies.

3.3 The online survey

Due to the large size of the sample frame a survey seemed to be the appropriate method. The questions in the survey were partly based on the framework of the survey carried out by [Van De Vrande et al. 2009] utilizing the innovation activities identified in their work, thus enabling us to standardise the questions and ensure unambiguous answers. The questions were adapted to the practices of companies within the life-science industry and also reflected our interest in the influences of the companies' geographical location in MV. Figure 1 illustrates the different variables included in our survey. However due to paper length limitations, we will only discuss the core dimensions of trends barriers and drivers for OI in MV, as well as the dimensions related to the cluster in this paper. The remaining variables will only be briefly described, to give a general overview.
A pilot testing of the survey was made with the purpose of identifying problems with wording, omissions, typos and other comments. The testing was done by: two Professors working within Innovation, two project managers linked to MV and a Business Development Manager from Copenhagen Capacity. The final survey consists of 16 questions and voluntary contact information.
Overall the survey was constructed with non open-ended questions to avoid misinterpretations of the answers and thereby collect a standardised image of OI processes in MV. However, many of the questions feature an open-ended box as the last option, where the respondents are given the opportunity to add comments of their own.

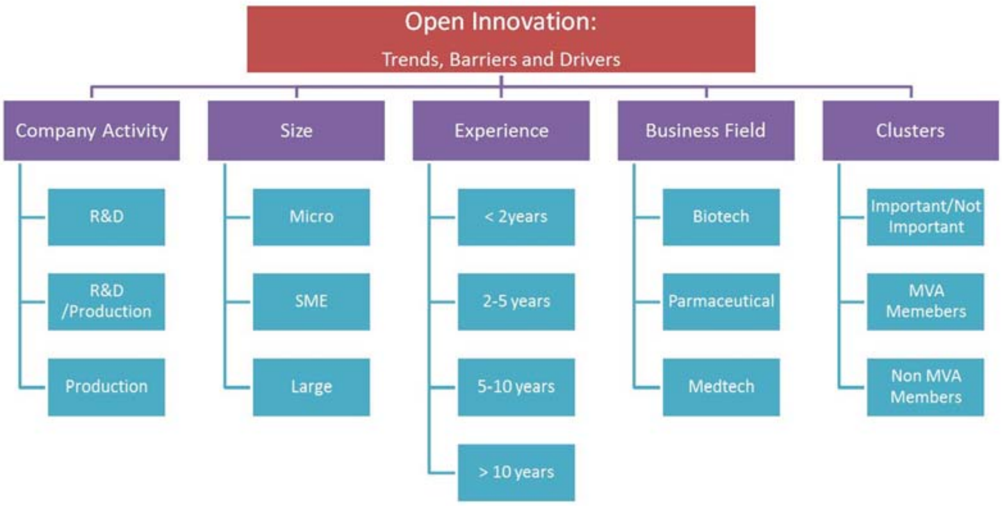

Figure 1. Unit of analysis

3.4 Semi-structured interviews

To gain a more in-depth knowledge and to contribute to our analysis of OI processes four semi-structured interviews were carried out to discuss specific knowledge gained from the survey. The first interview took place with an Innovation Strategist in a large company, the second with a former business developer with many years of international and local experience in large companies; the third one with a manager who has many years of experience in founding spin-off companies; and finally an interview with a business developer from Medicon Valley Alliance who has a very good understanding of the cluster's dynamics.

The questionnaire is used as a script for conducting the interviews. The interview guide had both structured and unstructured questions. This type of interview includes instructions for the interviewer that are not seen by the respondent and may include space for the interviewer to record any observations about the progress and process of the interview, which would not be presented in an on-line survey.

4. Results and interpretations

The aim of this research is to map the main trends, drivers and barriers of OI practices within firms in MV. This section presents the general results gathered from the quantitative survey and the qualitative interviews.

4.1 General overview of the results

The data gathered from the survey represents 28 companies' responses (that completed the survey). Of the 28 companies, there are 14 medtech, 12 pharmaceutical and 4 biotech companies. The majority (43%) of companies replying to our survey are micro-companies (micro-entities), with 10 or less employees, and 25% are small companies with 11-50 employees, about 14% are medium companies with up to 250 employees and the last 18% are large companies which are companies with more than 250 employees. This by itself adds originality to this study as it was stated above most studies were carried in rather large multinational companies.

About 70% of the companies have more than 5 years of experience in the business, where about 80% of the responding companies have more than 5 years of experience with product development and 50% have more than 10 years of experience, which confirms the goal of having an expert sample. 64% of companies focus mainly on R&D and 46% have focus on both production and R&D.

Regarding the geographic placement, 43% of the companies were established before 2000, where MV became officially known as a business cluster. Only 7% found it very important to place their company in MV. This would mean that the cluster itself was not a determining factor in placing the company within it.

Members of the MV Alliance were represented with 40% and another 40% of the participants were non-members, one was a previous member and the remaining 18% did not know whether their company had a membership with MV Alliance. When asking about the relevance of OI, 64% found it was important, 22% were neutral and 14% found it irrelevant or not applicable. This goes in line with the statements of OI increasing importance. When asked about the level to which continuous innovation is a part of a company's business strategy, 86% found it important, only 7% were neutral and an additional 7% found it not important or not applicable.

In summary, our sample shows that companies that are experienced in the life-science business, are aware of the importance of continuous innovation in general and Open Innovation in particular.

4.2 Innovation trends

The trends for OI activities are shown on the graph in Figure 2 by assessing the 6 main dimensions of exploitation, exploration and alliances as defined by [van de Vrande et al. 2009]. The most widespread activity is *Outsourcing of R&D to other parties*. Within the field of life-science the development process is long and features some highly specialised tasks. The companies might not possess the know-how or the apparatus which they require. Therefore it is often more expensive for the companies to carry these tasks out by themselves than having them outsourced. Many of the tasks are also very standardised, which makes them easier to outsource.

The second ranked trend is *Systematic searching for collaboration partners in MV*. This activity supports the practice of outsourcing, because companies have to find service companies which they trust and from whom they are sure to obtain the quality their own company stands for.

The third ranked trends are *Participating in new or existing businesses via capital or joint venture* and *Licensing of the Firms Patent to others*. These two activities are well supported in a cluster context and since most of the surveyed companies are small, they would ultimately be looking to be bought-up by bigger companies and/or to licence their IP.

A similar graph for OI trends, showing the answers to "increased", "the same" or "decreased" is illustrated in Figure 3. The answers have been divided by the number of total answers for each activity, to obtain a comparable value. We can see that the largest increase is a 30% score on the activity of outsourcing R&D, while systematic looking for partners has increased in 26% of the companies. In general it seems that OI activities are developing or at least staying the same; while the decrease is minimal. Not shown in the picture is that 74% of the respondents state that creation of spin-off companies does not apply to them, and 53% do not license patents from other companies this can be due to the fact that most of the surveyed companies were micro-size ones.

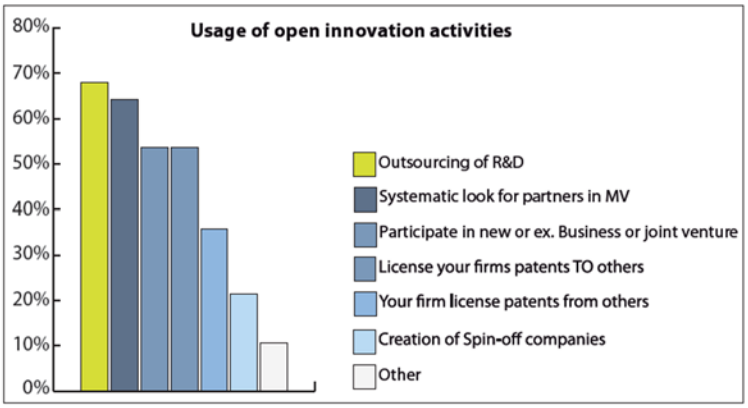

Figure 2. Usage of open innovation

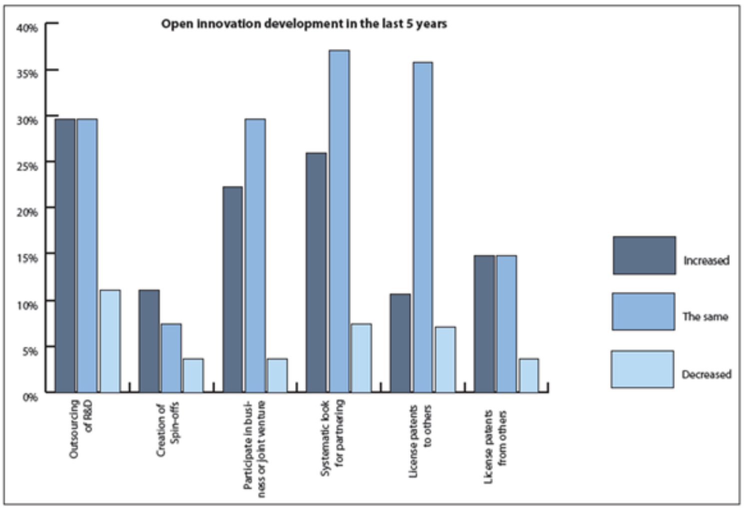

Figure 3. Comparison of five years development in OI activities

For exploring the barriers and drivers for open inovation in MV we used the same framework developped by Van de Vrande et al. [2009]

4.3 Drivers for open innovation in Medicon Valley

The drivers for OI activities are spread over the whole spectrum of possibilities, as can be seen in Figure 4. The most common drivers are *Cost and Knowledge*, which are closely followed by *Capacity and Focus*. Then follow drivers like *Market*, *Utilization*, *Renewal* and *Control*. The least popular drivers are *Policy* and *Motivation*, which are the only ones with a score below 50%.

When looking at the drivers mapped to the OI activities, we see that the highest score lies within the activity of *Outsourcing R&D*, and that the major driver is *Capacity*, with 46%. *Capacity* is followed by *Cost*, with 43%, which is also under the activity of *Outsourcing R&D*. The third most common driver is *Knowledge*, which also has 43% response, but lies within the activity of Networking. It seems that from the result the companies do concentrate on *Outsourcing R&D* as the main OI activity and when doing so the main driver being to gain capacity through the knowledge from others and at the

same time reducing costs and risks. Additionally, networking is just as important but its main goal being gain of *Knowledge*. It is worth noting that these two activities are also related to each other.
Other major drivers are *Capacity* and *Focus*, which in the life-science business relate to outsourcing and partnering. They can be linked to the same reasons as knowledge in terms of complex tasks, and focusing on the companies' core competencies, rather than for example clinical testing.
In the work by [Van der Vrande et al. 2009], Dutch technological companies were mostly driven by market and secondly by knowledge which is similar to our findings.

Control, e.g. Increased control, better organization of processes
Focus, e.g. Fit core competencies, focus on firm activities
Renewal, e.g. Improved product development, new technologies, process innovation
Knowledge, e.g. Gain knowledge, bring expertise to the firm
Costs, e.g. Cost management, profitability, efficiency
Capacity, e.g. Cannot do it alone, lack of capacity
Market, e.g. Keep up with developments, customers, increase growth/market
Utilization, e.g. Optimal use of talents, qualities, ideas of employees
Policy, e.g. Organization principles, management to involve employees
Motivation, e.g. Involve employees in innovation to increase motivation/commitment

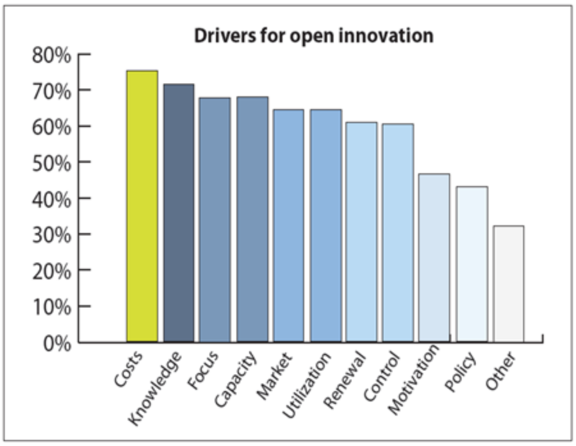

Figure 4. Drivers for participating in OI

4.4 Barriers to open innovation in Medicon Valley

When looking at the barriers in Figure 5, it is clear that *IP rights*, *Finance* and *Knowledge* are key barriers, which are expected result in as tightly regulated business area as medical/life-science industry. They are closely followed by *Administration*, *Quality of partners* and *Organisation/culture*. The least common barriers are *Customer demand*, *User acceptance* and *Marketing*.
Again the highest answering rate is within the activities of *Outsourcing R&D* and *Networking*, where outsourcing has the largest part. This means that while the companies see these activities as the ones which can bring the most value to OI, they also regard them as the ones where the most barriers may lie. It doesn't go without noticing that one of the main drivers was *Knowledge* and we find its counterpart in the barriers in the term of *Intellectual Property Rights*.
This findings are very common is this line of business and clarifies the importance of IPR as patents can be relevant in many stages of the process, and the early chemical compound patents can form the basis for a commercial product in the later phases.

Administration, e.g. Bureaucracy, admin. burdens
Finance, e.g. Obtaining financial resources
Knowledge, e.g. Lack of techn'/legal/admin/knowl' or skills
Marketing, e.g. Insufficient market intelligence affinity.
Organization/culture, e.g. Balancing tasks, communication
Resources, e.g. Costs of innovation, time needed
Property rights, e.g. Ownership of developments, user rights
Quality of partners, e.g. Deadlines & expectations not met
User acceptance, e.g. Adoption problems, customer reqs
Customer demand, e.g. Innovation does not fit market
Competent employees, e.g. lack knowledge /competence/flexibility
Commitment, e.g. Lack of employee commitment, resistance to change
Idea management, e.g. Employees have too many ideas, no management support (Howard et.al 2010)

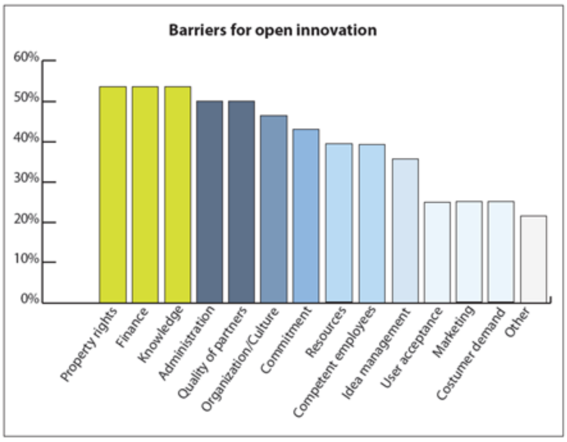

Figure 5. Barriers for participating in OI

Equal to *IP Rights*, the survey reveals the barriers of *Knowledge* and *Finance*. *Finance* can relate to patenting as being the core value, and when partnering or outsourcing, the company can choose to pay less for the service and share the patent. Furthermore, it is both time-consuming and expensive to apply for patents. The subject of *Knowledge* as a barrier can be explained as the fear of someone stealing your ideas and tapping into the knowledge and core competencies of the company.
However, the spread of the barriers from the survey is wide, while the highest scores are on *IPR*, *Finance* and *Knowledge* (53.6%), there are 3 more barriers that score over 46%, including the *Quality of partners* and *Organization/culture*. The explanation for the wide spread of barriers can be found in the complexity of the field. *Customer demand*, *User acceptance* and *Marketing* are the lowest scoring barriers. This is likely since these phases are not as time-consuming and expensive as the prior phases of the life science development process. Due to the complexity it is irrelevant to involve customers in the early phases, and due to the length of the development process, user acceptance and marketing are first relevant after you have a product and the authorities have approved it.
In the work by Van der Vrande et al. [2009] the main barriers were identified as organization/culture, resources and administration. Two of them are represented in our top three but not with quite the same importance as is given to IPR as a barrier for OI.

4.5 Nature of open innovation activities in Medicon Valley

The OI activities defined in the survey can be seen from the exploration / exploitation perspective. The most common is *Quality of partners* within the activity of *Outsourcing R&D*, with 39%, followed by *Organisation/culture* with 32%, within the same activity. The most frequent barrier within the activity of *Licensing patents* from others is property rights with 28%. Subsequently we find *Commitment*, *Administration*, *Finance and knowledge*, all within the activity of *Outsourcing R&D*, and all with a score of 28%. Under the activity of spin-off, there are 5 barriers that do not get any response and generally the spin-off activity does not have a lot of barriers. The same is applicable for the activity of *Licensing patents to others*. It also goes in line with the previous findings as ‘spinning-off’ was not an activity where the panel of surveyed companies fit.

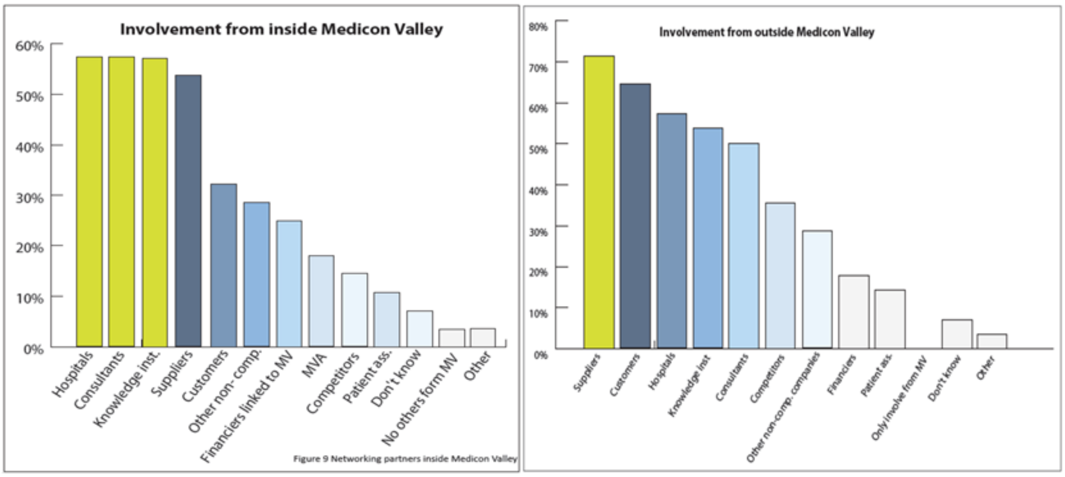

Figure 6. Networking inside and outside the cluster

Within the activity of *Networking*, the most common partners inside MV are *Knowledge institutions*, *Consultant or engineering firms* and *Hospitals*, followed closely by *Suppliers* as shown in Figure 6 (left). The least accepted partners are *Patient associations*, *Competitors* and *MV Alliance*, which is surprising as MV Alliance has the job of facilitating the activities of networking within MV. Networking outside of MV, which can be seen in Figure 6 (right) brings different actors to partnering. Outside MV the *Suppliers* are the most frequent partners. The suppliers are followed by *Customers*, which are then followed by *Knowledge institutes* and *Hospitals*. When networking outside of MV, *Consultants* or *engineering firms* also play a part as well as competitors. The least common partners outside are *Financers* and *Patient associations*.
From Figure 6, it is evident that companies engage almost equally in OI activities during the

explorative stages as well as the exploitative stages of the development process. However the exploitative activities are a bit more common than the explorative.
This result is quite different from th e study by [van der Vrande et al. 2009], as they reported the use and increase of technology exploitation were much higher than the use and increase of technology exploration. In the life-science industry the long development phase means that the activities are more iterative, and that the exploration and the exploitation activities can occur in turns. This iterative process calls for collaborations and outsourcing in different phases and at different stages, and thereby within different types of activities.

5. Further discussion

Using the results from the survey, four in-depth interviews were carried out. The interviews gave a good insight into the daily business of the companies in the life-science industry. The emphasis in the interviews was on OI experience and strategies within the companies. The general impression is that there is more emphasis on the barriers for OI than the drivers. However there are many drivers; especially drivers concerning risk and investment sharing are mentioned as attractive. Some of the statements from each interview have been assigned to different areas of importance in an affinity diagram, which can be partially seen in Figure 7.

Open Innovation Activities		Barriers	Drivers	Networking	
People	Product			Cluster	Partnering
The chemical syntehsis department is outsourced and represents about a third of staff.	Often the "arms and legs" work is outsourced. (standardised tasks).	You have to take out patents as early as possible, often you patent the basic compound.	You might as well outsource, the price is the same as doing it yourself.	You usually chose partners who people in your network have had good experiences with.	By outsourcing an on-going task you can cooperate with the same group for a long time.
Epitherapeutics is a	When creating a spin-	The patent is the core	Outsourcing makes it	As a small company	We do not engange

Figure 7. Screen print out of the Coding Scheme

The statements were sorted after their relevance to OI activities, which has been subdivided into "people" and "product"; next there are drivers and barriers; and finally networking, which is divided into "cluster" and "partnering". Thereby it is possible to get an overview of the interviews that relates to the answers from the survey and it also helps seeing where the main interest of the participants lay.
From the interviews results, the reason for the popularity of outsourcing R&D seems to be mainly due to the standardised procedures in the clinical trials, which makes it easy to outsource them as we already stated. The large pharmaceutical companies in MV region are not competitors; they each have their speciality, which makes them colleagues rather than competitors. The real competition is about the employees/talents within discovery and research and attracting capital for the smaller companies.
The big pharmaceutical companies do not care about the cluster; they existed before anyone invented MV, which tends to indicate that the cluster is more important to the smaller players as it helps their exposure and networking but did not appear as such in the survey results. MV Alliance represents the whole branch, but of course the interests of the larger companies, who are the main investors, have to be more considered. This can explain why such an alliance rated as a low priority partner as most of our surveyed companies were small in size. Most important is the economic attractiveness of a company, which is also a barrier to OI. All partnerships have to be in contract form, as any IPR must be protected for future buyers as many smaller companies hope to aquired at some point.

6. Conclusion

Through the results presented in this paper we have learned about how open innovation activities engage in networking and partnering, and the influence of the cluster. Open innovation activities depend on the field as became evident when noticing that the trends, drivers and barriers were different between the life-science industry case in Denmark and the technological industry case in the Netherlands. Both of these industries have their specific development phases and therefore different requirements too. In Medicon Valley the cluster plays a role in the open innovation processes of the appertaining companies. The process of networking and collaboration is a very important strategy for

innovation as this presents one of the major open innovation activities. The cluster of Medicon Valley has risen from competent employees, from the larger organizations that have the ability to spread their knowledge through collaborations and career moves. This diffusion of information and useful knowledge is thereby available and important for the survival of new and small companies. This is one of the fundamentals in Chesbrough's argument for open innovation. Companies in Medicon Valley already practice collaboration and partnering with a focus on expertise. Partners are engaged in a consultant-like manner to provide expert perspectives on key strategic functions and on maintaining access to flexible capacity, and sourcing non-core activities. Furthermore they practice partnering with a focus on efficiency, cost and talent redeployment, where the company maintains strategic ownership of the project and looks for a partner to operationally manage and execute it.
The results also show that the companies still have some work to do, in order to be more open. For this end companies must work around the confidentiality and intellectual property rights issues to create an innovation environment built on trust. Although building trustworthy relationships and realizing their value will take time, the end result should allow companies to focus on core competencies, which bring competitive advantage.

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