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MANAGING OPEN INNOVATION

- Present Findings and Future Directions

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Managing Open Innovation - Present Findings and Future Directions

by

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1 Introduction

Much evidence identifies innovation as the main driver for companies to prosper, grow and sustain a high profitability (e.g. Drucker, 1988; Christensen 1997; Thomke, 2001). This means that the questions that are asked in research no longer revolve around why innovation is important. The focus instead lies on how to innovate and how innovation processes can be managed. A recently proposed and popularized model for the management of innovation is based on the need for companies to open up their innovation processes and combine internally and externally developed technologies to create business value. This notion of *open innovation*, was first proposed by (Chesbrough 2003a; 2003b) and has quickly gained the interest of both researchers and practitioners, illustrated by a number of special issue publications, dedicated conferences and a rapidly growing body of literature.

As a point of departure, Chesbrough argues that internal R&D no longer is the invaluable strategic asset that it used to be due to a fundamental shift in how companies generate new ideas and brings them to the market (Chesbrough, 2003a; Chesbrough, 2003b). In the old model of *closed innovation,* firms relied on the assumption that innovation processes need to be controlled by the company – it was based on self-reliance. Changes in society and industry has led to an increased mobility of knowledge workers and the development of new financial structures such as venture capital – forces that have caused the boundaries of innovation processes to start breaking up (Chesbrough 2003a). Chesbrough defines open innovation as:

> *"the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology".*
> (Chesbrough, 2006b, p.1)

Open innovation has emerged as a model where firms commercialize both external and internal ideas/technologies and use both external and internal resources. In an open innovation process, projects can be launched from internal or external sources and new technology can enter at various stages. Projects can also go to market in many ways, such as out-licensing or a spin-off venture in addition to traditional sales channels (Chesbrough, 2003b).

There are many ways of practicing open innovation. Enkel and Gassmann (2007) suggest some examples:

- customer and supplier integration
- listening posts as innovation clusters
- applying innovation across industries
- buying intellectual properties
- investing in global knowledge creation

The focus lies on the transformation of the previously solid boundaries of the company to a semi-permeable membrane to enable innovation to move more easily between the external environment and the internal R&D processes. A central part of innovation process is also to organize search for new ideas that have commercial potential (Laursen & Salter, 2006).

The ideas of open innovation originated from experiences from open source software (OSS) development where new principles for development projects were identified (e.g. Gruber & Henkel, 2006; West & Gallagher 2006), and initially a lot of literature was based on technology transfer and spin out/spin in, but the scope has rapidly broadened. Today, open innovation is becoming a paradigm that connects research from various parts of management sciences. The term is still being debated and many authors agree that open innovation has a much broader application than first proposed by Chesbrough (e.g. Piller & Walcher, 2006). The research field is expanding in many directions and the ongoing debates cover a multitude of areas connected through the overall aim of understanding how firms can become more innovative.

1.1 Purpose and Research Approach

This report aims at giving an overview of the emerging research field of open innovation in a phase that is still very fluid. The purpose of this report is to depict the major tendencies of publications through identifying the main themes in literature and investigating the research frontier. It also aims at discussing potentially important fields of investigation that are still left rather unexplored.

This report builds on two main studies. First, a literature overview of the publications on open innovation published in key databases until November 20, 2007 was conducted. However, since the expression was coined as late as 2003, much ongoing research is still not found in the publications. In a second study, nine key researchers in the open innovation field were asked to define the frontier (from the UK, Denmark, France, Germany, Austria and the U.S.) in open innovation research. Their opinions were used as an additional input when trying to identify the future directions for research.

1.2 Limitations

In this report we have mainly chosen to focus on researchers that explicitly use the term open innovation. There are of course many researchers that investigate issues closely related to open innovation without using the term, but this lies outside the scope of this report. We have also restricted our search to the social sciences. Also we have not included industry reports and conference papers.

1.3 Structure of the Report

This report is structured as follows. Chapter two provides a literature overview and a thematic analysis of both books and publications on the subject of open innovation. It also reviews the directions of research that have been considered important. In the third chapter the interview study with the field experts is depicted and a thematic analysis of their opinions is presented. In the fourth chapter, the two studies are used to provide an analysis of the present research field of open innovation and its strengths and weaknesses are discussed. In the final chapter, potentially important future directions for research are proposed.

2 Open Innovation – Literature overview

In this chapter, the open innovation literature is outlined. First the method for conducting a structured review of open innovation publications is described. Secondly a thematic analysis of the publications is presented. Finally the published research on open innovation is synthesized and discussed.

2.1 A Structured Review of Open Innovation Publications

To get a better understanding of research done on open innovation a systematic literature search of publications up until November 20, 2007 was performed in two major databases of management journals and an additional innovation journal not covered by the databases:

- ISI Web of Knowledge-database
  - Social Sciences Citation Index (SSCI)
  - search term “open innovation” in title, keywords or abstract
- Scopus-database
  - search restricted to “social sciences”
  - search term “open innovation” in title, keywords or abstract
- Creativity and Innovation Management
  - search term “open innovation” in title, keywords or abstract

Furthermore, a search for books with “open innovation” in the title was made on Amazon.com to identify books published in the field. Except from one book by Chesbrough (2003b) and one edited book from him (Chesbrough, Vanhaverbeke & West, 2006) two shorter books were found. One is a former master’s thesis form the Leipzig Graduate School of Management (Motzek, 2007). The other is a consultancy report that heavily builds on Chesbrough (2003b). All books are included in the analysis. The result of the total literature search consists of 49 publications (see appendix 1). These publications are divided into 4 books, 35 articles and 10 book reviews or columns. The strict search criteria exclude papers that discuss open innovation using other terms and also sub aspects of the open innovation theme. It also excludes conference presentations and working

papers[1].The benefit of the current method is that it enables a comprehensive analysis of the journal articles published in the databases in the specified time period.

As the aim was to gain an overview of research conducted within the open innovation field, the book reviews and columns discussing or mentioning open innovation in general terms were excluded from further analysis of the publications in the field. These have been shaded in grey in appendix 1. The list reveals that there are some major thinkers in the area. The most published (and cited) author is Henry Chesbrough who coined the term in 2003. He has written or co-authored 8 of the 49 publications. The papers are also concentrated to a few journals:

- *R&D Management* (Vol 36, Iss. 3 – special issue) – 5 journal articles
- *International Journal on Technology Management* – 7 journal articles
- *Research Policy* – 4 journal articles
- *Research-Technology Management* – 4 journal articles

What this tells us is that the topic mainly has been dealt with as a pure innovation issue and that other aspects and consequences of organizing for open innovation have not been drawn in the open innovation literature.

14 journal articles appear in practitioner oriented journals (here: Academy of Management Perspectives, California Management Review, Harvard Business Review, McKinsey Quarterly, Sloan Management Review, Research-Technology Management). It is also worthwhile mentioning that 17 of the 35 articles are based upon case studies.

The papers and books were read, analysed and grouped according to their thematic content. Several of the publications naturally have bearing on several of the generated themes. After several round of iterations, the following categories were defined:

- The notion of open innovation
- Business models
- Organizational design and boundaries of the firm
- Leadership and culture
- Tools, technologies
- IP, patenting and appropriation
- Industrial dynamics and manufacturing

[1] The reasons for this include the lack of overview over conferences and working papers, the often low quality of the submissions and the lack of access to the papers.

2.2 A Thematic Analysis of Open Innovation Publications

The following section briefly presents the publications in each theme. It should be remembered that this thematic analysis is based on the publications that use the term open innovation as mentioned earlier.

2.2.1 Exploring the Notion of Open Innovation

The notion of open innovation comes from Henry Chesbrough, a Berkeley professor at University of California that has gained international fame through his book "Open Innovation – The new imperative for Creating and Profiting from Technology" that appeared in 2003. He describes how companies in the 20th century have invested heavily in internal R&D and hired the best people – enabling them to develop the most innovative ideas and protect them with IP strategies. The generated profit was used to reinvest in R&D – in a virtuous circle of innovation (Chesbrough, 2003a). However, in the end of the 20th century, a number of factors have changed, mainly: 1) Rise and increased mobility of knowledge workers, 2) growing availability of venture capital. This has caused the closed innovation process in firms to start breaking up (Chesbrough, 2003a). Chesbrough identifies a number of factors indicating a shift in how innovation was managed (2003b):

- Useful knowledge has become widely diffused
- Companies do not take full advantage of the wealth of information
- Ideas that are not readily used can be lost
- The value of an idea or a technology depend on its business model
- The presence of VC changes the innovation process for everyone
- Companies need to be active sellers and buyers of intellectual property (IP).

These insights led to the development of an *open innovation* model where firms commercialize external (as well as internal) ideas by deploying outside (as well as inside) pathways to the market – i.e. "the boundary between a firm and its surrounding environment is more porous, enabling innovation to move easily between the two" (Chesbrough, 2003a, p. 37). In an open innovation process, projects can be launched from internal or external sources and new technology can enter at various stages. Projects can also go to market in many ways, such as out-licensing or a spin-off venture in addition to traditional sales channels (Chesbrough, 2003b).

Open innovation is based on the following principles (Chesbrough, 2003a; 2003c):

- Not all smart people work in-house – need to tap into external knowledge
- External R&D can generate significant value to us
- Research does not need to originate from our internal work to be profitable for us
- A strong business model is more important than first to market
- Internal as well as external ideas are essential to win
- We can capitalize on our own IP and we should buy others' IP when needed

Open innovation is described as "both a set of practices for profiting from innovation and also a cognitive model for creating, interpreting and researching those practices" (West, Vanhaverbeke, & Chesbrough, 2006, p. 286). In later work, Chesbrough (2006a) claims that open innovation responds to two anomalies in previous research on innovation. First, he treats the *spill overs* as an explicit consequence of the business model (instead of something to avoid) and the *intellectual property rights* as a new class of assets (instead of as a tool for protection). He claims that both can deliver additional revenue to the current business model.

Chesbrough also identifies five key themes in research so far (Chesbrough, 2006b):

- The business model - two important functions, create value within the value chain and capture a part of it for the focal firm.
- External technologies – can leverage a firm's business model through filling the gaps and by creating complementary products that stimulate faster acceptance of the technology.
- Difficulty of identifying, assessing and incorporating knowledge – increased emphasis on managing knowledge and linking knowledge
- Start-ups – carriers of new technologies and explorers of new markets, and represent experiments with business models.
- IP rights – facilitates exchange of ideas and technologies

Early models of open innovation have been seen and studied in the industry of open source software development (OSS) and have later been transferred to more general open innovation practices. West and Gallagher (2006) identify three main challenges of open innovation (motivation, integration and exploitation of innovation) that they investigate through a qualitative and quantitative study of OSS development. They identify four generic open innovation strategies:

- Pooled R&D – shared R&D (Require shift in culture)
- Spinouts – a way of escaping large firm bureaucracies

- Selling complements – accepting commoditization or develop differentiated products based on commodities.
- Donated complements – general purpose technologies are sold so users can develop differentiated products (e.g. user toolkits)

Open innovation as a management model is currently gaining grounds in many industries. For instance, open innovation modes have been identified as one of the main trends in pharmaceutical innovation today. Since it is too costly to have all competences in-house, pharmaceutical companies have started to concentrate on core competencies evolving around technology platforms and therapy areas, in the same time as collaborations with the right partners is increasingly important. Balancing the right size and structure of R&D is one of main objectives in R&D management today (Gassmann & Reepmeyer, 2005). Gaule (2006) builds heavily on Chesbrough (2003b) to analyze the impact of open innovation on several parts of the organization, based on his own consulting model for open innovation. He further provides a series of short case studies, for example on Procter & Gamble. Motzek (2007) points to the motivation factors for companies to engage in open innovation. His empirical material is based on two organizations that are based on the ideas of open innovation. This sample is most likely different in character from already established companies that change to embrace open innovation. His motivation factors are rather similar to the general knowledge on motivation factors for entrepreneurs.

Another study shows that the key challenges for new ventures discussed in the entrepreneurship literature are less relevant in the case of open source software (Gruber and Henkel, 2006**)**.

- Newness – active participation makes firms known and allows them to rapidly build a public track record
- Smallness – market offering built on freely available code, also informal collaborations
- Market entry barriers – benefit from previous development efforts, quick focus on differentiations, low switching costs for users

The authors further argue that leanings from OSS also can be applied in more general terms, in any industry where blueprints can be exchanged over the internet and where innovation proceeds in incremental steps (Gruber & Henkel, 2006).

Chesbrough (2004) also introduced the metaphor of chess and poker to describe the management of innovation. When increasing the sources of ideas in a company the evaluation of early stage technologies is increasingly important. When targeting a known market with a new technology it is like *playing chess* – you know the pieces and what they can do – all information

is known. When in a situation of unknown technology and unknown markets – the path is not only unknown but *unknowable*. Measurement errors, i.e. *false positives* and *false negatives*, are likely to occur[2]. The metaphor of *playing poker* can be used for managing false negatives. To play poker, it is argued that companies "need to measure their capital and stage their investments in projects upon the receipt of new information" (Chesbrough, 2004, p. 25). Poker strategies include:

- Observation of what happens internally after the decision to terminate funding
- Exposure of the failure to outsiders – get new perspectives
- Out-licensing of the rejected project
- Formation of a spin-off venture

In *chess* you are looking for a fit with the roadmap of future project and the current business model, need a net present value > 0 and minimize the false positives. In *poker* you want to create options for future business models, leverage or extend the business value, have an options value > 0 and manage false negatives (Chesbrough 2004).

2.2.2 Business models

Chesbrough (2007) argues that a business model has two functions, it creates value and it captures a portion of that value, and that open business models enable companies to be more efficient in creating and capturing value. He also argues that companies need to adapt their business models to open innovation, as it is a way of generating value from your IP (Chesbrough, 2003c). Further, Chesbrough (2007) argues that the rising costs of technology development and the shortening product life cycles make it harder for companies to justify innovation investments. Using open business models, a company can attack the cost side through leveraging on external R&D resources to save time and money and attack the revenue side by licensing out internal technologies. He also argues that companies need to develop their capabilities to experiment with their business models, for instance through alternative brands or spinoffs (to reduce risks), fundamental changes that require top commitment and support (Chesbrough, 2007).

According to Chesbrough and Schwartz (2007), co-development partnerships are increasingly important in open innovation models. This is in line with Chiaromonte (2006), who argues that the difference of open

[2] False positives are ideas/technologies that have been judged to have good opportunities and then turn out to have less success and false negatives are ideas that are erroneously judged not to have any potential.

innovation to traditional outsourcing of innovative capacity is that the outside partners are not seen as suppliers but as peers. Chesbrough and Schwartz (2007) point out that the use of partners can create business models that reduce R&D expenses, expand innovation output and open up new markets. To be able to do this, the authors underline the need to:

- define the business objectives for partnering
- classify the R&D capabilities of the firm
  - core (key source of advantage)
  - critical (vital to success but not key)
  - contextual (needed to complete the offering, but not differentiator)
- align the business models of the two firms

This is confirmed by a study in the Netherlands that showed that very few companies actually had an articulated business model – which made it difficult for them to be flexible, for instance through succeeding with implementations outside the original business domain (Van der Meer, 2007).

2.2.3 Organizational design and boundaries of the firm

According to Chesbrough (2003 b) not all companies apply openness completely, it can rather be described as a continuum between high and low degree of openness. He also identifies a number of different roles that companies can have in models of open innovation Chesbrough, 2003b:13).

Organizations that fund innovation:

- Innovation investors (incubators, VC, private equity etc) and innovation benefactors (early financing)

Organizations that generate innovation:

- Innovation explorers (discovery research functions, used to belong to R&D)
- Innovation merchants (codifying and commercializing IP, royalties etc)
- Innovation architects (create value through creating a system for bringing pieces together, e.g. Nokia)
- Innovation missionaries (create and advance technologies to serve a cause, OSS)

Organizations that bring innovation to the market

- Innovation marketers (profitably market new ideas)
- Innovation one-stop centres (sell other's ideas, e.g. Yahoo!)

There are still some organizations – *fully integrated innovators* – still try to keep control of all parts (Chesbrough, 2003b).

Jacobides and Billinger (2006) discusses vertical architecture as a way of defining the scope of a firm and the extent to which it is open to final and intermediate markets. Permeable vertical architectures are described as partly open to the markets along the value chain. Increased permeability enables more efficient use of resources, better matching between market needs and capabilities, promoting more open innovation platforms. A case study of a fashion firm showed that it was possible to successfully change the vertical structure through increasing its permeability – arguing that firms can manage their boundaries to change and improve their own operations, strategic and productive capabilities, innovation potential and resource allocation processes (Jacobides & Billinger, 2006). In line with this, Tao and Magnotta (2006) describes the sourcing process at Air Chemicals, where the company has attempted to create a broader interface towards different pools of knowledge in the world, and to search providers that are able to further provide a broader interface towards for example scientists.

Fetterhoff and Voelkel (2006) focus on the problems involved in the search process for innovations. In their definition of innovation, customer demands need to be met by technology, and it is this merging process that they focus on. They argue that as firms mostly are not used to evaluate external innovations, there are a number of issues involved in the management of external innovation (Fetterhoff & Voelkel, 2006):

- Seeking opportunities
- Evaluating the market potential and inventiveness of a given opportunity
- Recruiting potential partners by building a convincing argument
- Capturing value through commercialization
- Extending the innovation offering together with outside partner

Dittrich and Duysters' (2007) analysis of Nokia's outside contacts are along the same line. For earlier generations of mobile telephony, Nokia kept product development as an internal issue, while for third generation telephony, the company opened up its processes. In this case, the company engaged in exploration together with outside firms. Whereas Nokia had earlier had long term partnerships based on the exploitation of innovations, the company now made use of explorative collaboration agreements to organizations with which the company had less strong relations. This set of "weak ties" implied that a more organic way of working than the previous "strong tie" exploitation agreements that built on stable structures. Simard and West (2006) also distinguish between different types of ties between companies. They discuss *deep ties* that enable a firm to capitalize on existing knowledge and resources and *wide ties* that enable a company to

find new technologies and markets. Open innovation networks can consist of both deep and wide ties and can be both formal (contractual) and informal. The authors further argue that *deep networks* tend to mostly lead to incremental innovations (Simard & West, 2006).

Another research study by Dahlander and Wallin (2006) deals with the central theme of how firms can utilize communities as complementary assets without having ownership or hierarchical control over them. Communities have developed practices to protect their work and in order to gain access to it as well as influence the direction of the community firms need to assign individuals to work in these communities. The authors showed that firm sponsored individuals are approaching more individuals than are approaching them and that they also seek to interact more with central individuals in the community.

Brown and Hagel (2006) discuss the emerging phenomenon of creation nets where a multitude of participants collaborate to create new knowledge, learn from each other and build on each other's contributions – under the guidance of a network organizer. They present examples such as the development of Linux but also motorcycle development in China and networks of amateur astronomers. Creation nets are started by a network organizer (gatekeeper) that decides who participates in the networks, defines participation protocols. Activities are usually organized in modular processes, enabling freedom with well defined interfaces. Creation nets also define action points, when participants must deliver. This requires long term incentives to align and motivate participants. It also requires new management approaches:

- Choose the appropriate way of coordination of the network
- Balance local innovation with global integration
- Design effective action points
- Establish useful performance feedback loops

The authors further argue that creation networks are best suited for situations where there is an uncertain demand for goods and services, where there is a need for participation of many different specialists to enable innovation and performance requirements are rapidly changing.

Lichtentaler and Ernst (2006) further discussed the management of boundaries through introducing new notions for organizational attitudes. In open innovation, managers need to organize the knowledge transactions with the environment. There are three major tasks (decisions) in knowledge management: Knowledge acquisition (Make or Buy), Knowledge integration (Integrate or Relate) and Knowledge exploitation (Keep or Sell). The authors base their paper on the classical Not-Invented-here (NIH)

syndrome adding the possibility of overly positive attitudes to externally organizing knowledge management. This leads to the distinction of six syndromes, overly positive or overly negative to each process:

- Make or Buy - Neg: NIH – Pos: Buy-In (BI)
- Integrate or Relate – Neg: All-Stored-Here (ASH) – Pos: Relate-Out (RO)
- Keep or Sell – Neg: Only-Use-Here (OUH) – Pos: Sell Out (SO)

With the trend towards more open innovation systems, companies will increasingly commercialize knowledge assets externally in order to keep up with competitors. Lichtenthaler (2007a) identifies three major principles that will help firms achieve strategic fit in the keep-or-sell decision: coordination, centralization, and collaboration. First firms need to consider external knowledge exploitation a strategic activity. Then this strategy needs to be aligned with other strategies (coordination) and a clear direction is needed (centralization). Finally emphasis should be put on cross-functional collaboration to reduce interface problems.

One way to externally exploit knowledge assets is by means of technology licensing. According to Lichtenthaler (2007b) technology licensing is seldom driven by one particular factor, but it results from a combination of various drivers/motivation factors). The author's questionnaire-based survey focusing on medium-sized and large industrial firms indicate that *ensuring freedom to operate* is of outstanding importance and *gaining access to another company's technology portfolio* is considered the second driver. The monetary dimension did not appear to be that important as was expected.

2.2.4 Leadership and Culture

Articles on open innovation tend to end up by stating that leadership needs to support people striving to be innovative. Yet very few articles actually analyze leadership in open innovation. Fleming and Waguespack (2007) discuss leadership in open innovation communities. They state that consistent with the norms of an engineering culture the future leader of open innovation must first make strong technical contributions from a structural position that can bind the community together. This is enabled by two correlated but distinct social positions: social brokerage and boundary spanning between technological areas. An inherent lack of trust associated with brokerage positions can be overcome through physical interaction. Boundary spanners do not suffer this handicap and are much more likely than brokers to advance to leadership. Longitudinal analyses of careers within the Internet Engineering Task Force community (the world's first open innovation community) from 1986-2002 support the arguments.

Witzeman et al. (2006) point out that not only the technological systems need to change. The more external innovation is sourced by the firm, the more of systems, processes, values and culture also needs to be transformed. The companies in Witzeman's et al. (2006) sample expressed resistance toward open innovation. Powerful forces inside the organization worked to harness current technology rather than search for new technologies from the outside. This is not strange, the authors argue. Company people are trained to think internally, and this tendency is strengthened by concepts such as core competences and Six Sigma. The leaders within this area are therefore those that manage to include the external sourcing in its procedures, for example as a standing point in its project management processes. This is indeed a challenge. Witzeman et al. (2006, p. 27) write:

> *"Building external thinking into the firm requires change. The firm must review the new product development processes, the supply chain, the strategic planning process, the reward system, the technology roadmap, and many other systems for their ability to incorporate external innovation. /…/ Harnessing external technology for innovation requires a fundamental change in employee thinking. The "Not Invented Here" syndrome is replaced with the "Invented Anywhere" approach."*

This is also in line with Dodgson, Gann and Salter (2006) who recognize that 1) Cultural changes as well as new skills are necessary, 2) the technology does not replace existing practices and 3) it does not overcome the uncertainty of innovation (Dodgson, Gann & Salter, 2006).

2.2.5 Tools and technologies

Several papers discuss the technological interface that enables the firm to collaborate with a large set of customers. As argued by Dodgson, Gann and Salter (2006) the change of the interface demands a change in the organizational ability to absorb, or assess the impressions from the outside. The organization needs to be prepared, the authors argue. In the case of Procter & Gamble, the case in question, the company had over decades developed a way to connect internally to improve the attitude for initiatives that came from outside the own department (both from outside and inside of P&G). The technique is called "Connect & Develop" (see also Huston & Sakkab, 2006; 2007, two of the leaders of the initiative).

The technologies, tools, and processes that are in use for open innovation can largely be described as:

Coordinating/aggregating

This point refers to for example the Procter & Gamble Connect and Develop (C&D) model that is used to leverage sources internally and externally to leverage the distributed innovative capacity (Dodgson, Gann & Salter., 2006; Huston & Sakkab, 2006, 2007). The C&D model makes use of the large interface of a multinational organisation towards outside parties all over the world to find ideas for new products, understand customer needs, and find solutions to technical problems or issues. Similarly, Tao and Magnotta (2006) provide an example of a process called "Identify and Accelerate" (I&A) that is used to create an understanding of the specific needs of the organization and extend the company's interface towards the market by collaborating with external search providers to find solutions to those needs. Under Coordinating/aggregating can also be included standard open source methods (cf. Henkel, 2006) as well as the toolkits used for innovation and mass customization (Piller & Walcher, 2006)

Liberating

Piller and Walcher (2006) argue that customer have "sticky knowledge" that is not easily revealed in standard market research. Their idea is to use idea competitions to release customer creativity and through that make use of the hidden knowledge and the hidden preferences. They use a case from Adidas' development of soccer shoes as an example.

Allowing/including

As several papers argue, there are problems involved in setting up the structures to use open innovation. One such problem is that the existing models direct attention towards internal sources of ideas and competence, rather than towards external sources. To change behaviour and culture, the formal models that govern the work process therefore need to be the start of the change. Gassmann, Sandmeier and Wecht (2006) write about the use of the software development model extreme programming (XP) to open up the innovation process. The authors point out that the iterative character of the process allows for intense customer interaction, and analyse the applicability of XP to new product development. The P&G practitioners Huston and Sakkab (2006; 2007) argue that the implementation of a new working system needs to be aligned with the leadership of the organisation and with the roles, responsibilities and relationships of the people and processes in place. They stress that the involvement of a senior executive is crucial for the success of open innovation.

There are not only advantages, but also negative sides of integrating customers in the innovation process. Enkel, Kausch and Gassmann (2005) discuss risks and strategies that companies can use to avoid these risks

based on a questionnaire study (141 companies) and in-depth case studies of nine companies that were invited to participate in a workshop series:

- Loss of know-how – Involve trustworthy customers, chose the moment and develop IP agreements.
- Dependence on customers' views – Chose the 'right' customers and work with a mix of customers.
- Dependence on customers' demands or personality – avoid exclusivity agreements, work with HR to understand customers and their culture and apply open communication.
- Limitations to mere incremental innovation – Work with lead users and indirect users, use the right method to include customers and chose an intelligent timing.
- Serving a niche market only – Use different customers in different stages of the innovation process and pay attention to the search field process.
- Misunderstandings between customers and employers – Develop solid relationships with customers, use the right tools and develop suitable incentive systems.

2.2.6 IP, patenting and appropriation

All firms using open innovation need to deal with the need to protect its intellectual capital (Henkel, 2006). How companies manage intellectual property (IP) depends on whether they operate in a *closed innovation* paradigm or an *open innovation* paradigm according to Chesbrough (2003a). One assumption of open innovation brought forward by the author, is that there exists a multitude of ideas outside the firm and that the firm should be an active buyer and seller of IP. Technology assets have no inherent value independent of the business model used to employ them. The author further discusses how Millenium Pharmaceuticals, IBM and Intel use different strategies to connect IP to business models and to leverage internal and external IP through those models (Chesbrough, 2003a).

According to von Hippel and von Krogh (2006) *free revealing* can often be the best practical route for innovators to increase profit from their innovations. The authors review evidence showing that *free revealing* is practiced far beyond software. The practical reasons why innovators want to freely reveal information instead of holding it secret or licensing it could be (1) when others know something close to your secret, (2) when profits for patenting is low and (3) when incentives for free revealing are positive. Von Hippel and von Krogh (2006) argue that the phenomenon of *free revealing* suggests that there is a *private-collective model* of innovation incentives. This model offers society the best of both worlds – public goods created by private funding.

In a qualitative and quantitative study of firm-developed innovations with embedded Linux, Henkel (2006) shows that companies are aware of this dilemma and use different means to protect their code. They reveal about half of the code they develop, depending on how important the need for obtaining external support in the development work is. The more support is needed, the more code is revealed. Smaller firms with less internal resources thus reveal more. The author further argues that firms practice *selective revealing* to minimize competitive loss. This is consistent with profit-maximization behaviour (Henkel, 2006).

Hurmelinna, Kyläheiko and Jauhiainen (2005) claim that the question on whether to be protective or to externally exploit new knowledge is two-folded. They use the term *appropriability regime* to discuss exploitation of knowledge assets and sustain competitive advantage. The strength or weakness of the regime in the protective sense may turn out to be both useful and harmful, depending on the situation the company is facing. The results show that in most appropriability issues, an intermediate position emphasising the means of legal protection might turn out to be the most effective strategy, and may provide the company with more control and various alternatives to react proactively to emerging opportunities.

2.2.7 Industrial dynamics and manufacturing

So far, the notion of open innovation has mainly focused on the company level and less on the network or industry level where the benefits for the focal firm is discussed jointly with those for the collaborating organizations. According to Vanhaverbeke (2006) there is a need to address a broader scope of analysis.

Christensen, Olesen and Kjaer (2005) place the concept of open innovation in the context of industrial dynamics and applied evolutionary economics. Berkhout et al. (2006) also point out, on a general level, the necessity of a cyclical model of innovation and argue that our society now has four production factors, capital, labour, knowledge and creativity, enabling the "innovation economy". Christensen and his colleagues (2005) further argue that firms manage open innovation in regards to an innovative technology in different ways depending on 1) their position in the innovation system 2) the stage of maturity of the technological regime and 3) the value proposition pursued by the companies and that there are many challenges to investigate further in the interplay between technology entrepreneurs and incumbents where open innovation are often played out under conditions of high transaction cost.

Cooke (2005) takes a regional innovation system perspective and argues that in order to overcome intra-firm knowledge asymmetries, firms tap into

the regional knowledge capabilities. This perspective explains better than the triple helix model how research, innovation and production actually functions. These capabilities are rooted in open science or open innovation. Further, he argues that capable knowledge actors congregate in a few places called “mega-centers” (e.g. in biotechnology). Network nodes are key relay points in global-regional innovation systems.

From an alternative perspective, Bromley (2004) gives an overview of the fundamental changes that manufacturing has gone through in US: craft production, mass production, lean production, and high-quality production. The author argues that the latest rapidly growing change in American manufacturing is what Chesbrough (2003b) describes in his 2003 book (Chesbrough, 2003b). This new approach to corporate research and development uses modern software and the Internet as brokers between firms that require research in specific area and those worldwide that are capable and willing to provide it at appropriate cost. Accordingly, Bromley (2004) points to the urge for US to undertake a major study of world trade and technology policy to understand how its position in science and technology and international economic competitiveness has been affected by open innovation.

2.3 Synthesis and Analysis

As with any emerging field, several authors have been keen to describe the phenomenon in question.**Fel! Hittar inte referenskälla.** lists the different authors that have been active in the different themes. It is clear that there has up until now been a certain focus on the money issue – how patents are protected and on how business models must change. As pointed out earlier in this report, several of the papers are in very practice oriented publications. The theoretical depth in the analysis of open innovation is yet to be developed. Looking at the themes, it is also clear that some themes have been more popular than others. The themes themselves are also very broad. Leadership is one topic brought up in three of the papers, but none of them analyze leadership as it is performed. Rather, two of the publications point out the importance of leadership on a surface level, and the third (Fleming & Waguespack, 2007) study how leaders emerge in networks. The leadership issue as such is thus as far left untouched.

Table 1 The themes found in the existing literature on open innovation

Themes	References
The Notion of Open Innovation	Chesbrough, 2003a, 2003b, 2004, 2006a[3], 2006b[4]; Chiaromonte, 2006; Gassmann & Reepmeyer, 2005; Gaule, 2006; Gruber & Henkel, 2006; Motzek, 2007; West & Gallagher, 2006; West, Vanhaverbeke, & Chesbrough, 2006[5]
Business models	Chesbrough, 2003c; Chesbrough, 2007; Chesbrough & Schwartz, 2007; Van der Meer, 2007
Organizational design and boundaries of the firm	Brown and Hagel, 2006; Chesbrough, 2003 b; Dahlander & Wallin. 2006; Dittrich and Duysters, 2007; Fetterhoff & Voelkel, 2006; Jacobides & Billinger, 2006; Lichtentaler & Ernst, 2006; Lichtenthaler, 2007a, 2007b; Simard & West, 2006[6], Tao & Magnotta, 2006
Leadership and culture	Dodgson, Gann & Salter, 2006; Fleming & Waguespack, 2007; Witzeman et al., 2006
Tools and technologies	Dodgson, Gann & Salter, 2006; Enkel, Kausch & Gassmann, 2005; Gassmann, Sandmeier & Wecht, 2006; Henkel, 2006, Huston & Sakkab, 2006; 2007; Piller & Walcher, 2006; Tao & Magnotta, 2006
IP, patenting and appropriation	Chesbrough, 2003a; Henkel, 2006; Hurmelinna, Kyläheiko & Jauhiainen, 2005
Industrial dynamics and manufacturing	Berkhout et al., 2006; Bromley, 2004; Christensen, Olesen & Kjaer, 2005; Cooke, 2005; Vanhaverbeke, 2006

The review of the existing literature in the open innovation field reveals a very young field in which the most energy has been put into a fascination for the subject as such. Researchers have mainly asked themselves the perhaps three most obvious questions resulting from an opening up of the innovation process:

- what happens to the way money is made (the business model)?
- what happens to the organizational structures?
- what happens to the rights to intellectual property?

[3] Chapter in Chesbrough, Vanhaverbeke and West (2006)
[4] Ibid.
[5] Ibid.
[6] Ibid.

So far, researchers have mainly explored these issues in general terms and have concluded that something must happen. How this is going to happen is much less clear. A reason for that may be that there are still a very limited number of cases that are often being referred to (such as IBM, P&G, Air Chemicals and Innocentive) and that there actually still very little knowledge available on this topic. Following from this, it also seems like the empirical basis for the suggestions being made in the papers is very limited. This is most likely what also appears in the relatively small amount of research on leadership and culture. More knowledge is available on tools and technologies. This is reasonable as technology enables the collaboration between many actors, for example when a firm collaborates with a large number of experts. The journal articles on industrial dynamics and manufacturing are somewhat different than the others, approaching the term from very different perspectives. This indicates a growing interest from other fields than the strictly firm-oriented.

A substantial amount of the publications are presenting case studies (often, however, referring to the same cases). This is not surprising in a field of research that are in its early phase. However this argues for the need of conceptualizing publications in order to further develop the open innovation body of knowledge and the underlying theoretical models.

There are also some clear limitations in the material. For example, there are very few authors that are critical to the concept of open innovation. These first years of publication have been characterized by a fascination for the topic and a need to explain it in many contexts. The explanations have to a large extent stayed at a fairly shallow level. There is a need also for a critical discussion on the concept, its strengths and weaknesses and how it contributes to existing management knowledge.

3 Asking the Experts

Chapter 2 of this report presented an analysis of research that has already been conducted and presented to the academic world. Because of the slow pace of academic publication, the research for the published papers was typically done several years in advance. To arrive at an understanding of the questions currently being addressed in the field, a number of established researchers were identified and asked to define what they consider to be the most crucial questions *for future research*.

3.1 Method

In the spirit of distributed innovation and ownership of ideas, key researchers in the open innovation field were interviewed to help define the research frontier in open innovation. The written interview study was done in two parts and via email. In the first part, five researchers were asked the following questions:

- What do you think are the reddest and hottest issues in the open innovation field in terms of theoretical depth, for example in:
  - innovation management
  - general management
  - organizational theory
  - sociology
  - leadership theory
  - strategic management
  - other?
- Who do you consider the most important and/or innovative thinkers in the field today?
- Where do you find the red and hot issues in the open innovation field in terms of tools and methods?
- Where do you find the red and hot issues in the open innovation field in terms of practical use?

All five answered and thereby helped to create a series of core issues of the questions that people in the field are currently thinking about. They were also asked to nominate other key researchers in the field that were interviewed in a second round.

Ten people that were nominated were sent the same questions, with the exception of the last one (as this question did not generate any answers in the first round). Four of them answered. The following analysis is hence

built on a total of 9 people that answered the questions (they are listed in appendix 2).

3.2 Thematic Analysis of the Research Frontier

The results from the first and second round have been merged in the synthesis of the answers below. Also, the answers have been structured not according to the theoretical fields, but rather in terms of key themes and specific issues as stated by the researchers. Four areas were identified as being mentioned more often than others:

- Open innovation as a model for innovation
- The contingency perspective of open innovation
- Implementing and using open innovation
- The role of management in open innovation

Below, the issues and questions that the researchers put forward in the interviews are presented for each of these four themes. Finally some of their reflections on open innovation research are recited.

3.2.1 Open Innovation as a Model for Innovation

Open innovation is still a rather new area of research and many of the responses underline the need to further explore the concept and how companies can change and adapt to this new approach of including external knowledge and skills in their innovation strategies. A number of issues around the model of open innovation are raised by the researchers:

Terminology

Some of the researchers argue that the terminology itself needs further development:

> *Developing a more precise terminology [is important]. Chesbrough used the term "open innovation" mainly for contract-based exchange of knowledge etc., as it is practiced, e.g., in corporate venturing. Yet, what we observe in the field of open source software is something completely different, and it would be helpful to separate the two phenomena conceptually.*

> *I assume by open you mean collaborative innovation built upon an innovation commons like open source software. Chesbrough's version of open is simply a marketplace for IP.*

The Organization and its Context

Another issue is the surroundings of the firm or the milieu. One of the main challenges for a company is to find the right people and to have a larger set

included rather than only a group of individuals and firms with which the company already is in contact. Some comments around this area were:

> *How can a firm organize a ”milieu” around itself, containing R&D resources and competences (see the ”innovation hubs” that are flourishing around the world)*
>
> *What settings do the organizations seek out? Users? Other firms? Online Communities?*
>
> *Overcoming the local search bias with crowd sourcing of problem solving seems to bear plenty of potential not utilized yet*

The word crowd sourcing comes from James Surowiecki, who wrote a book called “The Wisdom of Crowds” (Surowiecki, 2005). A fundamental idea/assumption in his work is that the collective intelligence of a larger group of people exceeds that of a few, both in terms of ideas and knowledge. Surowiecki sees great potential in the concept and believes that it can be used to solve major problems, both for firms and society as such. A problem is here how to organize the collective intelligence – to create structure out of the information chaos that otherwise would exist. This is also close to *community based innovation*, which was also put forward by one of the researchers as a future research area.

Organizational Structure

The organizational structure for open innovation is also an interesting issue to explore. Firms today are typically not organized to be able to collaborate with a very large set of actors. Several responses revolved around understand how organizations can organize for openness.

One of the researchers recommends the reading of Segrestin (2005) on the issue of organizational identity:

> *[There exists] no clear theoretical foundations of the organizational forms emerging from open innovation (neither market, nor hierarchy - what are the borders of the firm? what is the type of ”coordination” where the collaboration can potentially impact the identity of both companies?)*
>
> *The organizational aspects of change? Can we see open innovation as organizational innovation?*
>
> *How to organize for ”open innovation”? What is the role of R&D in the scheme?*

Aspects on the Theory of the Firm

If a new organization is created that includes both customers and the firm, then a number of questions on the role of the organization emerges. Some related issues put forward:

> *Is it necessary to have a ”common purpose”? If yes, how to ”design” it? If no, how to organize an open innovation without common purpose?*
>
> *If a network of (competing) firms collaborates for innovation, what is the room left for competition?*
>
> *If the competence supplier is the customer, what are the consequences on the market relationship?*
>
> *What is the nature of the firm if it neither based on production, nor on competences?*

As a result of the new organisational forms, the market dynamics change. One researcher concludes that we need:

> *A new theory of relationships between economic actors corresponding with the new forms of value creation. Also, in the perspective of ”open source software”: new types of ”firms” and organizations.*

3.2.2 The Contingency Perspective of Open Innovation

When a new perspective is introduced it is reasonable to have a debate on its validity: Under what conditions is open innovation an appropriate way of doing innovation? The respondents identified a number of debates that need to be had on the contingency of the open innovation approach. A number of variables were addressed:

Value of Open Innovation

Another issue identified by the researchers was the question of costs and benefits of open innovation - how to value this way of working. Questions put forward by the researchers include:

> *What are the contingency factors that affect the conditions under which open innovation is effective?*
>
> *What are the costs of open innovation?*
>
> *Showing the comparative advantages of open vs. closed innovation under different conditions via economic modelling / reasoning based on empirical findings to date.*

Timing of Openness

One such perspective was the timing of open innovation and the relation to the innovation process and the product life cycle:

> *When - over the product cycle -- do you have to be open?*
>
> *Are there some ”moments” in the innovation lifecycle where open innovation is more relevant ?*
>
> *Is there room for temporary openness?*

Degree of Openness

Another perspective was the degree of openness:

> *How open do you have to be? Can you be too open?*
>
> *Generally speaking: relationship between type of ”openness” and type of ”innovation”?*
>
> *Is the company open or does innovation take place in a project which is open?*

Type of Innovations

In the literature, a number of different typologies for innovations have been outlined (see for instance Tidd et al., 2005) and parameters such as degree of novelty are used to distinguish between incremental and radical innovation (Garcia & Calantone, 2002) or modular/architectural innovation (Henderson & Clark, 1990). An example of such a question put forward by the researchers is:

> *Are there some types of innovations that are more adapted to ”open innovation” (a contingency approach to innovation)?*

3.2.3 Implementing and Using Open Innovation

So far, open innovation has been an interesting phenomenon. Even though several authors point to the long history of joint development of innovations (e.g. Dahlander & Gann, 2007), only few firms have actively used it in the form that we are talking about it today.

One reason for there not being many more firms explicitly using open innovation , given the hype around open innovation issues, is the problem of organizing the external environment to make use of the wisdom of the crowd. Another issue is that even if the firm manages to do that, a core problem is to organize internally to make use of the innovative ideas and knowledge. The small study revealed a number of issues that need to be addressed to better understand how to implement and use models for open innovation in firms. These issues are summarized here:

Integration of External Ideas

To an increasing extent, firms use external input in the innovation process, but there is still a need to better understand the role of the evaluation process. The researchers argue that more research is needed to overcome the *local evaluation bias*.

New ways of working need to be combined with existing systems and structures. Another important issue is to investigate how systems for customer involvement and open innovation practices can be combined with systems already existing within corporate R&D structures. Also: how can the firm make sure that external knowledge is received and used properly at the right place in the organisation?

The well known ”Not Invented Here” (NIH) syndrome, described as a tendency of established project groups to believe they have all the necessary knowledge in an area of specialization, and therefore are rejecting ideas from outside the group (Katz & Allen, 1992) can be found also in open innovation contexts. It is seen the reluctance of members of one organizational function to accept information of innovations coming from outside (Szulanski, 1996). One of the respondents stated that:

> *overcoming the Not-invented-here problem is a core issue to making open innovation work. ”Proudly developed elsewhere” is a great claim by P&G, but not in the culture of most companies yet.*

Managing the Interface

Other issues rather addressed how the open innovation initiatives go together with the existing competences and processes for R&D inside the organization. There are still many questions to look into around this challenge. The researchers formulated a number of questions:

> *Does open innovation enhance creativity (new points of view, new competences,...) or does it impede it (refuse to share potentially interesting ideas,...) ?*
>
> *Open innovation and skills formation, learning trajectories, competence building?*
>
> *Open innovation and communities of practice?*
>
> *Linking open innovation and autonomous innovation in firms? (hypothesis: open innovation helps to ”pace” industry-wide innovation; internal innovations are only variations around this track shared at the industry level ?)*
>
> *Open innovation and dynamic capabilities of the firm?*

IP Management

Another issue that the researchers put forward as important to address further is the intellectual property policy and other governmental policies that were developed to support producer-centered innovation, but are seldom useful in open innovation models. More research is needed to understand how such policies can be changed to also accommodate user-centered or community-centered innovation. Questions put forward by the researchers include:

> *How do you protect innovations in an open innovation regime?*
>
> *Open innovation and property rights*
>
> *Open innovation and the employment relationship*
>
> *Getting away from the established wisdom that "appropriation" necessarily requires "exclusion"*

3.2.4 The Role of Management in Open Innovation

With a changing relationship between the firm and its surroundings (including customers, partners, competitors, suppliers and communities) the role of the manager is also shifting.

Leadership

The researchers put forward a number of issues that need to be investigated to understand how managers can lead open innovation:

> *The open innovation leader, a new type of leader not representative of the group?*
>
> *An enabler of individual initiatives?*
>
> *The open innovation leader as leading the emergence of new leaders ?*
>
> *Emergence of "organizers", "facilitators" of open innovation ?*
>
> *Tools and techniques to do that?*
>
> *Leader' charisma might be all the more necessary than there is no hierarchical relationship?*

Motivation Factors

The researchers also put forward thoughts on the need to better understand how managers can motivate not only its employees but also other actors participating in their innovation processes

- *What are the drivers of openness?*

- *What is the role of open innovation on the demand side, for example for online communities?*
- *What does the individual take from participating in open innovation?*

3.2.5 Reflections on Open Innovation Research

Some of the respondents also added some general reflections on the field of open innovation research. They pointed out both the need for more empirical research and theoretical elaborations:

> *There does exist a stable tradition of "open innovation" but it is actually limited to very restricted types of innovation (norms, standards,...); today new norms are emerging*
>
> *There have been very original forms in the history but we were missing the theory to interpret and understand them...*
>
> *We need more data. Relying simply on patent data is too restrictive. We need longitudinal survey data over multiple years in order to make progress.*
>
> *We also need to show the actual size of the user innovation phenomenon in terms of frequency and expenditures.*

3.3 Summary of the Input from the Experts

The key themes and the issues raised by the researchers are listed in **Fel! Hittar inte referenskälla.**. As can be seen in a simple comparison between appendices 1 and 2, the researchers that responded the interview questions are among the most well published in the area. Their analysis of the research frontier is potentially a good proxy for where the research will go, and also what research projects they will be pursuing.

Table 2 Summary of the expert's suggested future research fields

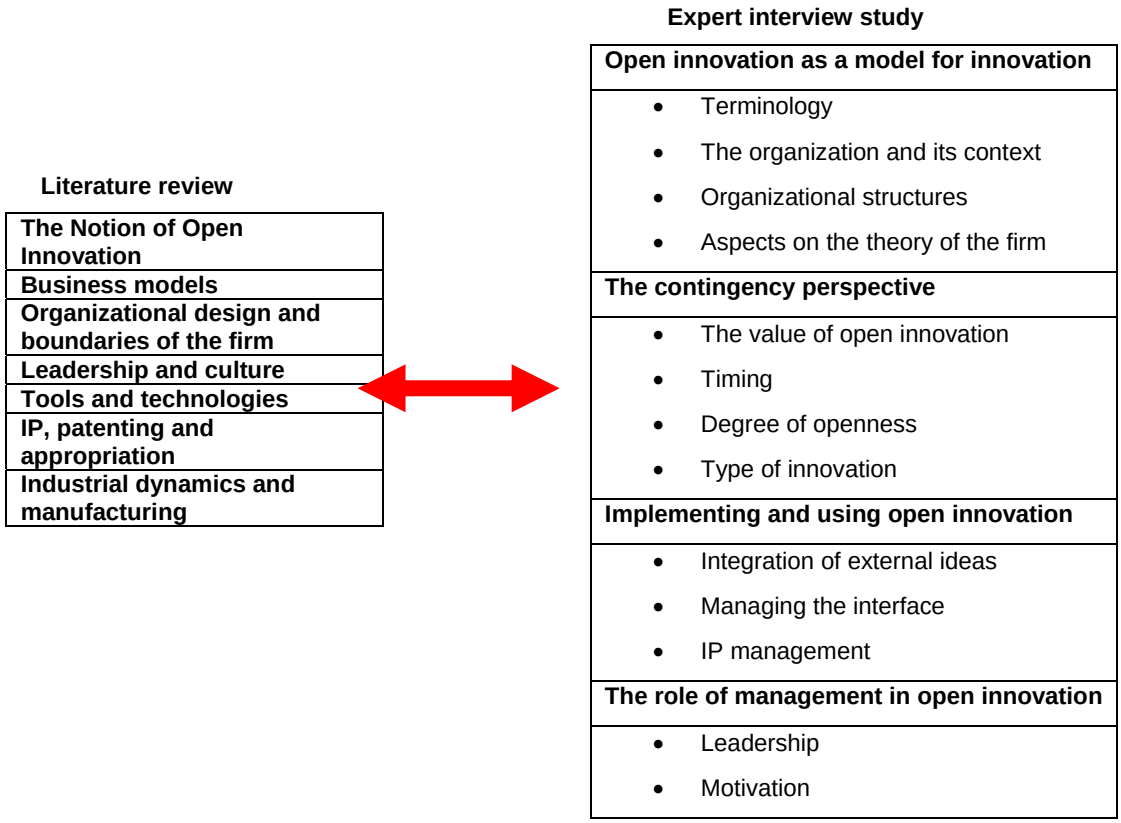
Open innovation as a model for innovation
• Terminology • The organization and its context • Organizational structures • Aspects on the theory of the firm
The contingency perspective
• The value of open innovation • Timing • Degree of openness • Type of innovation
Implementing and using open innovation
• Integration of external ideas • Managing the interface • IP management
The role of management in open innovation
• Leadership • Motivation

In the next chapter the interesting areas for research for the future (as defined by the experts) are compared with the fields that have already been the major areas for publication.

4 Discussion of the Literature and Research Frontier

Comparing the themes that were generated through the reading of the literature with the themes that were found in the comments from the researchers (**Fel! Hittar inte referenskälla.**), it is clear that the researchers call for a deepening of the open innovation concept in many respects.

Figure 1 Overview of the different fields from the literature review and the expert interview study, respectively



Looking at **Fel! Hittar inte referenskälla.** and Chapter 3, there are some interesting tendencies:

- The field is growing and includes more aspects. As can be seen in chapter 3, several of the researchers point to open innovation as a collaborative process between several different parties, rather than as a market for ideas. The different definitions have started to diverge. This means that the concept (as collectively defined by the researchers in

chapter 3 and the authors in chapter 2) is starting to diverge to include many more aspects than those first described by Chesbrough (2003b).

- There is a critical perspective arising. The researchers start asking what open innovation is good for (cf. also the conference paper from Dahlander & Gann, 2007, on this topic) and what the limits of the concept are.
- There is an increased acknowledgement of the negative sides of open innovation. Quite clearly, there are different situations where the model is beneficial and when it is not. This also includes research perspective investigating under what circumstances open innovation is a good idea and when it is not.
- The literature study revealed several practitioner accounts of open innovation, for example in the journal "Research-Technology-Management". It also found that most of the journal articles were case studies. The researchers call for more systematic studies cross organizations. They also call for more research on the specific parts of a model for open innovation, and on the specific problems involved in opening up the innovation process. This includes the not-invented-here problem, the sourcing issue (for example how to evaluate technologies that are found)
- The researchers also stress the role of management much stronger than what is reflected in current publications. This involves issues of the role of leaders in changing the organizations to become more open innovation oriented. The researchers also point to the individual that is supposed to be part of the open innovation scheme – what is the motivation for him or her to engage in practices that may be beyond the scope of current work?

Based on these insights from the literature and the researchers, the report will continue with a suggested focus on some issues that may potentially be fruitful to research in the future.

5 Suggestions for Future Research

Building on the knowledge gained, this chapter proposes some tentative areas for future research, based on two proposed dimensions that distinguish open innovation processes from other innovation processes. This report is written from a management perspective with the aim of sketching out issues that maybe of interest both for firms and for theoretical development.

5.1 Dimensions of Open Innovation

In current definitions, open innovation is described as an internal process that is becoming more dependent on external knowledge and external actors, but it still considers innovation as an internal process. Also, it does not indicate the number of collaborating parties to which the innovation process is opened up but this distinction can help the understanding of how innovation processes change. It can be argued that exploring these two dimensions, the locus of the innovation process and the extent of collaboration, can be of help for further investigations of open innovation.

5.1.1 The Locus of the Innovation Process

A main characteristic of open innovation is that the innovation process not necessarily takes place within the boundaries of the firm. Instead, the innovation process is distributed among a larger number of actors. Some authors refer to this as a boundary spanning activity, others describe the borders of the firm as increasingly permeable (e.g. Jacobides & Billinger, 2006; Enkel and Gassmann 2007). In both cases, this means that innovation cannot anymore be referred to only taking place within the R&D department of a firm. One alternative is naturally that innovation is bought by the firm from outside parties (a rather traditional solution). If, however, the innovation process takes place in iterations between the firm and its environment, this causes a series of issues that have impact on how the process is managed and understood. Innovation has long been seen as a "black box" (Rosenberg, 1994). Despite a large body of literature on innovation, there is little said on how the process of innovation actually takes place. When attempts have been made, they have often ended in descriptions and analyses on how you prepare for, and what the contingency factors are. If the locus of innovation is not only the R&D department, but a field of collaboration between the firm and outside actors, this puts the magnifying glass on how innovation actually happens.

A problem that arises when the innovation process becomes shared between a larger number of actors is that the hierarchical model of coordination no

longer becomes sufficient. Instead there is a need for other coordination mechanisms. The open source movement (cf. Henkel, 2006) provides one such coordination mechanism in terms of a joint technological platform. In Sawhney and Prandelli (2000) the community of users provide another example of a platform. If the locus of innovation moves from being deeply embedded within the firm to happening either outside the firm or in a relation between the firm and outside actors, there needs to be a coordinating, aggregating and synthesizing mechanism that is able to create value out of the pieces of information gathered from different sources.

5.1.2 The Extent of Collaboration

From given examples, a continuum can be drawn from the classic collaboration between two parties taking place in industry markets to a very large number of involved partners. In Sweden, the long developmental collaboration between Ericsson and Televerket is a good example of an alliance between two parties. The alliances created between the military forces and high technology industries in many countries are examples of the same thing (Rosenberg, 1994). A change that comes with the current movement towards open innovation is the ability to collaborate with many. Surowiecki calls this the “wisdom of crowds” (Surowiecki, 2005). The assumption is that the collective intelligence of a larger group of people exceeds that of a few, both in terms of ideas and knowledge. A problem here is how to organize the collective intelligence – to create structure out of the information chaos that would otherwise exist. A central problem arising from this kind of reasoning is how the knowledge and ideas of many can be aggregated and synthesized. One solution is provided by companies such as Innocentive (Lakhani & Jeppesen, 2007) that use the minds of many to find solutions to well defined problems. At BMW and Adidas, the innovation process is opened up also to the customers of the company (Gloor & Cooper, 2007; Piller & Walcher, 2006). Some collaborative networks are self-organized and often include customers as well as others outside the company’s boundaries. These networks are sometimes called swarm business and are utilized by companies like BMW, IBM and Novartis, They are moving beyond idea generation and product development to the very essence of doing business (Gloor & Cooper, 2007).

Using crowd sourcing – i.e. utilizing the wisdom of crowds - to increase innovativeness is close to community based innovation (which was also suggested by one of the researchers in chapter 3 as a future research area). Whether the customers or experts that support an organization with innovative ideas and/or solutions really constitute a community in its sociological sense (Wellman & Wortley, 1990) is a fundamental question. There is a strong likelihood that the contact between the firm and its outside

collaborators in itself creates increasingly strong ties that may lead to a sense of community. For experts, research usually speaks of communities of practice (Amin & Cohendet, 2004; Swan, Scarbrough, & Robertson, 2002). For customers, the correspondent term is brand communities (McAlexander, Schouten, & Koenig, 2002; Muniz & O'Guinn, 2001) or communities of creation (Sawhney & Prandelli, 2000; Sawhney, Verona & Prandelli, 2005).

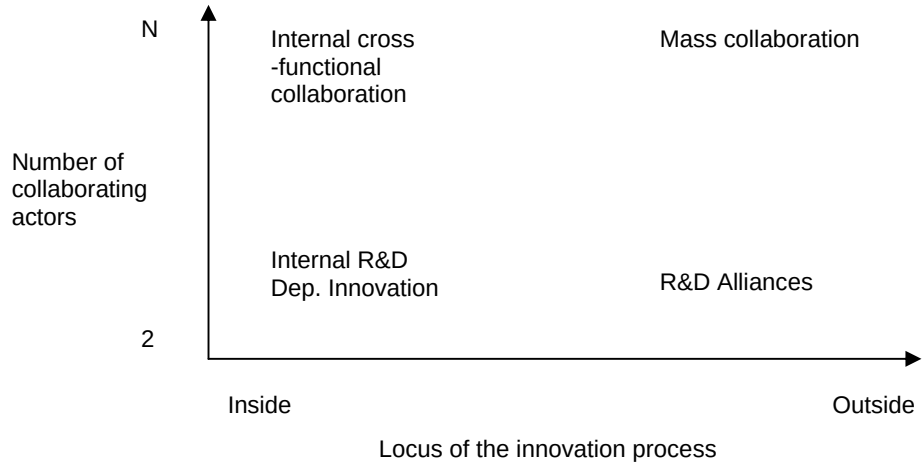
Related to the wisdom of crowds and community based innovation are ideas around mass collaboration. There are several examples to be found. The most well known is perhaps Wikipedia. Tapscott and Williams (2006) try to sketch out the benefits of mass collaboration in their book “Wikinomics”. A parallel and quite charming example is ”We are Smarter than Me” (Libert & Spector, 2007), which was generated through a web page (www.wearesmarter.org). The key point of all such initiatives is to create innovative solutions. To use the social networks for innovation is rather innovative in itself. Mass collaboration can be seen as an extension of the open innovation ideas. We may assume that the reason for the lack of academic articles in management on mass collaboration as open innovation is the slow pace of academic publishing. Wikinomics and We are Smarter then Me are not typical academic books. It is quite frequent that academic publishing follows discoveries made by practioners and analyze phenomena that have already been described in more practice-oriented books and journals.

A difference between crowd sourcing and mass collaboration as defined in the current literature is the centre of the innovation process (this is consistent with Feld, 1981, who argues that communities form around a focus). In the first case, the firm or the product is in focus, and people are given assignments to support in the process of innovation. There is a clear sender and a clear receiver of the assignment, in most cases the firm. The mass collaboration examples rather take the form of self-organizing, bottom-up driven movements, where the idea is the carrier and focus of the organization. Users typically take on different tasks in the organization such as moderators of forums, as co-developers of the technical platforms, or as censors of the material submitted by other community members. The differences between crowd sourcing and mass collaboration are not discrete. Rather, we may see a continuum between the top-down and bottom-up driven solutions.

5.1.3 The Complexity of Open Innovation

Connecting the dimension of the location of the innovation process with the extent of collaboration, a model for different alternatives for open innovation emerges, see **Fel! Hittar inte referenskälla.**.

Figure 2 A model of open innovation alternatives



Looking at the traditional form of R&D in the bottom left corner of **Fel! Hittar inte referenskälla.**, the situation is characterized by a low number of collaborating parties. Innovation primarily takes place within the walls of the firm. As the innovation process moves outwards, and includes a greater number of collaborating parties, the complexity of the process increases vastly. The firm needs to employ a different form of coordination to be able to handle the new situation.

The development in the two dimensions in **Fel! Hittar inte referenskälla.** challenges the conventional knowledge in management theory. Previously, managers mainly worked with internal processes for innovation, sometimes in collaboration with external partners, but to a limited extent. Knowledge on how to manage R&D (left bottom corner) is well developed in most companies. In extreme cases, open innovation requires companies to break the logics of both dimensions at the same time, involving a new set of complexity.

Many of the authors state that open innovation requires cognitive changes in the mindset of the leader (e.g. Buijs, 2007) and others underline the need for new organizational structures and managerial practices to enable an efficient open innovation process. These two research areas, the human side and the organizational side of open innovation are therefore put forward as important fields for further exploration and research.

5.2 The Human Side of Open Innovation

As has been acknowledged by several researchers in chapter 2 and 3, implementing open innovation is dependent on the support and preparation from management. Several claim that there need to be a cultural shift in the

organizations to be able to handle open innovation. Such aspects of what open innovation means in the management of people are sketched out below:

5.2.1 Leadership

Leadership is a vast and miscellaneous field of research. However, leadership in an open innovation context is still unexplored and it becomes clear from the present findings that a specific kind of leadership, capable of handling several stakeholders, complexity, and uncertainty is needed. Buijs (2007) puts forward that bringing in the open innovation concept make it a real challenge for leaders. He states that dealing with all the multiple aspects of innovation and at the same time harmonizing different perspectives of different team members and partner organizations calls for a very special kind of leadership. This leadership demands a great tolerance of ambiguity and paradoxes. It calls for choosing people over rules without loosing track of the innovation journey. Further the author states that the innovation leader needs to balance four processes; the innovation process, the group process, the creative process and the leadership process which makes the work with innovation very complex. These parallel processes make the leaders controlled schizophrenics, which means that they try to be in control by letting go. The leadership should adapt to changes in the environment. If met by a “no” from the organization the innovation leader should just continue and find ways of to circumvent that organizational “no” by for example playing with the budget or having fun with the organizational heroes (Buijs, 2007). In line with this other scholars point to the importance for project leaders to manage organisational politics for the sake of innovation (Buchanan & Badham, 1999; Buchanan & Boddy, 1992; Butcher & Clarke, 1999; Frost & Egri, 1991). This political perspective, although not studied in the context of open innovation, might add to our understanding of how leaders cope with complex and uncertain situations.

Leadership mediated by information technology can exhibit exactly the same content and style as traditional face-to-face leadership, especially as virtual interactions become more visual. This is stated by Avolio and Kahai (2003) in their article defining and exploring the concept of e-leadership. The critical differences may be in what is meant by ”feeling the leader's presence,” as well as the reach, speed, permanence, and perception of a leader's communication. Yet, certain fundamentals of leadership will probably always be the same, even in this new context. A successful e-leader must build relationships and trust. Avolio and Kahai (2003) discuss how leadership behaviours need to change in order to build the type of high quality relationships that will optimize follower trust, motivation and performance.

Future studies on leadership in open innovation can add to the existing body of knowledge by examining what kind of leadership style (e.g. transformational, transactional, controlled schizophrenic, political) is needed in open innovation and how this is influencing the members of the innovation process. It would also be interesting to further explore the concept of e-leadership by studying how relationships and trust can be developed in situations where people don not meet face-to-face. Moreover studies on leadership in open innovation of more exploratory character are expected to create knowledge on how open innovation leaders should deal with notions such as control, trust, motivation, learning and mutual respect.

5.2.2 Teamwork

Teamwork in a collocated group of people differs from teamwork in a distributed and sometimes even undefined group of people. Ancona, Bresman and Kaeufer (2002) are discussing why bad things happen to good teams and their critic is that teams are often too inwardly focused and lacking flexibility. Their research show that successful teams which they call X-teams are externally oriented, adaptive and see positive results across a vide variety of functions and industries. These teams have extensive ties with outsiders both weak and strong ties. They operate through three distinct tiers that create differentiated types of team membership – the core tier, operational tier, and outer tier. Team members may perform duties within more than one tier. Ancona, Bresman and Kaeufer (2002) recommend X-teams when one of the following conditions hold true; when organizational structures are flat, spread-out systems with numerous alliances; when teams are dependent on information that is complex, externally dispersed and rapidly changing; and when team tasks are interwoven with tasks undertaken outside the team. Most of these conditions probably hold true for team situations in open innovation.

Future studies on motivation could focus on creating an increased understanding of how teamwork takes place in an open innovation context; e.g. what constitutes teamwork in open innovation and how does the group lifecycle look like. It would also be interesting to compare teamwork in different types of open innovation settings and compare it to more traditional contexts.

5.2.3 Motivation

Since the foundation of innovations are ideas and it is people who develop, carry, react to, and modify ideas, it is critical to study what motivates or *enables individual innovative behaviour* (Van de Ven, 1986). The issue of what is motivating people to generate and contribute in an open innovation approach is discussed by some scholars studying open source software

development. West and Gallagher (2004) are discussing key challenges of open innovation by bringing in some lessons from open source software. Among other aspects they address motivation as something of great importance. Their paper is however not based on empirical data. For future research they suggest a closer investigation of the feasibility of *virtual teams* as a way to organize innovation enabling collaboration between organizations as well as understanding the *culture of open innovation* throughout teams that spans organizations.

Apparently a lot of interesting research has been conducted on motivation and innovation although not focusing on open innovation specifically. Some of this earlier work could be utilized to understand what drives people to become innovative and how this behaviour can be supported. Scott and Bruce (1994) propose a model of *Individual Innovation Behavior* which considers individual innovative behaviour as the outcome of four interacting systems – individual, leader, work group, and climate for innovation. The model is based on empirical data from a large centralized R&D facility of a major U.S. industrial corporation. One interesting finding is that the role expectations of a supervisor influenced individual innovative behaviour, providing support for the Pygmalion effect (Livingstone, 1969) within the context of innovation.

Future studies on motivation could investigate how this type of working environment can satisfy the psychological needs of people and thus be used as motivators for people to take part in open innovation. It would also be interesting to study the individual innovation behaviour of people taking part in open innovation. Also going back to the basic psychological drivers and study how these can be fulfilled in an open innovation context.

5.3 The Organizational Side of Open Innovation

Applying open innovation in firms also have an impact on the organization itself, the types of capabilities that are important for the company and the type of processes that need to be created in the firm. These organizational aspects are discussed below.

5.3.1 Organizational Structures

Organizational structures are the basic configurations of an organization. According to Scott (1998) the structures consist of technology, social structures, objectives and participants. He further argues that social structures are normative (values and roles), cognitive (convictions and understandings) and behavioural. According to Mintzberg (1983) there are five basic types of organizations; the simple structure, the machine bureaucracy, the professional bureaucracy, the divisionalized form and the

adhocracy, linked to the five coordination mechanisms in organizations (direct supervision, standardization of work processes, standardization of skills, standardization of output and ; mutual adjustment). Organizations are also to a large extent dependent of their environments (Scott, 1998).

These theories were developed under the assumption that the organization has firm boundaries and can interact with its environment. In open innovation, the boundaries are no longer stable and the activities do not only take place inside the firm. This has consequences, not only for the identity of the firm itself, as pointed out by some of the researchers in chapter 3, but also for all its structural parts. Also, control and coordination mechanisms may no longer be adequate, new factors such as trust become increasingly important. Today, most firms are organized either in a functional/divisional way or as a matrix organization, but when applying open innovation, it is interesting to question whether these forms are still suitable as organizational models.

Further studies on organizational structures could investigate how these structures deals with open innovation, where the problems arise and what the possible adjustments may be. Further it could be interesting to explore what control and coordination mechanisms are appropriate in such a context.

5.3.2 Open Innovation Capabilities

Many organizations do not only work with open innovation, rather they begin by experimenting in smaller scale or in a separate setting (Chesbrough, 2007). This means that there is often still an interface between innovative activities and the more closed structures. Research has shown that explorative activities performed separate from the core business can lead to isolation and resistance against the ideas that are developed (Birkinshaw and Gibson, 2004; Moss Kanter, 2006), this is also often referred to as the NIH syndrome (Katz-ref). In an open innovation context, understanding the potential difficulties of integrating close and open innovation activities is essential.

The term *absorptive capacity* is been used to describe the “ability of the firm to recognize the value of new external information and apply it to commercial ends” (Cohen and Levinthal, 1990, p.128). This ability is critical in innovation processes and even more so in open innovation processes where ideas per definition stem from outside the firm to some extent. Lane et al. (2006) specify the term absorptive capacity to include the recognition of valuable external knowledge, assimilating this knowledge and apply it to create new knowledge and commercial ends. Enkel and

Gassmann (2007) distinguish the need for two additional capabilities that companies need to develop to be successful in open innovation,

- Multiplicative capacity (capability to transfer knowledge to the external environment)
- Relational capacity (capability to build and retain relationships, networks)

Further, Mathews (2003) is also addressing the importance of blending internal resource accumulation with external resource leverage and thereby deepening the dynamic capabilities that is costly and time-consuming for competitors to duplicate or imitate. Others (e.g. Blomqvist et al., 2004) point at internal and external collaboration networks as crucial for creating a meta-capability for innovation. There is however a risk to get locked into established networks and at the same time it can be challenging to access new ones. Birkinshaw, Bessant and Delbridge (2007) propose some guidelines to firms to follow to more likely create high-performing networks for discontinuous innovation. This implies that open innovation capabilities contain a distinct set of skills and that there is a need for an increasing understanding of what these capabilities are and how they can be developed.

Further research on open innovation capabilities could explore what the most important capabilities are and how they differ from previous models. Also there is an explicit need for a better understanding of how companies can work in practice to build and develop their capabilities. This perspective is no less relevant in an open innovation context.

5.3.3 Open Innovation Processes

The innovation processes of a firm also need to be adapted to the changing characteristics of innovation activities, where external knowledge and actors are to an increasing extent part of the processes. One example of open innovation that draws on the input from outside parties is the design theory approach as described by Verganti (Utterback et al., 2007; Verganti, 2003). He argues that Italian design firms subject their ideas to public scrutiny by outside experts through a dialogue process, as a proposal to the surrounding context. The proposal is condemned, accepted or further developed by external parties. The proposal-making firm evaluate the design based on the attention that the design proposal gets. There are several reasons why this is important, according to Verganti. First, the firms cannot adapt to customer preferences, as the design objects that they produce do not fulfil specific customer needs. Second, the firms are very small and need to rely on the surrounding network. Usually, the designers themselves are not employed by the firms, but hired for specific tasks. They also typically are not Italians.

Closely related to Verganti is the theory of design reasoning proposed by Hatchuel, le Masson and Weil. They describe the design process (design here as the general process of innovation) as iterations between the generation of knowledge and concepts (Hatchuel 2002, Hatchuel, Le Masson & Weil., 2005; 2006; Le Masson, Weil & Hatchuel, 2006) that consists of identifying "innovative fields" (areas for innovative design). The innovative fields are based on "value concepts" that guide the exploration of new values and their related products through iterative "exploration projects" (Hatchuel, Le Masson & Weil, 2005). These explorations are made through close collaboration with external actors that can provide knowledge that the organization do not have internally.

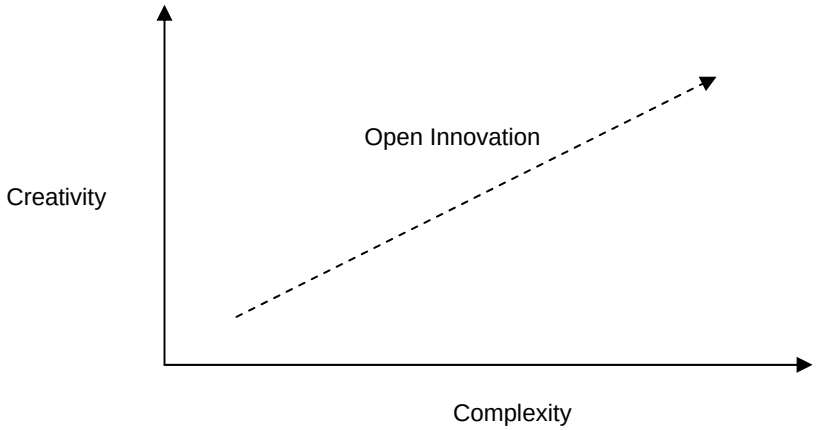
Further research on open innovation processes is still needed in terms of how to create innovation processes that enable a high degree of collaboration. It could be interesting to investigate companies that have succeeded as well as failures to understand enablers as well as barriers.

6 Conclusions

This knowledge overview of the open innovation field has highlighted the themes that are covered by already existing research. Furthermore, some of the most well published researchers in the innovation fields were asked about where they see that the research frontier currently is. This mapping provided a series of central themes that have been and are of current interest. As can be seen from appendix 1, there literature in the open innovation field is still limited, both in terms of the amount of publications and in terms of the amount of authors that have written about the subject. Also, a large part of the literature is practitioner accounts of open innovation, which are very valuable as case descriptions but do not provide much theoretical development. Looking, however, at the vastness of topics that are covered, both in the existing publications and what the researchers suggest are the coming areas, one may conclude that there is great potential in further theoretical development in the open innovation field.

Departing from the mapping, a series of issues of importance for future research were identified. The report focused on two central such issues – the Human Side of Open Innovation and the Organizational Side of Open Innovation. Both areas included several suggestions for further research. Through the report, there is a general observation and assumption that though open innovation increases the potential creativity in the innovation process, it also increases the complexity involved in managing the process (**Fel! Hittar inte referenskälla.**).

Figure 3 Open innovation increases both potential creativity and complexity of the innovation process



The complexity becomes higher both because of the increased number of actors involved, and the fact that the organization is no longer itself in control. Furthermore, an open innovation process demands (as is argued in chapter 5.2 on the Human Side of Open Innovation) that managers can handle both the inside and the outside of the organization. The traditional solution to handling complexity in innovation processes is to separate the parts that have to do with the outside, with new products or with changed processes from the standardized routine activities in the organization. The separation is done either spatially or temporally (Baden-Fuller & Volberda, 1997). During the last 15 years, authors have increasingly argued for the ability to do both at once. In the innovation literature, this is commonly referred to as *ambidexterity* (Tushman & O'Reilly, 1996). Although there has been large support for the necessity of ambidexterity, which in its scientific formulation often becomes described as the need to simultaneously be both explorative and exploitive (Gupta, Smith, & Shalley, 2006; March, 1991), few have been able to describe how it is actually done. Organizations that work with open innovation have to take the ambidexterity issue into account. This is especially true if they do not only open up the R&D department to external collaboration but all parts of the organization (as Witzeman et al., 2006, argue).

The two topics focused in this report – the Human Side of Open Innovation and the Organizational Side of Open Innovation – conclude that there are important interfaces between the open innovation field and classic management theories. There is much potential in posing the open innovation field in comparison with the established theories to create theoretical development.

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Appendix 1: The Existing Literature on Open Innovation

The table consists of the 49 papers and books that have open innovation in its title, abstract or keywords. Papers in trade journals and in journals that only refer to original papers were removed. Book reviews and columns have been marked with grey and are not included in the analysis in chapter 2.

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von Hippel, E. & von Krogh, G. 2006. Free revealing and the private-collective model for innovation incentives. R & D Management, 36(3): 295-306

Appendix 2: Interviewed researchers

The questions were answered by:

- Prof. Henry Chesbrough, University of California Berkeley
- Ass. Prof. Lars Frederiksen, Imperial College, London, UK
- Prof. Constance Helfat, Darthmouth College
- Prof. Joachim Henkel, Technische Universität München
- Prof. Keld Laursen, Copenhagen Business School, Denmark
- Ass. Prof. Pascal LeMasson, Ecole des Mines de Paris, France
- Prof. Frank Piller, RWTH Aachen, Germany
- Prof. Dominik Walcher, Salzburg University of Applied Sciences, Austria
- Prof. Eric von Hippel, Massachusetts Institute of Technology

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VINNOVA Analysis VA 2008:

01 VINNOVAs Focus on Impact - A Joint Approach for Impact Logic Assessment, Monitoring, Evaluation and Impact Analysis

VA 2007:

01 Nanoteknikens innovationssystem

02 Användningsdriven utveckling av IT i arbetslivet - Effektvärdering av tjugo års forskning och utveckling kring arbetslivets användning av IT. *For brief version in Swedish and English see VA 2007:03 and VA 2007:13*

03 Sammanfattning - Användningsdriven utveckling av IT i arbetslivet - Effektvärdering av tjugo års forskning och utveckling kring arbetslivets användning av IT. *Brief version of VA 2007:02, for brief version in English see VA 2007:13*

04 National and regional cluster profiles - Companies in biotechnology, pharmaceuticals and medical technology in Sweden 2004. *Only available as PDF. For Swedish version see VA 2005:02*

05 Nationella och regionala klusterprofiler - Företag inom fordonsindustrin i Sverige 2006

06 Behovsmotiverade forskningsprogram i sektoriella innovationssystem. *For English version see VA 2007:15*

07 Effekter av den svenske trafikksikkerhetsforskningen 1971-2004. *For brief version in Swedish and English see VA 2007:08 and VA 2007:09*

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09 Summary - Effects of Swedish traffic safety research 1971-2004. *Brief version of VA 2007:10, for brief version in Swedish see VA 2007:07.*

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11 Svenskt deltagande i sjätte ramprogrammet. *Only available as PDF*

12 The role of Industrial Research Institutes in the National Innovation System

13 Summary - User-driven development of IT in working life - Evaluating the effect of research and development on the use of information technology in working life. *Brief version of VA 2007:02, for brief version in Swedish see VA 2007:03*

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15 Needs-driven R&D programmes in sectorial innovation systems. *For Swedish version see VA 2007:06*

16 Biotechnology, pharmaceuticals and medical technology in Sweden 2007 - Cluster profiles

VA 2006:

01 End of an era? Governance of Swedish innovation policy. *For Swedish version see VA 2005:07*

02 Forskning och utveckling vid små och medelstora företag. *Only available as PDF*

03 Innovationsinriktad samverkan. *Only available as PDF*

04 Teknikbaserat nyföretagande i Sverige 1990 - 2003. *Only available as PDF*

05 Offentligt stöd till universitetens samverkansuppgift - en internationell kartläggning. *Only available as PDF*

06 Inkubatorer i Sverige - analys av indikatordimensioner och nyttoefektivitet. *Only available as PDF*

VINNOVA Forum VFI 2007:

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02 Tillväxtgenvägen - affärsinnovation i svenska tjänsteföretag *(Innovation policy in Focus)*

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01 *Under production.*Upptäck det innovativa Sverige.

02 Forskningsprogrammet Framtidens personresor - Projektbeskrivningar

03 *Under production*. Passenger Transport in the Future - Project Descriptions

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05 Forska&Väx - Program som främjar forskning, utveckling och innovation hos små och medelstora företag

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VI 2007:

02 MERA-programmet - Projektkatalog. *For English version see VI 2007:03*

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09 Komplexa sammansatta produkter - Projektkatalog 2006

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13 VINNOVA´s Activities in Biotechnology.

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19 Effektiv Produktframtagning - Projektkatalog 2006

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VP 2006:

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