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Open innovation in process R&D
the activities needed for an integration of open innovation in a manufacturing firm

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Open Innovation in Process R&D: The activities needed for an integration of Open Innovation in a Manufacturing Firm

by

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Preface

This master thesis is the result of my graduation project for the master of Innovation Management at Eindhoven University of Technology. The study has been performed at Firm A and was supervised by the Innovation, Technology, Entrepreneurship & Marketing (ITEM) department of the faculty of Industrial Engineering & Innovations Sciences (IE&IS).

This graduation project has been an interesting journey and a great opportunity for me to translate the knowledge I have gained through the years of my academic education into practice. After an instructive year of hard work and inspiring (international) experiences, my master thesis is a fact. I owe my gratitude to a number of persons, because without their help this master thesis would not be the same.

First, I want to thank my first academic supervisor Myriam Cloodt. She has been very collaborative from the start when last minute my literature study had to be finished, till the end when my planning was extended. Thank you for all the effort and feedback, Myriam! Without your support this project would not have been possible.

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Furthermore, I am thankful for the supervision of Linda. Our conversations helped me with understanding the operational processes and increased my insight in the differences between literature and practice. Thank you for your support and creating a nice working environment for me.

Last but not least, I want to thank my family and friends for their continuous support during my master thesis project and study. Special gratitude I would like to show to my dad for his patience feedback and brainstorming.

Franka van Breemen,
Eindhoven, June 2014
Summary

This report describes what activities are needed for open innovation integration in the current innovation routines of the process R&D Department B in the manufacturing Firm A.

Open innovation is currently a very popular concept in innovation management (Van de Meer, 2007; Huizingh, 2011) and an increasing number of organizations integrate some form of openness in their practice (Chesbrough & Crowther, 2006; Knudsen & Mortensen, 2011). However, literature on how to integrate open innovation focuses on aspects of the integration process. This is surprising since literature indicates that it is most beneficial to integrate open innovation as a total package (Keupp & Gassmann, 2009; Lichtenthaler, 2009) and it is risky to partly integrate open innovation as it can make the organization vulnerable when the parts are integrated in a disjointed, unbalanced manner.

By means of a case study, it was investigated how the integration process of open innovation should be performed and how choices therein are affected by external factors and organizations characteristics. For a specific organization; Department B, activities are identified that are necessary for the integration process and the choices therein are analyzed. A case study was appropriate since this research method takes the contemporary, real-life context into account and the till-then unknown, associated dynamics can be identified.

From literature a process model was derived that describes the integration of open innovation with two linked processes. One process is the transition process from closed from open, roughly described by the three organizational change phases of Lewin (1947): unfreeze, change and institutionalize. The current state is the input of this process, the impediments to open innovation affect the change and the output is the open state. The other process is a cyclic process of practicing open innovation; making the open state a dynamic state, going through phases of ‘formulating the openness strategy’, ‘implementing the strategy and executing the projects’, ‘evaluation’ and ‘modification’. In this second process external factors and the performance of current project execution affect the choices made in this process.

When starting the transition towards open innovation, not many organizations follow a fully closed innovation approach (Chesbrough & Crowther, 2006; Dahlander & Gann, 2010; Huizingh, 2011), and also in the current state of Department B some level of openness is observed. External knowledge is recognized as helpful and something that the department needs to use. The organization collaborates with a variety of different partners and searches for external knowledge sources. However, at the same time closed mindset characteristics as ‘to profit from knowledge, we need to develop it ourselves’ and ‘we need to control our IP’ are observed in the organizational context. The department does not (yet) make use of business models and supporting capacities to make in-depth collaborations possible are still rather internally focused.

The fact that both open and closed characteristics are present in the current state of Department B, creates tension and ambiguities that hinder the implementation of open innovation. Observed ambiguities are ‘what knowledge to share and what not’, ‘how much are we willing to give in a collaboration’ and ‘which projects are appropriate to collaborate in and which less’.
How to, appropriately, practice open innovation depends on external factors. Organizations can choose to vary the extent of openness across the R&D project portfolio and across the project duration (Knudsen & Mortensen, 2011). External factors of Department B that currently encourage some closeness, are industry dynamics as; stable growth, not many new business models arise, knowledge leverage is uncommon, the industry is asset intensive. And process innovation characteristics as; knowledge leakage is difficult to prevent, the effectiveness of protection strategies is low, partners have to shift to a niche market to collaborate with them and process innovations signal a weakness in production process. At the same time industry dynamics of high technology intensity and fusion of technologies currently encourage open innovation activities.

The collaborations that Department B already performs with external partners can be categorized as ‘alliances’. These alliances are characterized by work done by the partner at the requests of the R&D department, therefore the alliance type is considered as a ‘unilateral outside-in contract’. The collaborations are managed with a focus on technical aspects, and success and failure factors related to business and social aspects get less attention.

To align these collaborations with the practice of open innovation, Department B needs to deepen their inbound activities. This will have the benefit of less effort has to be spend on adapting external knowledge to internal applications. It should also perform outbound activities to increase the R&D efficiency, and it should start to use and think in business models because that makes that knowledge is used in a smarter way and implementation success could be increased. Department B could extend the range of collaboration modes so external knowledge is used more and creativity is increased. Another activity that needs to be done is the creation of an entrepreneurial culture so open innovation activities are supported and creativity increased.

To make the transition from closed to open, an ‘open-innovation implementation team’ should be created that challenges the status quo and involves other functions of the firm in the discussions. In addition, a structural team has to be established that coordinates on the long term all open innovation projects. That team should select tools that support the open innovation practice and, in collaboration with the implementation team, should start a pilot study. During this pilot study the impediments can be solved in collaboration with management. And finally after the pilot, open innovation should be integrated on larger scale and employees should be trained.

To realize the practice of open innovation and ease some decisions, it is recommended to develop templates. A first template should be developed for defining a project’s openness strategy, therein three matrices can be used. The matrix of Huizingh (2011) is recommended to define whether inside-out or outside-in process are used and whether the purpose of making money is important. The matrix of Dahlander and Gann (2010) is recommended to define the openness of the product and outcome. And a third matrix is recommended to define the collaboration mode based on whether the project is core or not and a strategic issue or not. A second template it recommended for managing projects wherein is collaborated with external partners. To not only pay attention to technological but also social aspects in collaboration, the handbook of Duysters et al. (2002) can be used as inspiration while setting up this template. Finally, an open innovation project should be evaluated, therefore the model of Fetterhoff and Voelkel (2006) could be used to standardize this phase.
This report provides valuable contributions for management since it gives insight in what open innovation is and what has to be done to integrate it. It contributes to literature by connecting the literature on aspects of open innovation and by providing insights in when open innovation is integrated and what dynamics play a role in process innovations.

In addition to the contributions of this research, future research is required to proof that the recommendations and activities lead to the desired open innovation performance, is also valid in others contexts than manufacturing firms doing process innovations and when the integration of open innovation is initiated by another part of the organization. This study also makes curious for more research on ‘how open an organization can and must be given the industry dynamics’ and ‘whether the insight of this process model speeds up the integration of open innovation’.
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1. Introduction

This report contains the results of the study on how to integrate open innovation in the organization of process R&D Department B. The report starts with the motivation of the study. The first paragraph introduces the theoretical background, the second paragraph states the research question and third paragraph clarifies the setting wherein the research took place. The chapter closes with an outline of the rest of the report.

1.1 Theoretical Background

Open innovation is currently a very popular concept in innovation management (Van der Meer, 2007; Huizingh, 2011). A decennium ago, the term was coined by Henry Chesbrough (2003a), which is all about the idea that a single organization is less efficient when it innovates in isolation and external actors can leverage an organization’s investment in R&D (Dahlander & Gann, 2010). The leverage of partnering in innovation results in benefits as ‘access to the newest knowledge and technologies, faster identification of technical problems, focus on core competences’ (Gassmann & Enkel, 2004) ‘alternative ways to raise cash, measuring real values of innovation and increased loyalty and motivation among employees’ (Rigby & Zook, 2002).

Due to the numerous benefits it is not surprising that the application of the concept is increasing. More and more organizations follow the examples of Procter & Gamble (Dodgson et al., 2006; Hudson & Sakkab, 2006), IBM (McQueeney, 2003; Bjelland & Wood, 2008; Chesbrough, 2011), and Lucent (Chesbrough, 2000; Chesbrough, 2003a). Most organizations have already applied some form of openness (Chesbrough & Crowther, 2006; Knudsen & Mortensen, 2011) and in literature organizations are advised to open up even more (Keupp & Gassmann, 2009; Lichtenthaler, 2009).

Current literature on the integration of open innovation focuses on aspects of the integration. Examples of aspects are ‘select suitable collaboration types and partners’ (Dushnitsky & Lenox, 2005; Van de Vrande et al., 2006; Chesbrough & Prencipe, 2008), ‘connect strategy and open innovation in business models’ (Christensen et al., 2005; Chesbrough, 2007a; Chesbrough & Appleyard, 2007; Jarzulski & Holman, 2011), ‘create a suitable culture with essential competences’ (Vanhaverbeke et al., 2007; Lichtenthaler & Lichtenthaler, 2009; Lichtenthaler et al., 2011) and ‘realize the organizational change’ (Rigby & Zook, 2002; Chiaroni et al., 2010; Chiaroni et al., 2011). As these articles show, these aspects play a role in the successful integration of open innovation and are therefore important.

However, in spite of the rising interest in applying open innovation, there are hardly any unifying studies that address how to integrate all these aspects together. This is surprising since there are studies that prove that open innovation has to be integrated as a total package (Lichtenthaler, 2009) and there are limitations to the extent of integrating open innovation (Laursen & Salter, 2006; Knudsen & Mortensen, 2011). This implies that paying attention to only a few aspects of open innovation is not sufficient for success, since the synergy is in the interaction between the aspects and coordination of all aspects is required to prevent too much openness. Hence, the absence of studies like this formed the objective of this study; to provide a manual for full open innovation integration.
1.2 Research Question

In order to contribute to academic literature and managerial understanding the following research question was formulated:

*What activities need to be done in order to integrate Open Innovation?*

The objective is to formulate the process of open innovation integration and to construct a manual by identifying specific activities that need to be performed during the integration process. This should result in a practically useful manual that also fills the literature gap on full open innovation integration.

The study is started with a literature review to sketch the content, context and process of open innovation integration (Pettigrew, 1990; Huizingh, 2011). It answers the following sub questions:

1. What is open innovation?
2. What are the effects of the characteristics of manufacturing firms and process innovations on open innovation integration?
3. Which processes are associated with the integration of open innovation?

This is supplemented with a study on a real-life context. The approach is to develop guidelines for a specific organization and define activities that need to be done in order to integrate open innovation. To direct the data collection, sub questions were defined with focus points on ‘what currently is’ in order to be able to analyze what ‘should be’, what potential ‘benefits and barriers’ are associated with the open innovation activities in this industrial setting and what ‘current boundaries’ of the organization need to be taken into account and if needed ‘how should these boundaries need to be changed to obtain the benefits’:

4. What Open Innovation activities are already done?
5. What Open Innovation activities are not yet done?
6. What activities can be done within the current set up of the organization?
7. What activities can be done with potentially changed boundaries of the organization?
8. How should the boundaries be changed?
9. What are the associated benefits with these Open Innovation activities?
10. What are the associated barriers with these Open Innovation activities?

1.3 Research Setting

The study of the real-life context took place in the process R&D department (Department B) of manufacturing firm A. This department deals with the question of how to integrate open innovation in their business. They see open innovation as a promising new way of improving the R&D activities, especially to accelerate their innovation process. However, it is hard for them to interpret what they have to do to integrate open innovation into their operational activities.

Firm A has a dual structure for their R&D activities. The responsibility of Department B is to research and develop new manufacturing technologies until the technology is working in a relevant environment. Thereafter the technology is transferred to the business units where it will be further tested, optimized and implemented in the production processes. Department B therefore solely focuses on process innovations. See Figure 1. This setting characterizes the scope of this study:
The customers of process R&D Department B are the business units. It is an internal customer, which is natural for process innovations (Bergfors & Larsson, 2009), and which has certain consequences for the goals of the innovation process. First of all profit and sales are not a prominent issue; earnings are received indirect when the business units are able to produce more efficient. Second, the department is perceived as a ‘cost center’ that should turn money into knowledge. Business units invest in the R&D department and new technologies should increase the margins, creating more budget for future investments. Last it makes that success is defined as ‘the implementation of a new technology in the production process of the business units’.

Since process innovations have to generate efficiency improvements at the business units, the R&D projects have to be aligned with the needs of the business units. These units are represented in two boards that control the technology areas and projects that Department B works on. One board focuses mainly on long term, fundamental technology developments, while the other focuses on shorter term, less riskier projects.

Within Department B a variety of technology areas are studied. The diverse group of researchers has a lot of knowledge and is able to make useful connections between these areas. This creates absorptive capacity (Vanhaverbeke et al., 2007), meaning that the department has the ‘ability to assimilate and replicate new knowledge gained from external sources’ (Cohen & Levinthal, 1990).

The department recognizes that it is not possible to develop all technologies internally from scratch. Current collaboration partners are the internal customer, external technology manufacturers, current suppliers and universities. These collaborations are primarily focused on how to make best use of external knowledge to generate the best new technologies for the internal customer without losing intellectual property. It could therefore be said that Department B has experience in collaborating and using external knowledge, especially in the form of alliances, but from a rather closed mindset.

1.4 Report Outline
The rest of the report is organized as follows: the next chapter, Chapter 2, discusses literature and creates a framework wherein this research is set, thereby answering sub questions 1 till 3. When that is clear, Chapter 3 explains the empirical research methods and reflects on the quality aspects of these methods. This is followed by the description of the results and the analysis, spread over two chapters; Chapter 4 and 5, answering sub questions 4 and 5. Chapter 6 continues with the evaluation of the results, answering sub questions 6,7,8,9 and 10. Followed by Chapter 7, which contains the recommendations, giving practical input for answering the research question. Chapter 8 concludes with a recap on the answers to the research (sub) questions, and the report closes with a discussion and suggestions for future research in Chapter 9.
2. Literature Review

In this chapter current literature is reviewed to provide insight in the integration process of open innovation and to answer the first sub questions. The chapter exists of three parts; 1) it will first introduce the concept of open innovation, answering sub question 1: What is open innovation? 2) Then it places the focus company within this concept, answering sub question 2: What are the effects of the characteristics of manufacturing firms and process innovations on open innovation integration? And finally part 3) reflects on how to implement and practice open innovation. Answering sub question 3: which processes are associated with the integration of open innovation? The parts discuss open innovation from a general perspective narrowed down to specific, as shown in Figure 2.

**2.1 Open Innovation**

The formal definition of open innovation is: “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough et al., 2006 p.1). It is about the realization that ‘knowledge creation’, ‘innovation’ and ‘exploitation’ do not have to happen at one place in an organization and do not necessarily have to happen inside the same organization (Gassmann & Enkel, 2004). This means that where before the complete new product development process was dealt with inside one company, with open innovation there is much more interaction with the environment. Ideas can be extracted from the environment and knowledge development could make use of knowledge available externally. In addition, internal knowledge could be brought outside the organization even before the development cycle is completed, when other parties outside the organization can develop the knowledge further.
Central in the definition of open innovation is the flow of knowledge. This is not remarkable, since “innovation could be defined as the application of knowledge” (Trott, 2005 p.17). In open innovation, knowledge could be exchanged in a tacit-form, shared in social interactions, or in a more tangible-way, for example when knowledge is captured in technologies, employees or other resources (Trott, 2005 p.28&29).

Open innovation is assumed to be a paradigm forming our ideas on how to work through the innovation funnel (Chesbrough, 2006). As is common for a paradigm, open innovation builds on concepts and ideas already known before the recognition of the paradigm (Trott & Hartmand, 2009). These concepts are, amongst others, the Not Invented Here- Syndrome (NIH) (Katz & Allen, 1982), absorptive capacity (Cohen & Levinthal, 1990), and ideas on collaborating with market-players and intermediaries (among others: Von Hippel, 1988; Dyer & Singh, 1998; Gulati, 1998; Dodgson, 2000). Chesbrough assigned the single term ‘open innovation’ to these already existing activities, thereby connecting and integrating these knowledge areas (Huizingh, 2011).

The difference of open innovation with the traditional business strategy theories, termed ‘closed innovation’, is that these latter have ‘guided firms to develop defensible positions against the forces of competition and power in the value chain, implying the importance of constructing barriers to competition, rather than promoting openness’ (Chesbrough & Appleyard, 2007). It is an internally focused logic, whereby is trusted on the idea that oneself knows best, and external knowledge is scarce (Chesbrough et al., 2006; Moore, 2001b). It is a view that says “successful innovation requires control” (Chesbrough, 2003a p.20). In contrast, open innovation concentrates on the process of joint value creation and distribution (Vanhaverbeke et al., 2007), implying that barriers should not be built and collaboration is essential. Figure 3 summarizes the contrast between open and closed innovation.

**Figure 3 Closed vs. Open Innovation (Chesbrough, 2003a; Osterwalder & Pigneur, 2010)**
Practice of innovation management is however not binary open or closed (Chesbrough, 2003a). Characteristics of both ways of innovation are often present, creating a grey area wherein open and closeness are balanced. Among open innovation researchers openness is accepted as a continuum (Dahlander & Gann, 2010), wherein the extent of openness can vary across the R&D project portfolio and across the project duration (Knudsen & Mortensen, 2011). Open innovation replaces the focus of innovation management from only on internal R&D to both internal & external R&D (Laursen & Salter, 2011). Thereby one cannot go without the other; internal and external R&D complement each other (Dahlander & Gann, 2010). Because, for effectively using external R&D absorptive capacity is needed (Gassmann & Enkel, 2004) and internal R&D efforts are a prerequisite for learning and nurturing absorptive capacity (Lavie et al., 2010). With only internal R&D a lot of opportunities will be missed, since external knowledge development occurs so rapidly (Chesbrough et al., 2006).

2.1.1 Open Innovation Processes
When applying open innovation in the innovation process, two dimensions can be distinguished: using external knowledge and commercializing internal knowledge. The first dimension is so called inbound open innovation; which is about deliberately building on external sources of innovation in exploration processes (Gassmann, 2006; Lichtenthaler, 2009). It is about enriching the own knowledge base through the integration of suppliers, customers and external knowledge sourcing (Gassmann & Enkel, 2004). And the second dimension is the so called outbound open innovation; which is about earning profits by bringing ideas (instead of complete developed products) to market, selling Intellectual Property (IP) and multiplying technology by transferring ideas to the outside environment outside own markets (Gassmann & Enkel, 2004).

From these two dimensions, open innovation can be practiced in three different ways: outside-in, inside-out and coupled processes. This is represented in Figure 4. Outside-in processes are solely based on the inbound dimension, inside-out processes solely on the outbound dimension and the coupled process makes use of both dimensions. Coupled processes are often about long-term strategic connections, where close interrelationship are developed in order to establish mutual learning, on both tacit and explicit knowledge level (Gassmann & Enkel, 2004).

2.1.2 Elements of Open Innovation
For the practice of open innovation in innovation routines, three elements are important (Chesbrough, 2003a); the Business Model, Structure and Culture, since these elements effect the innovation process significantly on operational level.

2.1.2.1 Business Model
A business model describes how value is captured. When practicing open innovation, firms jointly create value, and this value has to be divided (Vanhaverbeke et al., 2007). A business model describes the series of activities producing the product or service, how the final consumers are satisfied, how value is captured from a proportion of these activities and how the profit is generated (Chesbrough, 2007b).
The strongest open innovation business models are those models that are integrated with business models of its partners (Chesbrough, 2007b), because it could give a company a unique position in the value chain and it could open new ways of income generation. As is said; “a same technology could deliver different outcomes with different business models” (Chesbrough, 2010).

Perr et al. (2010) identified seven distinct business models in the software industry. Varying from generating incomes directly from the main product; like 1) support contracts for additional service, 2) subscriptions for temporary agreements, and 3) professional services as training and consulting. Till income from selling different versions as 4) proprietary extensions or 5) dual licenses; only charging for advanced versions of the software with a free trial version. Till providing additional products and services like 6) complementary (hard-ware) devices or 7) community sources like collaboration tools. Elements of these business models are reflected in examples of Xerox generating profit from leasing copiers instead of selling them and GE selling flight hours instead of jet engines (Chesbrough, 2006).

2.1.2.2 Structure
Under the structure of open innovation is understood “the mechanisms for importing and exporting knowledge, ideas and projects” (Van der Meer, 2007). These mechanisms affect the innovation process and include two parameters: ‘the partners’ that could be chosen and the potential ways of collaboration; ‘the modes’. Both parameters will be separately explained below.

Partners
Including and collaborating with partners in the innovation process is a consequence of the theory of open innovation. (In contrast, in closed innovation the innovation process would be all managed within one company.) In all stages of the development process organizations can collaborate with a variety of external partners. External sources of useful knowledge are users, suppliers, universities, competitors and institutions (Huston & Sakkab, 2006; Keupp & Gassmann, 2009; Knudsen & Mortensen, 2011; Laursen & Salter, 2006; Von Hippel, 1988). All connections an organization makes with these sources, with the purpose of exchanging information, knowledge or resources construct the innovation network of an organization (Koschatzky, 2001).

Chesbrough & Prencipe (2008) argue that the dynamics of the technology development should be reflected in the dynamics of the network; in other words the appropriate partner to engage with depends on the phase of the technology development. Connections with research centers and universities are appropriate during the early development of technology when there is still a lot of uncertainty to explore alternative solutions and collaborations with startups and new entrants are helpful for experimenting with alternative designs. And when the technology is better understood and uncertainty is reduced, connections with third-party firms to establish industry standards and collaborations with suppliers and customers become appropriate.

Modes
Modes describe the way in which organizations connect with each other. Collaboration forms are numerous, and the same forms of collaboration can show different ratios of outside-in and inside-out processes. Stereotyped ways of connecting to the external environment, distinguished in this study, are ‘knowledge communities’, ‘venture capital’, ‘alliances’ and ‘acquisitions’. ‘Knowledge communities’ are modes wherein knowledge is shared interactively, in non-routine, personal and unstructured ways (Earl, 2001 p.223). These communities can be formed online by means of intermediaries; famous examples are InnoCentive and NineSigma, and offline when partners meet at
for example conferences and congresses. In ‘venture capital’ relationships are based on receiving funding in turn for access to knowledge and/or value creation. These relationships are still explorative and the commercial value of the technologies involved is still highly uncertain (Van de Vrande et al. 2006). ‘Alliances’ are more tightened relationships characterized by formal commitment and active cooperation (Gulati, 1999). And ‘acquisitions’ are relatively closed collaboration forms wherein knowledge is bought in order to secure total value capture. Further explanations and illustrations of these modes can be found in Appendix I.

The appropriate mode changes through the phases of the innovation funnel (Roberts & Berry, 1985). Each mode has its own characteristic goals and consequences (Rotheamel & Deeds, 2004) and the choice of a mode is, amongst other factors, affected by the level of uncertainty in the funnel phases (Van de Vrande et al., 2006) and the goal of exploration or exploitation (Rotheamel & Deeds, 2004). This study maintains a division of the funnel in the stages ‘Idea Generation’, ‘Research’, ‘Development’ and ‘Commercialization’; which corresponds more or less with the distinguished modes. See Figure 5.

![Innovation Funnel with Modes](image)

**FIGURE 5 INNOVATION FUNNEL WITH MODES**

**2.1.2.3 Culture**

The third element of open innovation that plays an important role on operational level and is different from managing innovations in a closed context is the culture of the organization. In an open context the culture needs to value outside competence and know-how (Gassmann et al., 2010), and the ‘do-it-yourself’ mentality is obsolete (Gassmann, 2006). As Procter & Gamble experienced when implementing open innovation, the attitude had to move from resistance to innovations “not-invented-here”, to enthusiasm for those “proudly found elsewhere” (Huston & Sakkab, 2006).

Culture is influenced by many factors relating to the values of the company and the use of management tools as incentive systems and decision criteria (Gassmann et al., 2010). The wrong formulation of values of a company or wrong use of management tools can result in the Not-Invented-Here Syndrome (NIH) or the Not-Sold-Here Syndrome (NSH) among the employees. NIH is ‘the tendency of a project group of stable composition to believe that it possesses a monopoly of knowledge in its field, which leads it to reject new ideas from outsiders to the detriment of its performance’ (Katz & Allen, 1982 p.7). And the parallel of this for inside-out processes is NSH, in this case employees show protective attitudes towards the external exploitation of knowledge. Both are not desirable for open innovation (Lichtenthaler et al., 2011). On the other hand, Knudsen and Mortensen (2011) warn for over-
emphasizing the importance of external knowledge, since otherwise a culture could be created wherein a bias appears of valuing external knowledge higher than internal knowledge. The culture in an open innovation context is therefore a delicate balance that has to value external knowledge in an objective manner.

So far literature is considered that describes open innovation in general. Its definition was given, the central processes were introduced and operational elements affecting the innovation routines were discussed. Altogether this gives insight in what open innovation is, thereby answering sub question 1:

**BOX 1: Open innovation is the use of purposive flows of knowledge between different companies. It is a paradigm for innovation management that recognizes innovation is faster and smarter when the own knowledge base is combined with the external knowledge base. It contains two dimensions: 1) bringing outside knowledge internally and 2) bringing internal knowledge via external paths to the market. For innovation routines open innovation means that business models, partners and modes become important, and that the culture should be open to external knowledge and opportunities.**

### 2.2 Open Innovation in Process Innovations in Manufacturing Firms

In this second part of the literature review the scope is narrowed down. Just like every management concept, open innovation does not have positive effects in every situation (Huizingh, 2011), therefore current studies are reviewed to reflect upon the opportunities and limitations of the real-life context on open innovation. Thereby answering sub question 2: What are the effects of the characteristics of manufacturing firms and process innovations on open innovation integration?

#### 2.2.1 Open Innovation at Manufacturing Firms

In the open innovation paradigm the manufacturing firm is mainly viewed as an established firm that could incubate external ideas (Christensen et al., 2005; Knudsen & Mortensen, 2011). Manufacturing firms are "large private, profit-oriented business firms involved in the handling of goods in some or all of the successive industrial processes from the procurement of raw materials to the sale to the ultimate customer" (Moore, 2001b p.32). Traditionally these are assumed to be highly independent, vertical integrated units, but nowadays it is seen that these firms turn into open systems with direct and accessibly linkages between the factory and its internal and external customers (Desmet et al., 2003).

The inbound open innovation dimension, of enriching the internal knowledge base by building on external knowledge for innovation, is most natural to manufacturing firms. Chesbrough and Crowther (2006) found this dimension most often performed in their sample of mature, asset-intensive companies and Ili et al. (2010) showed that the outside-in process is most common for manufacturing firms in the automotive industry. For manufacturing firms in the automotive industry it is found that this process improves R&D productivity (Ili et al., 2010), reduces workload and speeds up product development (Clark and Fujimoto, 1991, as cited by Eisenhardt & Tabrizi, 1995).

In order to investigate many external sources for new knowledge, the so called search breadth, participating in knowledge communities is a good strategy (Laursen and Salter, 2006; Van de Vrande et al., 2006; Keupp & Gassmann, 2009). Especially when the community spans multiple technical domains and utilizes weak ties this mode is useful for exploring novel ideas and technology areas (Chesbrough & Prencipe, 2008). There is however, a risk that organizations get stuck in a network with familiar knowledge and do not get exposed to new knowledge (Knudsen & Mortensen, 2011).
Therefore, it is important that these knowledge communities incorporate a wide range of informal relationships between different parties with different knowledge (McDermott & O'Connor, 2002).

Manufacturing firms should form alliances to deepen collaborations. This so called search depth is necessary for thoroughly understanding of external knowledge (Keupp & Gassmann, 2009). Alliances generate deeper understanding when the collaborations take place with strong ties, intimate trustful relationships and intensive, recurring knowledge exchange (Chesbrough & Prencipe, 2008). Alliances can help established manufacturing firms overcome challenges of radical innovation (McDermott and O'Connor, 2002).

For manufacturing firms, universities are suitable market players to partner up with in early stage development; generating interesting outcomes for guiding the direction of future technology development (Chesbrough & Prencipe, 2008; Pertuzé et al., 2010). As soon as knowledge is more developed, a spinoff will often be created and it could become a supplier to a larger organization (Christensen et al., 2005). Suppliers are good partners for manufacturing firms to form valuable alliances in the development stage (Dyer & Hatch, 2006). Suppliers can be startup firms and complementary asset holders.

2.2.2 Open Innovation in Process Innovations
The R&D of manufacturing firms mainly deals with two kinds of innovations; with product innovations, and with process innovations. Process innovation applies to organizational functions; it is about the way things are created and delivered and all the value that comes along with this. In contrast, product innovation applies to changes in what the organization offers and to the total operation by which a new product is created and marketed (Bessant & Tidd, 2008; Crawford & Di Benedetto, 2011).

Process innovations are often an exploitative activity with incremental innovations, driven by internal production objectives (Bergfors & Larsson, 2009), because their goal is generally to limit variation, create process control systems and reduce production costs and product price, in the maturity phase of the product development (Utterback & Abernathy, 1975; Davenport & Short, 1990; Adner & Levinthal, 2001; Benner & Tushman, 2003). Many process innovations are however based on knowledge originally developed externally (Huizingh, 2011). Therefore open innovation can add substantial value by increasing explorative search activities (Keupp & Gassmann, 2009) and lowering the effort put in process R&D.

Huizingh (2011) recognizes, hard and soft organizational issues are more important to process innovations than to product innovations. Issues as losing competitive advantage of a product by giving away too much information on the process, since processes are designed on the basis of the product design, play a significant role (Chesbrough & Prencipe, 2008). The risk of giving away product knowledge is less when modularity (independency) between the product and the process is high (Gassmann & Enkel, 2004). Caution needs to be paid with too high modularity, since this also lowers complexity and therefore lowers the barrier for imitation (Ethiraj et al., 2008). Lowering complexity for the part of the process collaboration could be a good thing, since this could make the collaboration more straightforward. But for the product part, to be difficult to copy for the open innovation partner, this knowledge should be low in modularity with the process. Open innovation in processes innovation is therefore appropriate when product and process are individual modules and the product innovation is highly complex.
Process innovations are generally protected by trade secrets, especially when the process could not be seen on the product (Bekkers, 2009). This is because process innovation are not ought to make profit but to improve the internal production process or to differentiate the sold produced product from others, for example with higher quality and/or additional services. However, secrecy is conceptually contrary to openness (Cohen et al., 2000), and therefore limits the suitableness of open innovation. And even when patenting is used as protection strategy, the fact that process technologies can be hard to see on products, makes that patent infringements are hard to check.

Due to the internal objectives, modularity and protection issues open innovation is risky for process innovations. Therefore collaboration partners should be found with no interest in copying the technology, and who are in a business non-related to the own business. Smaller collaborations, with one or two partners, limit the risk since in small collaborations coordinating the value creation is easier. Or another strategy could be to reposition process innovations, changing ‘process innovation’ to ‘process knowledge’. Knowledge is harder to copy (Arora, 2001), could secure competitive advantage (Barney, 1991) and is therefore more appropriate for inviting external parties who can complement the development of a new process with their knowledge.

This second part of the literature review identified opportunities and limitations set by the context of manufacturing firms and process innovations, in order to answer sub question 2:

| BOX 2: The characteristics of manufacturing firms make that inbound activities are most natural to them. It makes participating in knowledge communities suitable for exploration search and alliances suitable for exploitation search. Suitable partners thereby are universities and suppliers. The characteristics of process innovations make open innovation risky, therefore a level of closeness in dyadic open innovation relationships is required. |

### 2.3 Integrating Open Innovation

The last part of the literature review considers literature on the integration of open innovation. Thereby answering sub question 3: Which processes are associated with the integration of open innovation?

The articles on the integration of open innovation can be split into two groups: one group focusing on the transition-process from closed to open and the other group focusing on the practice of open innovation (Huizingh, 2011). These processes are visualized in Figure 6, and will be explained separately in the paragraphs below.

#### 2.3.1 Transition from Closed to Open

Integrating open innovation in an organization requires an organizational change wherein the organization transitions from closed innovation to open innovation. The process of organizational change could roughly be described by three phases: 1) unfreezing the status quo and creating urge for change, 2) moving the organization, putting the change into practice and 3) institutionalize; consolidate the change and making sure everyone acts on it (Lewin, 1947). Chiaroni et al. (2011) argue that this model is also valid for the transition from closed to open innovation processes and that the organizational change affects four dimensions of the organization (Chiaroni et al., 2010):
1) the inter-organizational networks; as the organization needs to change the way it search for new value, in breadth and in depth (Laursen & Salter, 2006), it needs to establish new relationships with external partners.

2) organizational structures: the organization needs to transform solid boundaries into semi-permeable membranes that enable innovation to move easily between the external environment and the internal innovation process (Chesbrough et al., 2006), so that the organization is able to capture, coordinate and use external opportunities.

3) evaluation processes: the organization should be prepared to both commercialize own ideas as well as other firms’ innovations and bring in-house knowledge to the market with other business models than the current (Gassmann & Enkel, 2004), this requires that evaluation criteria also evaluate external sources of innovation.

4) knowledge management systems: in order to capture, coordinate and use external knowledge it needs to be managed next to internally developed knowledge, the knowledge management system has to be able to support this, within the firm and with the external environment (Chiaroni et al., 2010) Organizational change in general, and the transition towards open innovation in specific, is not an easy process. Continuous experimentation, adaptation and learning is needed to pro-actively define the business environment (Chiaroni et al., 2010) and to learn how to gain knowledge from external sources (Laursen & Salter, 2006). This could be the reason that Knudsen and Mortensen (2011) found that the open, collaborative strategy could lead on short term to longer times to market and increased costs. This finding is supported by the famous examples of IBM and Procter & Gamble, who also needed a period of experimenting before they found their successful, renowned configuration of open innovation (Chesbrough, 2007a).

2.3.1.1 Level of Openness

At the start of the transition towards open innovation, organizations rarely follow a fully closed innovation approach (Chesbrough & Crowther, 2006; Dahlander & Gann, 2010; Huizingh, 2011). Therefore, it needs to be defined how the open innovation concept is already present in order to formulate an adequate change program.

Literature mentions several measures of openness based on different aspects of open innovation (Dahlander & Gann, 2010; Knudsen & Mortensen, 2011). Since open innovation could be present in different ways, different measures are needed to get a good picture of the openness in the current innovation approach. In this study four measures are considered that together measure whether open innovation is integrated in the collaboration-routines and in the organizational context, in soft terms and hard terms1, see Figure 7:

<table>
<thead>
<tr>
<th>Measures</th>
<th>Soft measure</th>
<th>Hard measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational context</td>
<td>Measure 1: Openness in mindset</td>
<td>Measure 3: Use of open business models</td>
</tr>
<tr>
<td>Collaboration routines</td>
<td>Measure 2: Open innovation knowledge capacities</td>
<td>Measure 4: Search depth &amp; breadth of external knowledge</td>
</tr>
</tbody>
</table>

![Figure 7 Openness Measures](image)

1 The first measure analyzes the appearance of the closed and open paradigm in the mindset of the organization (Dahlander & Gann, 2010). The characteristics of open and closed innovation, as

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1 Soft terms means that the measure is based on qualitative data related to thoughts and skills. Hard terms means that is easier observable and about the use of open innovation constructs.
summarized in Figure 3 paragraph 2.1, are used as checklist to identify how is thought about openness in the organizational context. This measure gives an idea of the attitude of the organization towards open and closed innovation. However, it is not an absolute measure. It is a soft measure that positions the mindset with respect to the two extremes. Since there is still a grey area in between those extremes additional measures are needed.

2. The second measure analyzes whether the organization possesses the knowledge capacities that are critical for managing internal and external knowledge (Lichtenthaler & Lichtenthaler, 2009). See Figure 8. This is still a soft measure that measures skills directly related to the collaboration routines. Its shortcoming is that it does not give an idea whether the organization actually purposively uses knowledge flows, it only measures that it could. Therefore the following two measures are required.

3. The third measure analyzes how the organization makes use of business models. Chesbrough (2007b) developed a Business Model Framework that characterizes business models from basic, closed models to advance, open models aligned with the models of partners. See Figure 10. Business models are a key construct in open innovation (Chesbrough et al., 2006), and therefore it is a good measure to identify the extent to which open innovation is part of the organizational context. However, open innovation is not equal to applying an advanced business model, therefore one last measure is needed.

4. The fourth measure analyzes how much and how an organization collaborates with external partners (Keupp & Gassmann, 2009). By defining the extent to which an organization searches in breadth and in depth for external knowledge an organization can be categorized as an archetype. See Figure 9. This measure could be quantified with the definitions of Laursen and Salter (2006). Since, open innovation is broader than searching for external knowledge and using this knowledge in collaborations, all mentioned measures are needed together to get a total picture of the openness in the current innovation approach.
2.3.1.2 Impediments

The articles on the transition process of integration open innovation also mention different impediments that can hinder the transition. Challenges are for example overcoming the NIH-syndrome, sustaining internal commitment over sufficient time to realize benefits from adopting open innovation (Chesbrough & Crowther, 2006), and learning to handle business models in a flexible and open way (Chesbrough, 2007b; Van der Meer, 2007). Impediments can appear on strategy, structure and process level, aligned with the levels of decision making that Ansoff identified (Moore, 2001a).

On strategy level, top management support is one of the critical factors for performance of open innovation (Moore, 2001c; Rigby & Zook, 2002; Chesbrough, 2010). Top management should make time available for experimentation and locate resources to make it happen (Enkel et al., 2009). Next to that, by demonstrating commitment and support top management could overcome objections of those less inclined to accept the new approach (IfM report, 2009).

On structural level, incentive systems and performance measures should be in place to support open innovation. Traditional incentive systems can be based on patenting activities, however these only favor closed innovation. Incentive systems that favor open innovation are for example systems that value the identification of licensing opportunities (Lichtenthaler et al., 2011). Also should the structure of the organization make internal knowledge exchange and cross-unit collaboration possible, to optimal benefit from the attracted external knowledge (Kirschbaum, 2005).

On the process level, impediments due to culture and individual preferences can hinder the open innovative performance. The NIH-Syndrome (Chesbrough et al., 2006; Laursen & Salter, 2006; Keupp & Gassmann, 2009) and NSH- Syndrome (Lichtenthaler et al., 2011) were already earlier mentioned (in paragraph 2.1.2.3) and are commonly recognized in literature. Another well-known phenomenon that could form an impediment on the transition is ‘resistance to change’ (Gilbert, 2005). This could occur in all types of change, and so also with organizational change towards open innovation.

2.3.2 Practice of Open Innovation

The second process that could be distinguished in literature is the practice of open innovation. Practicing open innovation is a continuous process wherein innovation managers need to make new decisions such as when, how, with whom and with what purpose should there be cooperated with external partners (Huizingh, 2011). Thereby, should the appropriate balance between openness and closeness be maintained and the organization needs to know how to optimally collaborate, this is addressed in the paragraphs below.

2.3.2.1 Balancing Open- & Closeness

Since open innovation is a continuum and too much open innovation can hurt the organization (Laursen & Salter, 2006), there will likely remain a certain level of ‘closeness’. How far an organization wants to go in being open depends on environmental characteristics. Industrial dynamics that stimulate open innovation are globalization, technology intensity, technology fusion, new business models and knowledge leverage (Rigby & Zook, 2002; Gassmann, 2006). These dynamics make that market developments are fast and internal capabilities alone cannot be enough to keep track and stay ahead of it. An industrial characteristics that hinders open innovation is the intensity of assets. Asset intensive-organizations are less flexible and therefore it is difficult for them to pursue a very open strategy (Chesbrough & Crowther, 2006). (Very open strategies are seen in the software-industry; with open source software.)
The model mentioned by Huizingh (2011) and the model developed by Dahlander & Gann (2010) can help an organization define a strategic degree of openness for a project. The first model groups open innovation practices by distinguishing between the process and the outcome of innovation; both dimensions can be closed or open, leading to a 2x2-matrix, see Figure 11. The second model, also a 2x2-matrix, distinguishes four types of openness strategies based on open innovation processes being outside-in or inside-out and set up with the intention for monetary reward or not. See Figure 12.

2.3.2.2 Optimal collaboration

Alliances appear a natural collaboration mode in the context of manufacturing firms doing process innovations, since;

- Outside-in processes are most performed by manufacturing firms and they need alliances to gain in depth insights in external knowledge (Paragraph 2.2.1).
- Open innovation is risky for process innovations and therefore a level of closeness in dyadic relationships is required (Paragraph 2.2.2).
- Asset-intensive organizations are not very flexible and therefore a more closed approach is appropriate (Paragraph 2.3.2.1).

Alliances are such smaller, more closed collaborations, with tightened relationships and formal commitment (Gulati, 1999). It remains however a challenge for organizations to not share too much information and still actively cooperate in alliances. Therefore, the review of literature on how to optimally collaborate focuses on this mode.

Alliance Forms

An extensive definition of alliances is given by Duysters et al. (2002) who defined alliances as:

- Voluntary, evolutionary and flexible organization forms (Osborn & Hagedoorn, 1997)
- Between two or more organizations (Duysters, 2001)
- To realize both collective and individual goals (Varadarajan & Cunningham, 1995)
- Where products, services and technologies are exchanged (Gulati, 1998)
- While maintaining their corporate identities (Duysters, 2001)

Alliances often incorporate a formal agreement about what is shared and how value is divided between partners (Gulati, 1999). In this way open knowledge sharing and value capture is balanced. These formal agreements can range from a rather flexible Nondisclosure Agreement (NDA) till a rigid contract.
Alliance forms often mentioned are joint research (Teece, 1986), joint ventures (Stuart, 2000) and licensing (Christensen et al., 2005). These forms can be distinguished from each other, by recognizing the different levels of commitment and integration. The level of integration can range from low; when in a short-term relatively few resources are exchanged, till high; when over a relatively long-term hierarchy in ownership of resources is dominant (Lorange & Roos, 1995 as cited by Duysters et al., 2002). The level of commitment related to alliances can range from low; when the collaboration is relatively easy to reverse, till high; when collaborations are hard to reverse and takes a lot of effort and investment to get it undone (Van de Vrande et al., 2006). This is visualized in Figure 13, and more explanation of the picture and alliance forms can be found in Appendix II.

Success and Failure Factors
To know how to optimally collaborate, it is helpful to know what the success and failure factors are of alliances. Literature reports that the failure rate of alliances is high and knowing what to do and what not to do could to help managers actively influence the likelihood of successful performance (Kale et al., 2001; De Man & Duysters, 2005).

Several empirical studies have shown that experience is a significant indicator of successful alliances. The more an organization had formed alliances in the past, the more tacit skills it has developed to manage the collaboration (Kale et al., 2001; De Man & Duysters, 2005). Experience is also helpful in having a feeling for the right balance between open and closeness for value creation and value capturing. Involved employees need to know the boundaries of what knowledge has to be shared and what knowledge can be kept confidential.

However, ‘experience’ is not a very helpful advice for knowing what to do, and luckily ‘experience’ alone is not enough to predict the chance on success (Kale et al., 2001). Table 1 shows more practical success and failure factors, pointed out by Porter Lynch (2001, as cited by Duysters et al., 2002). These factors can be used as guidance while selecting and setting up an alliance. Appendix III contains more detailed descriptions of these factors.
This last part of the literature review addressed the integration processes of open innovation and the factors that influence an optimal process. Thereby answering sub question 3: Which processes are associated with the integration of open innovation?

**Box 3:** The processes associated with the integration of open innovation are a transition process of opening up the innovation routine and a process of practicing open innovation. For the first process the current level of openness and the impediments to open innovation are of importance. And for the second process the balance between open and closeness and the performance of collaborations are of importance.

### 2.4 Conclusion

The literature review, with the answers on the first three sub questions in boxes 1, 2 and 3, gives insight in the integration of open innovation. From this information the integration processes could be visualized as in Figure 14.

As was shown in the literature review, two integration processes are associated with open innovation. The transition process from closed to open innovation is an organizational change, which can be described by the phases of unfreeze-change- and institutionalize (Lewin, 1947; Chiaroni et al., 2010). This is a generally accepted, but very simplified model because in reality the transition is a long journey (Van der Meer, 2007) of experimentation, adaptation and learning (Laursen & Salter, 2006; Chiaroni et al., 2010). The current level of openness determines the start of the change and impediments can hinder the change-process.
The second process, the practice of open innovation, is the dynamic end state of the transition process. It is a cyclic process that starts with a formulation of how open the organization wants to be in a project. Informed by external factors and industry characteristics the organization should make choices on the balance between open- and closeness and on what collaboration mode to pursue. In the next phase the strategy should be implemented during the set up and execution of a new project. When the project is finished an evaluation phase takes place wherein the project performance is assessed regarding open innovation and whether right choices were made. And before a new cycle is started, the lessons learned from the evaluation should be incorporated in the practice.
3. Method

This chapter describes how the data on the business processes is collected; explaining the research-, data collection- and analysis methods and reflecting on the quality of these methods. In order to contribute to academic literature and managerial understanding, the research method was guided by the Business Problem Solving logic of Van Aken et al. (2007). The logic is to compare literature with real-life business processes and so formulate a rigor and relevant (Katzav, 2011) diagnosis, leading to a solution design that is practically useful and theory-informed. See Figure 15.

3.1 Research Method

To collect data on business processes in their real-life context an appropriate research method is a case study (Yin, 2009; Blumberg et al., 2011). This study investigates the question ‘how to integrate Open Innovation in R&D Department B?’ Especially how questions are appropriate to investigate with a case study, since the broad scope of a case study enables to detect patterns initially not expected (Blumberg et al., 2011). A case study generates outcomes embedded in the contemporary, real-life context (Yin, 2009), and therefore strengthens the usefulness of the outcomes. Looking at the integration processes of open innovation is also relatively new in literature, this supports again the choice for this research method since it enables an exploration of the problem from multiple perspectives (Eisenhardt, 1989).

Within the case study qualitative data was collected, this points out ‘the nature of a phenomenon’ instead of ‘an amount’ (Blumberg et al., 2011). Since the research outcome should give insight in ‘how to integrate open innovation?’ and should describe activities how this could be done, qualitative data aligns with the problem that was investigated and the kind of answers that were expected from this research.

3.2 Data Collection Phases

The study encompassed four different phases; a ‘preparation’, ‘exploration’, ‘descriptive’ and ‘concluding’ phase, see Figure 16. This structure is deducted from the regulative cycle of Van Strien (1997), see Figure 17. The preparation phase contained a general introduction to the company and the problem, thereby analyzing the problem mess. This phase was closed by defining the problem. Then the study continued the exploration phase, wherein data was collected on the current level of openness and on...
impediments that could hinder the integration of open innovation. That was followed by the descriptive phase collecting data on how external factors influence the practice of open innovation and how current collaborations take place. In the final phase, the data was linked to the literature for the analysis and evaluation, resulting in recommendations about what activities need to be done in order to integrate open innovation in R&D Department B. It could be said that this study works out the regulative cycle until the third step; ‘analysis and diagnosis’. The other steps; the plan of action that puts the recommendations into practice and the evaluation of the performance of these activities is left to the receiver of this report, because this exceeds this master thesis duration and requires broader knowledge of the company dynamics.

3.3 Data Collection Methods
The data was collected by means of three different methods; namely interviews, documents and observations. The benefit of relying on different sources of evidence is that in this way the richness of the context could be captured (Blumberg et al., 2011). And this multi-method approach allows for triangulation, whereby each data source is validated by information from the other data sources (Schwenk, 1985).

3.3.1 Interviews
Interviews were used to get insight in the perceptions of key persons in the current situation. The technique of semi-structured interviews was applied. Benefits of semi-structured interviews are that it allows to not only describe or explain a certain topic, but also to explore that topic. It gives the respondent the possibility to turn the interview in different directions and to come up with new sub-topics not yet thought of. At the same time, the interview is structured by means of an interview guide. This secures that different interviews are conducted in a similar way and all necessary areas are covered (Blumberg, et al., 2011). The interview-guides used in this study are included in appendix IV, there have been different samples and each sample had a different guide that was aligned with their knowledge content.

Two interview sessions were scheduled; one in the exploration phase and one in the descriptive phase. The objective of the first session was to know the informants perspectives on the theory of open innovation and on the suitableness of the theory for the department. The second session was held to gather insights and information on the current practice of alliances and the dynamics that influences these collaborations. The interviews of the first session were conducted one-on-one, and scheduled for one to two hours. These interviews contained an introduction to open innovation of about 15 minutes, since most interviewees had heard of open innovation but were not familiar with the concept. The interviews of the second session were conducted in couples, since this created a small discussion group among the interviewees that enabled them to reflect better on the topic of open innovation. These interviews were slightly shorter and took 45 minutes till one hour. All interviews were taped to capture all information and facilitate an accurate analysis of it.

3.3.1.1 Sample Selection
Interview participants were selected on the basis of purposive sampling, in order to collect data related to the key business processes in an efficient way. This method selects participants non-random and subjective on the basis of a criterion (Blumberg et al., 2011; Guest et al., 2006). The criterion in this

See [http://prezi.com/4birqzi4t-yr/?utm_campaign=share&utm_medium=copy](http://prezi.com/4birqzi4t-yr/?utm_campaign=share&utm_medium=copy) for the presentation used as introduction to the concept of Open Innovation for the interviewees.
study was that individuals had a key managerial role in Department B or had a formal role connected
to a selected project on Technology X. It was chosen to select participants from these two levels
because it was expected this would result in practical insights. Specifically Technology X was chosen
because this project considers more open collaboration with external partners. Which functions the
individuals had in the different samples is shown in Table 2.

The appropriate size of purposive samples depends on ‘saturation’. This means that the optimal
amount of interviews is the amount where an extra interview will not reveal new information or
themes (Guest et al., 2006). Francis et al. (2010) propose the use of an initial analysis and stopping
criterion in order to systematically assess saturation. They state that for theory-based interview
studies, with rather homogeneous samples, investigating one phenomenon and not a generational
characteristic, a minimum of 6 interviews is sufficient for the initial analysis.

In the exploration phase of this study two samples were interviewed, one focused on project level and
one on general level, since it was expected that this would create more homogeneous samples. The
former had a size of 5, covering the whole population (everyone involved in the specific project) and
the latter had a size of 7, meeting the standard for initial analysis, and containing one case as stopping
criterion. This is not sufficient to thoroughly investigate saturation, but it could be assumed that
saturation is approached since analyzing the case used as stopping criterion (the last interview)
showed that it contained few new information, the samples were interviewed for (almost) an hour or
more, in a fixed, focused and (semi-)structured way with participants possessing high quality
information. These factors indicate that all information was gathered (Morse, 2000). In the descriptive
phase the sample contained 8 cases, enough for the initial analysis and two tests for the stopping
criterion.

### Table 2 Functions of Interviewees

<table>
<thead>
<tr>
<th>Explorative phase, Project level</th>
<th>Explorative phase, General level</th>
<th>Descriptive phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Technology X-team members</td>
<td>2 Department Managers</td>
<td>2 Technology X-team members</td>
</tr>
<tr>
<td>Project Manager of Technology X</td>
<td>Manager Team C</td>
<td>Project Manager of Technology X</td>
</tr>
<tr>
<td>Team Leader of Technology X</td>
<td>Manager</td>
<td>Team Leader of Technology X</td>
</tr>
<tr>
<td></td>
<td>Account Manager</td>
<td>Team Manager Team C</td>
</tr>
<tr>
<td></td>
<td>Manager of R&amp;D Department B</td>
<td>3 Department Managers</td>
</tr>
<tr>
<td></td>
<td>Director of Department B</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.3.2 Documents

The second method collected data from documents and archived writings. This method collected data
on formal processes and protocols. Information from the company’s intranet on the firm’s policies
regarding communication and intellectual property, annual reports, organization charts, decision
structures and project plans were consulted. The benefit of documents as data source is the objectivity
of the information, it complements the other data sources by supporting (or not) the cognitive
produced data from interviewees and observed processes. Precaution is however taken since the
documents can be written for a completely different purpose than used (Blumberg et al., 2011).

#### 3.3.3 Observation

The final data collection method in this research was observation. In a systematic way the current
situation of how problems are solved and how often external communication takes place was
observed. The observations were only conducted for data gathering on the specific project, since
observing the business processes of the total group would not have been feasible due to time
limitations and complexity. The framework that guided the observations is presented in appendix V. A
participant was asked to weekly log events that occurred in the preceded week. The retrospective bias was limited by solely asking for facts and behaviors in the framework (Golden, 1992). Logging occurred over a period of one month.

3.4 Analysis Method
In order to structure the high amounts of information coming from the interviews, company documents and observations, first a database was built. It contained all information obtained, as meeting notes, observation notes, downloaded documents, tapes of the interviews, interview reports, and weekly reflections on the experiences of the previous week. With this database data was organized and it was ensured no information was lost. It also made transparent what was done during the research, increasing the reproducibility of this research and ensured conclusions could be checked.

In order to analyze the amount of information, the qualitative method ‘content analysis’ was used. This method is able to cover the rich content of all the data material and facilitates to end up with relevant recommendations (Blumberg et al., 2011). This method reduced the amount of information, with coding procedures, to a manageable amount. The coding procedures were to first mark data with theme labels (identified from the a priori literature study and stirred by the content of the collected data), followed by categorizing phrases in ‘antecedents’, ‘characteristics’ and ‘effects’. See Table 3 and Table 4 for an overview of the labels used in both phases of interviews. The coding procedures were performed with the help of ‘post it’s’ and mind maps.

These coded fragments were analyzed: 1) by constantly comparing them with previous fragments and fragments under other labels, to ensure consistency in coding, 2) by comparing them with fragments from other data sources to triangulate; crosschecking the interpretation and assumptions from data with the results of the other data collection techniques, and 3) by connecting them with literature to identify gaps, indicating what activities need to be done and formulate suitable recommendations and 4) by checking whether new interviews contained new fragments for saturation.

<table>
<thead>
<tr>
<th>Labels</th>
<th>Categories</th>
<th>Antecedents</th>
<th>Characteristics</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Innovation Structure External Partners</td>
<td>Level of Openness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Innovation Structure Internal Partners</td>
<td></td>
<td></td>
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<tr>
<td>Open Innovation Structure Modes</td>
<td></td>
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<tr>
<td>Business Model</td>
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<tr>
<td>Culture</td>
<td></td>
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<tr>
<td>Impediments</td>
<td></td>
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<tr>
<td>Appropriateness of Open Innovation</td>
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</table>

<table>
<thead>
<tr>
<th>Labels</th>
<th>Categories</th>
<th>Antecedents</th>
<th>Characteristics</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success Factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure Factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization &amp; Mentoring of Alliances</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 3 ANALYSIS LABELS AND CATEGORIES USED IN THE EXPLORATION PHASE

TABLE 4 ANALYSIS LABELS AND CATEGORIES USED IN THE DESCRIPTIVE PHASE
3.5 Securing Quality

In order to secure the quality of the research, the controllability, reliability and validity of the data collection methods were taken into account while setting up and executing the research. The last paragraph of this chapter reflects in retrospect on the quality of the methods.

3.5.1 Controllability

Controllability means that the results are reproducible; when the research would be repeated it should lead to the same results (Blumberg et al., 2011). Controllability of the results should increase the confidence of the results. To establish this, it is revealed (in this chapter) how the overall research was executed, what the interview and observation guides were (in appendix IV), and what the used coding procedures were (Paragraph 3.4). Also, to increase the transparency, a database was built. It stays however hard to guarantee complete reproducibility of the analysis since the coding is subjected to interpretation biases.

3.5.2 Reliability

A research is reliable when the same results are reached when the research is performed (1) by a different researcher, (2) with a different instrument and (3) with different respondents (Blumberg et al., 2011). In this research it was tried to prevent 1) the researcher bias by constructing interview guides and solid interview preparation. Interview guides were reviewed by the supervisors and the preparation contained self-training by reading advices for semi-structured interviews found through google and in the book of Blumberg et al. (2011). It was tried to prevent 2) the research instrument bias: by the application of triangulation. Findings from the individual sources were used for verifying the findings from one of the other sources. And 3) the participant bias was tried to prevent by educating the interviewees with an introduction to the topic prior to the first interview session and using figures as support for answering questions. In the second interview session it was tried by conducting the interviews in pairs of interviewees so small focus groups were created wherein little discussions arose and answers given by one participant could be confirmed, complemented and/or put in perspective by another participant.

3.5.3 Validity

Validity means that the topic a researcher wishes to cover, is really covered in the research (Blumberg et al., 2011). There are three different subtypes of validity, each addressed as follows:

1) Construct validity is the degree to which a research instrument measures the construct characteristic it is intended to measure. To guarantee this, established measurement questions were used from earlier studies, tailored measurement questions were based on existing literature and reviewed by the supervisors and triangulation was used to neutralize potential flaws of an individual measure.

2) Content validity is the degree to which the measured characteristics exclude plausible competing explanations of the relationship between the characteristic measured and the construct. This is guaranteed by viewing the construct from different perspectives (in different samples), reducing the chance on undiscovered alternative explanations.

3) Criterion validity is the degree to which the instrument is able to produce accurate predictions for other contexts. In case studies, criterion validity is by definition limited since this research method focuses on generating a deep understanding of a certain context, limiting the generalizability of results. However, some criterion validity is established by supporting the results with literature.
4. Results & Analysis: Transition Process

As the literature review pointed out, the integration of open innovation consists of two processes. This chapter focuses on the first process; the transition process from closed to open, and shows the results of the analysis on the current state of R&D Department B and on the impediments that are holding the department back in the transition. See Figure 18. Thereby it partly answers sub questions 4 and 5: 4) what open innovation activities are already done? & 5) What open innovation activities are not yet done? The other part of the answers on these sub questions is given in the next chapter, Chapter 5, which focuses on the second process.

4.1 Current State

The current state is analyzed to get an idea how the open innovation concept is already present. Therefore the four methods for assessing the level of openness, as introduced in the literature review, are applied in the subparagraphs below.

4.1.1 Measure 1: Openness of the Mindset

Recall that measuring the openness of the mindset is a soft measure that gives an idea of the department’s attitude towards open and closed innovation. The opening question of the first interview session was to position department B between the two extremes of innovation on a scale from 0 (closed) to 100% (open). This “grading” was based on the information given in the introduction on open innovation prior to the interview. Although this is not an empirical verifiable measure, since it is not possible to be x% open, this question helped the interviewees to communicate their tacit knowledge. All interviewees judged the openness in the range between 20 and 40%, expressed by the star in Figure 19. Indicating that Department B is somewhat open in their opinion, but still rather closed. To some this is not necessarily bad, or even adequate, as was stressed in the anecdotes about how ‘a Business Unit had been too open’ and how ‘projects have gone wrong when too much knowledge was shared’. Others were however convinced that Department B has a ‘strong fear of showing what is done’, and is ‘too closed even to the internal customer’. The consequence of this, according to them, is that real customer problems are not known and implementation is difficult.

The openness of the mindset is more detailed investigated by the content analysis on the paradigm characteristics. See Figure 20. The content analysis reveals that the first open mind-set characteristic of ‘we cannot do everything on our own’ is acknowledged, as was said ‘we have bright people working for us, but we need the external environment’. This is supported by observations that noticed some forms of collaboration with universities, customers and suppliers already take place.
Although it is believed that research does not have to be originated to profit from it, indicated by quotes as ‘using existing technologies and knowledge, translating it to useful applications for Firm A could be just as good or even better’, the closed philosophy of ‘discover the application for own use, develop it ourselves and apply it ourselves in order to benefit from it’ is also present, given comments as ‘we do not want others to use our technology’. This closed orientation is not surprising for process innovations, since they are developed for an internal customer and protected by trade secrets.

Department ‘B does not work with business models’, was the answer when was asked for the business model. It was said that the department is ‘a cost center with the purpose to develop new technologies for the internal business units’. The process innovations are therefore not about building a better business model, but to get it implemented as fast as possible in order to win.

Related to the idea that research does not have to be originated, is the open innovation idea of ‘if we make the best use of internal and external ideas, we win’. This is supported in the mind-set of Department B, showed by statements as ‘using ideas from others can be very beneficial’. It is also reflected on operational level, as was said that employees are open to external knowledge, the culture is ‘creative’ and ‘curious’, and ‘specialists always want the best and want to have access to the newest knowledge and technologies, and for that it does not necessarily have to be originated internally.’

In contrast, the final mind-set characteristic about IP is heavy closed oriented. Interviewees stated that the belief of ‘we should control our IP, so competitors don’t profit from it’ is strong and there is a fear of knowledge leakage. People pointed out often that patent infringements are hard to check and the organizational document, with policy on protecting technical know-how, stresses that ‘only the information should be shared that is necessary’.

Summarizing this, shows that three of the six mind-set characteristics are open oriented and three closed oriented, indicated by the stars in Figure 20. Since the last characteristic is strongly closed and the open characteristics are closely related, judging the openness level of the mind-set as ‘not yet halfway open’ seems justified.
4.1.2 Measure 2: Open Innovation Knowledge Capacities

The second measure of openness mentioned in the literature review is the framework developed by Lichtenthaler & Lichtenthaler (2009). This soft measure assesses whether the organization possesses the knowledge capacities that are needed for managing internal and external knowledge, critical in open innovation routines. See Figure 21.

The analysis of documents show that Department B has a large, diverse, international, high educated research team. This makes that it has a solid capacity to internally generate new knowledge and inventions are done relatively often (Lichtenthaler & Lichtenthaler, 2009). It could therefore be concluded that the ‘inventive capacity’ is sufficient.

Interviewees referred to collaborations with multiple external sources and to their experience on how to use that knowledge. Therefore it could be said that the ability of Department B to recognize, assimilate and capture external knowledge, also known as absorptive capacity (Cohen & Levinthal, 1990), is sufficient.

Based on information from the interviews and documents, it could be judged that the capacity to ‘keep knowledge internally and keep it up-to-date’ is present. There is a formal gatekeeping function that facilitates knowledge sharing among others in Friday-talks, there is active resource management with HR involvement, a database is built with historical projects and workshops are organized to refresh the knowledge on how to keep knowledge. Interviewees recalled that it has occurred that new projects were started without being aware of old projects that previously investigated related topics, but eventually this knowledge was reactivated and used in the recent projects.

The content analysis showed that there is however less attention paid to retain knowledge in inter-firm relationships. An interviewee pointed out that ‘collaborations are set up to solve a single problem and if this collaboration was satisfying the partner would be considered again when new projects related to the previous project come along, otherwise another partner will be chosen.’ This results in rather ad hoc collaborations, which is not beneficial for acquiring privileged access to external knowledge. Therefore it is concluded that the connective capacity of Department B is low.

Interviewees stated that a common problem at Department B is to get their inventions implemented at the customer’s site. For a R&D department ought to develop inventions and fundamental knowledge for new technologies it is not surprising that not all the inventions are turned into products, taking into account that it is a natural phenomenon that out of a multitude of ideas, only few become a market success (Stevens & Burley, 1997). But in interviews it was often argued that there is a misconception with the customers and the percentage of applied inventions is too low. This indicates that innovative capacity is low.

Department B is a R&D department with the goal to develop inventions that could increase the efficiency of the internal manufacturing processes. This means that inventions are developed for internal use and external knowledge transfer is not an issue. This indicates that the desorative capacity is also low for Department B.

<table>
<thead>
<tr>
<th></th>
<th>Knowledge exploration</th>
<th>Knowledge retention</th>
<th>Knowledge exploitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (Intrafirm)</td>
<td>Inventive capacity</td>
<td>Transformative capacity</td>
<td>Innovative capacity</td>
</tr>
<tr>
<td>External (Interfirm)</td>
<td>Absorptive capacity</td>
<td>Connective capacity</td>
<td>Desorative capacity</td>
</tr>
</tbody>
</table>

FIGURE 21 OBSERVED KNOWLEDGE CAPACITIES (LICHTENTHALER & LICHTENTHALER, 2009)
Summarizing this openness measure reveals that Department B is good in knowledge exploration through internal knowledge creation and enriching with external knowledge. But the capacities of knowledge exploitation; capacities directed at replication of new approaches in diverse context and application of it in different settings, are lacking. The capacity to retain knowledge is internally good, but to keep healthy relationships with external partners, the connective capacity could be developed more. The question is however to what extent organizations need to possess all capacities for good open innovation performance (Lichtenthaler & Lichtenthaler, 2009). It may not be essential to develop all capacities to the fullest; an option could also be to adapt the open innovation strategy to it.

4.1.3 Measure 3: Business Model
The third measure identifies the extent to which open innovation is part of the organizational context, based on the appearance of the open innovation key construct: the business model (Chesbrough et al., 2006). When was asked for the business model, most interviewees had difficulties to define their business model, just as many other organizations have (Van der Meer, 2007). There was also no document found that formally described the business model.

When an answer was given in the interviews, it was in line with ‘building business models is not our task’ and ‘Department B is a cost center’. Company documents sketched a decision structure wherein two boards, with representatives from management layers throughout Firm A, determine the topics and projects of the R&D department. The business units invest in the projects to make the research possible, and the factories from the business units are the customers who should apply the process technologies that Department B develops. This makes that Department B is not focused on making profit, but to ‘turn money into valuable knowledge’, and business models are not perceived as relevant. In addition, policy regulations show that commercialization and licensing of IPR is controlled by an IP department and should be in agreement of all affected units. This puts the responsibility of taking initiative to commercialize knowledge via alternative, external paths outside the department.

It could therefore be said that the cost center structure is as much as a business model for the R&D department. Because there is only one standard model for all technologies and it is a quite natural evolved model from the traditional organization of an R&D department as support group for a manufacturing firm, the business model could be classifies as a type 1 business model of the Business Model Framework (Chesbrough, 2007b). See Figure 22.

4.1.4 Measure 4: Search Breadth and Depth
The final measure for assessing the openness of Department B, measures the extent to which an organization searches in breadth and in depth for external knowledge. Department B collaborates with 9 out of the 16 source types distinguished by Laursen & Salter (2006), this is a medium score for search breadth. Department B collaborates with 1) universities, 2) suppliers, 3) (internal) customers, 4) technical consultants, 5) commercial laboratories, 6) government research organizations, 7) other
research institutes, 8) professional conferences and 9) technical press and computer databases. See Table 5 for examples.

**TABLE 5 EXAMPLES OF EXTERNAL KNOWLEDGE SOURCES**

<table>
<thead>
<tr>
<th>Knowledge Sources</th>
<th>Example</th>
<th>Innovation phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 University</td>
<td>World-wide although especially in Europe, contact is kept by special centers within the department &amp; facilitates (Ph.D)-research &amp; professor-positions.</td>
<td>Idea Generation</td>
</tr>
<tr>
<td>2 Suppliers of equipment, materials, components or software</td>
<td>Requesting prototypes, tools &amp; machines not yet adjusted to the department’s specifications. Also from potential future suppliers.</td>
<td>Development</td>
</tr>
<tr>
<td>3 Customers</td>
<td>Contact with internal customer, takes place in boards and during visits to understand problem and run tests with new technology.</td>
<td>Idea Generation &amp; Development</td>
</tr>
<tr>
<td>4 Consultants</td>
<td>External technology experts are standard hired at the department.</td>
<td>Research</td>
</tr>
<tr>
<td>5 Commercial laboratories</td>
<td>Buying hours &amp; requesting measurements &amp; analysis from spin offs from universities</td>
<td>Development</td>
</tr>
<tr>
<td>6 Government research organizations</td>
<td>Participating in national programs</td>
<td>Idea Generation</td>
</tr>
<tr>
<td>7 Other research institutes</td>
<td>Members of (international) consortia with suppliers and other industry partners</td>
<td>Idea Generation</td>
</tr>
<tr>
<td>8 Conferences</td>
<td>Regularly visit and participate in conferences</td>
<td>Idea Generation</td>
</tr>
<tr>
<td>9 Technical press &amp; computer databases</td>
<td>Contacts with journals, academic literature databases and patent databases to follow new developments.</td>
<td>Idea Generation</td>
</tr>
</tbody>
</table>

In the interviews universities and (potential future) suppliers were most mentioned external partners. This is in line with the literature review that found theses sources are most important for manufacturing firms. Also the phases wherein Department B uses these sources is in line with the literature review. Especially early in the development of new technologies Department B connects with universities for fundamental research, conferences and consortia and research institutes with market partners for new ideas. Later in the development Department B makes exploitative connections with (potential future) suppliers, when it knows better what it wants. The internal customer is incorporated when projects are initiated and collaborations take place when a technology needs to be tested in a real-life environment (Chesbrough & Prencipe, 2008). How Department B connects with these sources is described in Appendix VI., this appendix describes the collaboration modes mentioned in the interviews.

Turning to the search depth dimension, the analysis reveals that the extent to which the department uses external sources is rather low. As expressed in the interviews, universities are told on what topics to do research, without specifying the purpose and use for the company. And suppliers and other manufacturing firms are asked to develop samples without revealing specifications. It is an official policy to share not more information than needed and absolutely ‘no information is shared on specifications considered unique for Firm A’.
It was also said that the selected partners ‘are the ones best suited for the department, this means that not always the most renowned partner is chosen but a partner who best fits the needs of the department’. An important need for them is stick to the policy of not sharing more information that needed. That this leads to collaborations wherein few work is done jointly is showed in the anecdote whereby Department B tried to set up an in-depth collaboration but the potential partner, a small start-up company, was scared away and the collaboration turned into a contract wherein hours for measurements were bought by one from the other.

The few interaction and precaution to share information is established by experiences that ‘suppliers are the most valuable source in knowing what competitors are doing’. Even though NDAs are signed, suppliers (often on operational level) still share confidential information. Therefore Department B is suspicious in giving suppliers any information.

At the same, when the external partner has more knowledge that is useful for the department, it seems that Department B does not exploit this. Observations show that weekly once or twice external contact moments are used for idea generation and inspiration and not to deepen knowledge. And it was also said that the purpose of the formal task of capturing ideas from conferences and academic literature, is that these ideas could be selected to try it internally.

Translating these measures to the archetypes of Keupp and Gassmann (2009), it could be said that Department B is a ‘Scout’. The department uses different sources on intermediate level but the depth of their collaborations is limited, without deep integrated external sources in the innovation process. ‘They scan the environment for suitable sources without necessarily engaging in any deepened collaboration’ (Keupp & Gassmann, 2009 p. 335). See Figure 23.

4.1.5 Conclusion Current State
Measure 1 showed that out of six, three openness characteristics are present in the mindset which is somewhat open but still rather closed. Measure 2 showed that the department possesses capacities related to knowledge exploration, but capacities for retaining external knowledge and exploiting this knowledge are less developed. Measure 3 showed that currently the department follows a rather closed business model and Measure 4 showed that the department is open in terms of search breadth for external knowledge, but the usage depth of this knowledge is rather superficial.
Therefore it can be concluded that in the organizational context the mindset is somewhat open, but this could be carried out more in ‘hard organizational characteristics’ as the business model. In addition, openness seems somewhat integrated in the collaboration routines as there is searched for external knowledge sources, but the supporting capacities to make in-depth collaborations possible are still rather internally focused. See Figure 24.

4.2 Impediments

Open innovation activities are not yet done because of old habits and beliefs formed by earlier experiences that hinder the transition from closed to open innovation. The previous paragraph showed that Department B has traditionally a protective orientation. This orientation contradicts with the open innovation paradigm and so leads to impediments in the form of ambiguities of how to deal with open innovation.

4.2.1 What knowledge to share and what not

A first ambiguity on process level is that in collaborations it is unclear to employees what knowledge can be shared and what not. There is a “clear” guideline that states ‘only share what is needed’, but in combination with the traditional protective orientation that propagates ‘everything is secret’ it leads to situations wherein employees chose to play safe and give answers as ‘I have to check if I can say that’, or ‘I don’t know’. Which is not motivating and does not give an intelligent signal to the collaboration partner. Managers stated in the interviews that it takes experience to judge what information is critical to the company and what less, therefore it is encouraged to ‘say less than more’ in communication with external partners.

The fear of knowledge leakage has been argued to be appropriate in this environment, by statements as 1) ‘you do not want competitors to know where you are good in; since there is a big threat of imitation which you cannot control’, and 2) ‘you do not want others especially the financial market to know where you are not good in: since process innovations are initiated by a problem or inefficiency in the production process, and when they get to know this there is a risk of lost in confidence in the production systems.’ Support for this fear is that process innovation can be easily copied, it is hard to check whether others have copied it and earlier experiences learned that customers and specialists of partner organizations do not realize the sensitivity of the knowledge. A main concern with implementing open innovation is therefore ‘how do you control information that you are sharing when opening up’. This need for control favors closed innovation and hinders the transition towards open innovation.

4.2.2 How much do you want to give

The focus of keeping and protecting knowledge for value capture, is stimulated by the position of Department B within Firm A as a cost center. The external knowledge is perceived as useful to enrich the internal knowledge base, but it is not the intention ‘to enrich the environment’. One interviewee recognized in the interviews that indeed for successful collaborations ‘you need to be willing to put in 6 and get 4 back’, however in contrast, another interviewee declared that ‘open innovation is about getting more, than you put in’. It could therefore be said that within the department there is no
consensus about how much Department B is willing to give in a collaboration in order to create the opportunity of getting.

It could also be said that the root assumption of open innovation of ‘useful knowledge is widely distributed’ (Chesbrough et al., 2006) is not leading yet at Department B. It looks like that by not willing to give too much, it is still believed that competitive advantage can be gained based on the internal knowledge base and developing new technologies internally. However, according to open innovation the advantage of internal R&D is diminishing (Chesbrough, 2003b) and sources of competitive advantage are flexibility, agility and concentration on core processes. (Gassmann, 2006)

The ambiguity about how much Department B is willing to give in a collaboration makes it hard for Department B to transform from a Technology Sponge (only absorbing external knowledge) to a Technology Broker (actively trading internal and external knowledge) (Lichtenthaler et al., 2011), since give-and-take relationship need to be established then. This transformation would be necessary to complete the transition towards open innovation.

4.2.3 What is core and what is not
A strategic impediment for Department B hindering the implementation of open innovation, is that it is unclear which topics are judged as core and which are not. It is preferred at Department B to keep core topics internally, since often on these topics ‘state-of-the-art knowledge is already in house’ and external partners could not have much to contribute, and simply because managers judge that it is ‘too dangerous to bring any information on this outside’. But non-core topics could in their eyes be very appropriate for collaboration, since it ‘could save resources and increase development speed’. However, which technology topics are ‘core’ or ‘non-core’ is ambiguous.

Department B has done some managerial interventions to solve this ambiguity by defining road maps and setting up a new government system. But interviewees still indicated that more detail need to be given to this, since even within a core-topic there could be useful aspects for collaboration and within non-core topics there could be information that is rather not shared.

The ambiguity results in the fact that it is hard to make choices between ‘develop it ourselves’ or ‘ask a partner to do it for us’ or ‘develop it jointly’. Which eventually leads to no choice made at all, and ‘too much projects are performed’ within the department itself. Figure 25 summarizes all just discussed ambiguities that form impediments for Department B.

4.3 Conclusion
This first of two analysis chapters assessed the current state and impediments of Department B to the transition from closed innovation to open innovation. Thereby it answers sub question 4) What open innovation activities are already done?, and sub question 5) What open innovation activities are not yet done?
BOX 4: Open innovation activities that are already done are collaborations with external partners, searching the market for and enriching the internal knowledge base with external knowledge. However, what is not yet done is deepening these collaboration with external partners, exploiting external knowledge, building business models and retaining relationships. The mindset is open to external knowledge but is also rather closed, due to the need for protection. This creates a tension and ambiguities as ‘what knowledge to share and what not’, ‘how much are we willing to give in a collaboration’ and ‘which projects are appropriate to collaborate in and which less’ hinder doing these activities.
5. Results & Analysis: Practicing Process

This chapter focuses on the other process of open innovation integration; the practice. It analyses which external factors play a role in determining the appropriate level of open and closeness in projects of Department B, and analyses how alliance collaborations are currently performed so an evaluation can take place what to change to optimally practice open innovation. See Figure 26. The results of this chapter deepen the answers given in Chapter 4 on sub question 4) What open innovation activities are done?, and sub question 5) What open innovation activities are not yet done?

![Figure 26: Practice of Open Innovation](image)

5.1 External Factors Affecting the Open- & Closeness Balance

Recall from the literature review that managers need to make decisions to balance open and closeness, since too much openness can have negative effect (Laursen & Salter, 2006) and organizations can pursue different openness strategies in an individual project (Knudsen & Mortensen, 2011). These decisions are determined by external factors such as industry dynamics, as mentioned in the literature review.

The first of the five industry dynamics that favor a decision for openness is ‘Globalization’. When markets grow fast due to the rise of international markets, an open strategy by collaborating with international partners can be useful (Rigby & Zook, 2002; Gassmann, 2006). However, in the context of the studied manufacturing firm doing process innovations this trend is not observed. The history of Firm A tells that it operates globally already for more than a century, and global competitors have been there just as long. Also the market growth is quite stable for the produced engineering product. Only growth waves of certain production technology areas are observed, wherein the perception of importance of this technology changes. Witnessing the quote ‘now many customers require this technology’.

Second, when industries show high technology intensity it is favorable to collaborate with external partners. Since then it is easier to keep up with new developments and the knowledge base for innovating is enlarged (Gassmann, 2006). Manufacturing processes exist of many different technologies, as the size and amount of different groups within the studied R&D department indicate. Automation and digitalization make these processes even more complex, and an effect of this is that lot of new knowledge is required for innovations and therefore the intensity whereby innovations arise is low. These industry dynamics make that it is beneficial to collaborate.
When innovations are created by combining different technologies or knowledge areas, it is often beneficial to open up since it is not possible to be an expert in every field (Gassmann, 2006). At the studied process R&D department was mentioned that **combining different technology areas is advantageous and necessary**. This is also stressed by projects with focus areas as ‘mechatronics’, and the fact that process innovations are often initiated in other industries: for example IT integration (computer & software industry) and mass production systems ([steam]-engines) (West & Gallagher, 2006, as cited by Huizingh, 2011). On the basis of this industry characteristic a choice for openness in projects seems appropriate.

Within an industry that is characterized by the rise of new business models and a lot of new market entrees, it is also good to choose for openness (Ribgy & Zook, 2002; Gassmann, 2006). These dynamics make that knowledge is fast outdated and imitation is too slow. Within the industry of Department B **not many new business models arise**; ‘the industry is rather traditional’ and ‘not many start-up companies exist’. This could be explained by the asset-intensiveness and the easiness to copy technologies. Therefore from this point of view, a choice for closeness in projects seems appropriate.

The fifth industry dynamic that favors openness is the level of knowledge leverage. When knowledge is valuable to a wide range of potential users, partnering in order to exploit the knowledge to the fullest is beneficial. However, **knowledge leverage has been unnatural to Department B**. Historically, they have always focused on the internal customer. (Stressed by the common first responses as ‘the internal customer you mean?’ to a question as ‘how do you collaborate with customers?’) And as an interviewee stated collaborating with competitors ‘feels as supporting the competitor’. This gives the feeling that the perception of ‘collaborating reduces your competitive advantage’ is strong in this industry, and it is not ready yet for joint development. The observed industry dynamics are summarized in Table 6.

**TABLE 6 OBSERVED INDUSTRY DYNAMICS**

<table>
<thead>
<tr>
<th>Industry Dynamic</th>
<th>Current Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globalization &amp; Steep Market Growth</td>
<td>No</td>
</tr>
<tr>
<td>Technology Intensity &amp; Innovation Intensity</td>
<td>Yes</td>
</tr>
<tr>
<td>Technology Fusion</td>
<td>Yes</td>
</tr>
<tr>
<td>New Business Models</td>
<td>No</td>
</tr>
<tr>
<td>Knowledge Leverage</td>
<td>No</td>
</tr>
</tbody>
</table>

The external factor mentioned by the literature review as argument for more closeness in projects is **the asset-intensiveness**. The industry of this manufacturing firm is such an asset-intensive, as it is also classified as such by Chesbrough & Crowther (2006). The content analysis revealed in addition more external factors associated with process innovations that discourage openness.

Due to the relatedness to product innovations and the favored protection strategy of secrecy (Bekkers, 2009), **knowledge leakage is difficult to prevent**. As interviewees told that ‘the internal customer [who sells the product innovations] often does not realize how valuable certain process knowledge and specifications are for the uniqueness of the product, while these are not patented’. Even though the modularity between product and process innovations is high, since they are developed in other departments, this is not sufficient to protect against knowledge leakage of process innovations.
Interviewees stressed that process innovations are relatively easy copied, and that this is also hard to prove since competing productions processes are seldom completely revealed and the treatment of the technology cannot always been seen on the product. Teece (1985) states that when imitation is easy, markets do not work well and imitators may profit rather than the developers of the intellectual property. The effectiveness of protection methods as patents is in this context rather low, which decreases the likelihood and appropriateness of open innovation activities (Cohen et al., 2000; Shane, 2001).

‘The application of the external technology in our processes is a niche market for the owner of the external technology’. The effect of this, is that an external company can have little interest in joint development with this R&D department. The example was given of a new sensor for manufacturing processes, Department B wants to develop this with the purpose for internal use of Firm A. However the sensor manufacturer develops and sells an array of generic sensors, the benefit for the partner to join this project is therefore small.

Like literature indicates (Utterback & Abernathy, 1975; Davenport & Short, 1990; Adner & Levinthal, 2001; Benner & Tushman, 2003; Bergfors & Larsson, 2009), process innovations are driven by internal production objectives to reduce variation and improve efficiency. According to some interviewees this is another reason for not wanting to open up. ‘You do not want to get public on which areas you are developing, because it signals a weakness in the current production process, which could affect the quality image of the product’.

The analysis of external factors shows that within the current industry dynamics the balance of open and closeness should in general be overweighted by closeness. However, as managers also said ‘it depends on the technology how open we can be’, the right balance of open and closeness for an individual project should be determined by analyzing these factors again for a specific technology.

5.2 Current Practice of Collaborations
The above mentioned external factors call for smaller, more closed collaborations, this in line with what the literature review showed; that alliances are a natural mode for manufacturing firms. Therefore the analysis of the current performance of collaborations focuses on the mode alliances.

5.2.1 Type of Alliances
In the interviews collaborations were described wherefore voluntary contact was made with other companies in order ‘to learn from them’, wherein services or technologies were exchanged (‘so they can do measures for us’ and ‘they can learn from us’), and wherein both organizations kept their own goals and corporate identities (‘you both first focus on your own goals’). For these collaborations formal agreements are signed (‘the idea is that they do not disclose what they did with others’), either in the form of an NDA (‘the NDA is quite standard’) or in an ‘agreement of quite some pages specifying what each partner should bring in’. These collaborations qualify as ‘alliances’ as they correspond with the, in the literature review mentioned, definition of Duysters et al. (2002).

In the given examples of alliances, suppliers or potential suppliers were most mentioned as partners. These partners often possess a technology Department B wants to learn more about or wants to have measures done with this technology. However, integration with these partners is rather low as the collaborations were described as ‘we define what we want the researcher to work with, and then they actually do the research for us’ and ‘collaborations with suppliers usually ends up that we buy a
machine for instance and then we develop the process further, or we outsource the production’. ‘Collaborations are set up to solve a specific problem’, therefore the level of commitment for Department B is short term and therefore relatively low. In case of an unsatisfying collaboration, the main consequence is that that ‘partner will not be chosen again’.

When categorizing the alliances of Department B, it could be said that mainly unilateral outside-in contracts are performed; in-licensing knowledge or forming R&D contracts, whereby one-way communication takes place, since Department B directs the partner what to do. See Figure 27.

5.2.2 Success & Failure Factors
Department B performs the alliance types discussed above for already quite some years, therefore it could be said that Department B has built some alliance-experience: one of the success factors mentioned in the literature review. In the interviews the alliances have been described as ‘successful, since often we get out of it what we want’. When alliances are not successful, they are often cancelled before time, new projects are started or no new collaborations with the “unsuccesful partner” are established.

It became clear that alliances are mainly managed on the basis of technological factors. As the content analysis showed, interviewees talked mostly in line with ‘knowing the desired technical specifications is important’ and ‘a success of an alliance depends on the technological successes’. This conclusion is supported by the observation that a procedure for how to manage collaborations is lacking. A company document with the procedure for general project management was found; this structures project management, but not specifically managing collaborations. Without managing alliances actively on social and business aspects, it could be that lessons learned are not capitalized (Kale et al., 2001).

When analyzing the presence of success and failure factors, a similar pattern could be distinguished. For example related to the failure factors; there are no alliances formed without commitment and trust (‘a formal contract is not enough, you need trust’ and ‘they have something that we want’). But the focus therein is on technical aspects as ‘you trust they have the competences’. What misses are
social factors as ‘goodwill of partners to collaborate with you’ and ‘how their commitment relates to the other projects the partners will have’.

In addition, the content analysis found that attention is paid to operational integration in terms of ‘partners should be able to plan meetings and have regular (virtual) contact’. However attention to cultural integration lacks, because ‘similarity of norms and values are not considered’ when setting up an alliance. This is a failure factor and the experience of ‘suppliers who turned out to share confidential information with and about competitors’ could be a consequence of this.

It could be analyzed that synergy in terms of technology aspects are incorporated when setting up an alliance. A partner will only be selected when it matches and complements the department’s knowledge base, otherwise they will do it themselves. But due to the lack of focus on social aspects, synergy in terms of the collaboration chemistry is neglected.

That Department B has a rigid attitude in collaborations is showed by quotes as ‘a success factor is when you really know what you want, so you can give very good specifications’. The R&D department only wants to get out of an alliance what they have in mind. This attitude in combination with a focus on technology aspects and fear of knowledge leakage, causes that Department B focuses on internal alliance-issues. The collaboration is approached from their position aimed on the benefits they want to gain; a long term win-win commitment is less of their concern.

Alliance success factors that are taken into account are ‘strategic fit’ and ‘selection of the right partners’. A preferred list of collaboration and purchase partners is set up ‘for technologies wherein we can use external help’. ‘Technology strategies have been defined for individual technologies wherein is stated where we want to be in a few years’. The fit of partners with the needs of the project at hand is assessed on ‘knowledge competences, location and communication possibilities’. However, of this could still be argued that it is focused on technology aspects and less on social and business aspects. Table 7 summarizes what goes well and what could be improved in collaborations.

<table>
<thead>
<tr>
<th>Failure factors</th>
<th>Success factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>No commitment</td>
<td>Strategic fit</td>
</tr>
<tr>
<td>Lack of trust</td>
<td>Keeping chemistry</td>
</tr>
<tr>
<td>Weak cultural and operational integration</td>
<td>Selection of right partners</td>
</tr>
<tr>
<td>No synergy</td>
<td>Create most value in the eyes of the customer</td>
</tr>
<tr>
<td>No flexible attitudes</td>
<td>Commitment to long-term win-win</td>
</tr>
<tr>
<td>Focused on internal alliance-issues</td>
<td></td>
</tr>
</tbody>
</table>

5.3 Conclusion
This chapter analyzed what the external factors are that favor or discourage openness and how collaborations are currently performed. Thereby deepening the answers given in Chapter 4 on sub questions 4) What open innovation activities are done?, and 5) What open innovation activities are not yet done?
BOX 5: Department B collaborates in ‘alliances’. These dyadic, somewhat closed collaborations are appropriate, since the external factors encourage some closeness: there is stable growth, not many new business models arise, knowledge leverage is uncommon, industry is asset intensive, knowledge leakage is difficult to prevent, effectiveness of protection strategies is low, partners have to shift to a niche market and process innovations signal a weakness in production process. At the same time industry dynamics of high technology intensity and fusion of technologies encourage open innovation activities. The collaborations that are currently performed are set up and managed with a focus on technical aspects, and success and failure factors related to social and business aspects are taken less into account.
6. Evaluation: Open State

This chapter evaluates how the integration of open innovation in the end should look like. It states what open innovation activities that are not yet done can be done and what could be improved in the current executed open innovation activities, thereby taking into account the barriers formed by the external factors and the organizational boundaries formed by the habits and ideas of the R&D department. See Figure 28. This chapter answers the still unanswered sub questions: 6) What activities can be done within the current set up of the organization? 7) What activities can be done with potentially changed boundaries of the organization? 8) How should the boundaries be changed? 9) What are the associated benefits with these open innovation activities? And 10) What are the associated barriers with these open innovation activities?

6.1 Open Innovation Processes

6.1.1 Inbound Dimension

The analysis showed that Department B is mainly interested in the inbound dimension of open innovation, absorbing external knowledge. Performing this dimension is a good decision since this inbound open innovation is useful when there is lack of internal resources (at Department B few specialists have to divide their scarce time on a lot of different projects), the external technology position is better (external parties often have high expertise on a single process technology, and process innovations are often based on knowledge originally developed externally (West & Gallagher, 2006, as cited by Huizingh, 2011)) or the knowledge transfer is relatively easy and low market barriers exist (the absorptive capacity is high and patent protection is low (Hermes, 1993, as cited by Gassmann & Enkel, 2004)). However, the current practice of outside-in processes could be improved by making more use of the knowledge external partners possess. At this moment it is rather superficial and it requires a lot effort from Department B to adapt the external knowledge to the internal processes.

Barriers to change to more in depth inbound collaborations are the asset-intensiveness of the industry, the fact that partners have to shift to a niche market to collaborate, knowledge leakage is difficult to prevent and the effectiveness of protection strategies is low. This makes that it takes a lot of investments to develop new technologies, it is not always attractive for an external partner to collaborate with Department B and when there is, competitors are able to copy the technology fast so it will only temporarily result in competitive advantage. Therefore, when doing more in depth collaborations, Department B should choose for partners for who the collaboration is important too, as for example startups, and build long term social relationships with them so win-win situations and understanding could be created.

FIGURE 28 THE OPEN STATE
The industry dynamics can be seen as a good argument against more in depth collaborations, but they miss the point (Van de Meer, 2007). Industry dynamics can change and as literature states; open innovation is an organizational choice, and not an industry driven decision (Keupp & Gassmann, 2004; Chesbrough & Crowther, 2006). Deepened inbound open innovation could increase the ability to adapt to change (Laursen & Salter, 2006) and relate to higher acceptance by customers (Keupp & Gassmann, 2009). When Department B would be the first to deepen their external collaborations they can gain an advantage over their competitors. For that to happen it needs to open up their mindset; ‘when you give more you are able to get more’, and their search routines should become more in depth.

6.1.2 Outbound Dimension

Department B pays significantly less attention to the outbound dimension of open innovation. Although this is less natural to manufacturing firms, exploiting and commercializing new developed knowledge can be useful, because this enables organizations to focus on and specialize in an early stage of the value creation (Tidd et al., 2005; Chesbrough et al., 2006), create new value streams from unused knowledge and test the value of new technologies (Chesbrough, 2009; Chesbrough & Garman, 2009). An additional benefit of this is that it could stimulate employees since they see their knowledge is more applied, which could increase creativity (Chesbrough & Garman, 2009).

A barrier for outbound activities is that knowledge leverage is uncommon in the industry. As said in the interviews, bringing knowledge outside in external paths is assumed to be not an activity of them. In order to change this, boards and management of Department B should change the idea that cost-centers will not make money and should stimulate and invest in outbound-ideas. Another barrier is that the effectiveness of protection strategies is low and the risk of knowledge leakage is high. This makes selling or licensing knowledge quite hard. In order to lower this barrier, the IP department should be more involved in judging whether (parts of) process technologies are adequate for patent protection. The IP department should have resources to perform these extra activities and should be trained and encouraged to recognize licensing opportunities.

For outbound open innovation an organizational boundary that should be changed is that the department should think more in business models: analyzing for a project how to create value and how to capture value. Also should capacities of exploiting knowledge be developed, as was shown in Chapter 4, Department B needs to develop its connective capacity. Therefore the organizations needs to develop supporting contextual mechanisms; which shape behavior as job enrichment schemes and incentive systems, and it needs to develop supporting leadership mechanisms; as promoting internal and external knowledge integration and reduce conflicts when internal and external knowledge is brought together (Lichtenthaler & Lichtenthaler, 2009).

Adequate outbound projects are those where others can contribute to important but expensive development, projects are complementary initiatives to the core business, contains IP that is unused, or are projects that can substantially benefit from network externalities (Chesbrough & Garman, 2009). A strategy could be to position it as knowledge instead of a technology, in this way it is harder to copy, or to create a kind of ‘Intel-inside’-mark, which is feasible with their renown company-brand, or to license-out ideas to universities who have full time available to spend on the rough ideas.
6.2 Open Innovation Elements

6.2.1 Business Model

It has already been said that Department B does not think in business models because it is assumed it is not one of their tasks. However, business models are not only helpful for outbound-activities, but also in general for the organization to facilitate smarter use of new knowledge (Chesbrough, 2007) and to link the technical domain with the social domain (Van der Meer, 2007). In a business model the processes of value creation and value capture need to be described (Chesbrough, 2007b), which forces the department to think about how to capture value and what role IP plays in this. It also forces the management to give answers on what knowledge can be shared, how much are they willing to give and which external partners are desirable, and could help to evaluate whether the project is in line with the innovation strategy. This will lead to more efficient collaborations and higher chance on implementation success.

The fact that knowledge leverage is uncommon in the industry is a barrier. It hinders this open innovation activity, since due to this Department B sticks to the idea that as a cost-center it is not their task to develop business models. The industry in turn also does not show alternatives to this thought, as not many new business models arise. Alternatives for business models and thinking in business models should therefore be supported by the boards and management of Department B. A clear innovation strategy guiding when to be open, when to be closed, when to do outbound and when to do inbound, could help in this.

The organizational boundary is that the open innovation idea of ‘best business models win’ is not yet central in the mindset. It should be a habit to think in line with how to create value that is valuable for the organization and what has to be done to capture this value. Employees of Department B are mainly focused on the technology aspects, but business aspects are essential for business models. The business models for the internal customer may not necessarily have to contain a description of value streams, but it should formulate how money can be saved and how the technology should get a place in the current production process. The internal customer should be involved in the formulation of the business model, and the competitor of Department B in the form of ‘an external development partner for the internal customer’ should not be forgotten.

6.2.2 Structure

Regarding the structure of open innovation, Department B is doing things in line with the findings of the literature review. It was found that mainly selecting universities and (potential) suppliers as partners and selecting alliances as collaboration mode is natural to manufacturing firms doing process innovations. This does not mean, however, that other open innovation activities should be excluded. Department B could extend the range of alliance forms to more integrated ones and even look further than just alliances. Department B already participates in knowledge communities, but it could for example also use an intermediary; a website to publish a problem and share it with selected knowledgeable people, like an internal jam session wherein the internal customer could comment on what is needed for them to adopt the invention. This could stimulate creativity and increase the use of external knowledge.

The idea that process innovations signal a weakness in the production process creates a need for control and therefore limits the experimentation of new collaboration modes. That in the industry few
examples of alternative collaboration forms can be found, creates an additional barrier as it is uncommon to collaborate in other modes.

An organizational boundary is the closed, technology focused mindset: Department B is not willing to integrate more with collaboration partners since it fears to share too much information. This fear should be reduced to realize that the more integrated collaborations will perform well. In addition it could look outside their own industry for partners; the knowledge about manufacturing technologies that developers from other industries possess could also possess valuable in Department B’s industry. Selecting partners from a strategic point of view (rather than ad hoc, focused on solving a specific technology problem) could create a long term win-win situation wherein the underlying need for control could be released. Partners who are cultural and technological similar facilitate exploitative learning, but when partners operate in unrelated businesses explorative learning occurs (Schildt et al., 2005).

6.2.3 Culture

Finally, as the third open innovation element, it is important in the open state that the culture is in line with open innovation. This means that outside competences and know-how is valued (Gassmann et al., 2010) and the ‘do-it-yourself’-mentality is obsolete (Gassmann, 2006). Chapter 4 showed that the culture at Department B is on one hand ‘creative’ and ‘curious’ to external knowledge, however on the other hand quite reserved due to the concern of knowledge loss. An entrepreneurial spirit could make employees more creative (which could be increased as indicated in the interviews) and independent. To become more in line with an open innovation culture, the culture should loosen up and become more entrepreneurial: taking initiative and showing readiness to pursue new opportunities while taking the risks into account. Entrepreneurs are needed to create external connections, identify new opportunities and distribute and promote these new opportunities (Huston & Sakkab, 2006).

The barrier for a more entrepreneurial spirit are the fears and impediments. Due to the ambiguities it is not clear what could be done and employees stick to the status quo of innovating. When Department B would have clear innovation strategy, employees have a clear guideline on what should be done and around that guideline they can be creative and think out-of-the-box.

Boundaries that should be changed is that employees should have the capacity to judge what important initiatives are and how they should deal with risks, as knowledge loss. When they would have these capacities, they can get the freedom to interact with external partners. For an entrepreneurial culture, Barringer and Bluedorn (1999) found that important factors are especially high scanning intensity, high planning flexibility, deep locus of planning (i.e. high level of employee involvement) and a high degree of emphasis on strategy controls instead of financial controls. Especially these control systems are recognized in open innovation literature as influential on the culture (Chesbrough et al, 2006; Huston & Sakkab, 2006; Gassmann et al., 2010).

6.3 Conclusion

This chapter has defined how the open state of Department B should look like. Thereby it has answered five sub questions: 6) What activities can be done within the current set up of the organization? 7) What activities can be done with potentially changed boundaries of the organization? 8) How should the boundaries be changed? 9) What are the associated benefits with these open innovation activities? And 10) What are the associated barriers with these open innovation activities? An overview of the answers is given in Figure 29 in Box 6.
**BOX 6:**

<table>
<thead>
<tr>
<th>Open Innovation Activity</th>
<th>Deepen Inbound activities</th>
<th>Perform Outbound activities</th>
<th>Use Business models</th>
<th>Extend range of collaboration modes</th>
<th>Create Entrepreneurial culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>- Less effort adapting external knowledge</td>
<td>- Higher R&amp;D efficiency</td>
<td>- Smarter use of knowledge</td>
<td>- Increased creativity</td>
<td>- Increased creativity</td>
</tr>
<tr>
<td>Barriers</td>
<td>- Asset-intensiveness</td>
<td>- Knowledge leverage is uncommon</td>
<td>- Knowledge leverage is uncommon</td>
<td>- Process innovations signal a weakness in the production process</td>
<td>- Ambiguities formed by the impediments</td>
</tr>
<tr>
<td>How to change the Organizational Boundaries</td>
<td>- Open up to share information</td>
<td>- Involve IP department</td>
<td>- Think more in business models</td>
<td>- Think more in business models</td>
<td>- Open up to share information</td>
</tr>
<tr>
<td></td>
<td>- Deepen search routines</td>
<td>- Think more in business models</td>
<td>- Develop ‘connective capacities’</td>
<td>- Communicate an innovation strategy</td>
<td>- Select partners strategically &amp; for long term</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Create an entrepreneurial culture</td>
</tr>
</tbody>
</table>

**FIGURE 29 OVERVIEW OF OPEN STATE**
7. Recommendations

This chapter gives recommendations to Department B on how to come to the open state as described in the previous chapter. Hereby it gives practical input for answering the research question: what activities need to be done in order to integrate open innovation?

7.1 Transition Process

This first paragraph defines what activities need to be done in the phases of organizational change to transform the current state of Department B into the open state.

7.1.1 Implementation Team

To establish an organizational change, an ‘open-innovation-implementation’ team should be created. This team focuses on the short term and needs to seed an open innovation culture, identify which functions within a firm should be connected and identify what supporting tools are available for practicing open innovation (IfM report, 2009).

In the first phase of organizational change; the unfreezing stage, the open innovation culture could be seeded by questioning the status quo and creating an urgency for change (Lewin, 1947). Questioning the status quo has already started; since strategies are formulated that define in what areas external knowledge can be used, this study is initiated to investigate what value open innovation can deliver and interviewees doubted whether the current, rather closed, approach is legitimate. To proceed this and create the sense of urgency, the implementation team could organize discussions and meetings for the department that explain open innovation as an alternative to the status quo.

The team should involve other organizational functions in the discussion as well, since Department B needs their support in order for the integration of open innovation to perform optimal. To strengthen the willingness to cooperate and the sense of urgency by these functions, the implementation team should make clear what the benefits are for each individual function and calibrate how it is desirable for the functions to be involved; for example how they can deal with extra workload in their capacity. Functions that it should connect with are for example IP, production and management.

The IP department should be more closely involved because this department controls the IP and the role of IP changes when practicing open innovation; from a passive, protection tool it becomes a tradable good around which business models can be build and collaboration boundaries can be set (Gassmann, 2006). Instead of only being involved to scan the market for similar already existing patents and when Department B has selected a technology for patenting, they should be involved to judge whether parts of process technologies are adequate for patent protection and to develop protection strategies that are suitable for external collaborations.

The team should also connect with production and management. Production should understand why Department B wants to collaborate with external partners and that they will benefit from this too since it could result in better developed technologies. And the relationships with top management and the boards, who invest and decide on the new projects of Department B, should intensively be managed to secure essential support so resources are available for open innovation and their commitment can push the implementation of open innovation.
Team C, the team that initiated this study and that has the responsibility to develop new techniques and routines for innovation within Department B, could be assigned to set up this team. At least one employee could be trained to become an “export of open innovation” or an external person could be attracted. The implementation team could in the long term (partly) evolve into a structural team.

7.1.2 Structural Open Innovation Team
When the urgency for change is created, the implementation team should think about how to set up a structural team which on the long term coordinates all open innovation projects (Huston & Sakkab, 2006; Bjelland & Wood, 2008). An organization can choose strategically to pursue different degrees of openness across the project portfolio (Knudsen & Mortensen, 2011), and the structural team should coordinate all these projects, making sure synergy is created and preventing too much openness. It is important that this structural team captures all the lessons the implementation team has learned, therefore it is recommended to let (part of) the implementation team evolve into the structural team.

The structural open innovation team will become the friendly face of the organization that provides support and internal openness (IfM report, 2009). It continues the work of the implementation team to keep the connection with other functions as IP, production and management and it is involved in setting the openness strategy: how to strategically practice open innovation within a project (Kirschbaum, 2005). This group investigates sources of recent innovations, sets out roadmaps and identifies gaps and blind spots as input for determining open innovation activities (Chesbrough, 2003a). This unit should have the power to change business models (Chesbrough, 2007b) and train employees to maintain open innovation skills.

In cooperation with the implementation team, the structural team should identify and develop suitable tools that support the change towards an open innovation approach. In the IfM report (2009) tools as cross-functional project teams, sponsorship of selected universities, technology/market/competitor intelligence and corporative venturing units are mentioned. Most articles also mention incentive systems as important tools (Gassmann & Enkel, 2004; Chesbrough et al. 2006; Huston & Sakkab, 2006; Chioroni, 2010). Incentive systems can be based on rational/financial factors; as market shares and revenues, perceptual factors; as contribution to organizational mission, and internal efficiency factors; as throughput times (Debackere & Van Looy, 2003, p. 418). Open innovation studies show that reward systems based on financial factors and amount of patents do not work, instead perceptual factors based on creating most value for the customer stimulates employees to equally value internal and external developed knowledge and perform open innovation activities.

7.1.3 Pilot Study
Change does not happen by only talking about it, therefore it is important that as soon as possible, a pilot study is started. This project forms an example for the change and tests the ideas of the open innovation integration before it is implemented department-wide. By performing the process-cycle of practicing open innovation in a part of the organization important lessons can be learned and failures can be limited. A pilot study could stress success and generate support for the implementation in the total organization (Rigby & Zook, 2002; Chesbrough, 2007).

The area of Technology X is suitable as pilot project since this technology area encompasses multiple, rapid developing technologies: industry dynamics that favor openness. These technologies are not core, but are strategically relevant since application of these technologies is requested by the end
customer of the company's products. Therefore it could be considered as an appropriate area for testing more in-depth open innovation collaborations.

Often related to change is ‘resistance-to-change’ (Gilbert, 2005). The pilot study will reveal this probably too and could be used to learn how to solve this. The implementation and structural team should involve management, since their message often forms ‘the opinion of those who feel less inclined to accept the new approach to innovation’ (IfM report, 2009, p. 50). Management needs to clarify the ambiguities that form impediments to open innovation and explain the desired practice.

When the results of the pilot study are positive and the department decides to continue with open innovation, open innovation should be rolled out over more and in the end all projects. The structural team should train involved employees to consolidate the change and making sure everyone acts on it. Relevant skills for open innovation are ‘awareness of who possesses which skills’, ‘social analytical skills to understand partners’, ‘communication skills to interact efficiently’ and ‘technological and business skills to support the value creation’ (IfM report, 2009). When training employees it is also beneficial to create dedicated organizational roles as champions who keep ideas and projects alive and thriving (Fichter, 2009). The team should also train the other involved functions within the organization, since they need to obtain skills as knowing how to deal with external knowledge contribution when setting up a patent.

7.2 Practice Process
This second paragraph gives recommendations on what needs to be done so Department B could perform the practice-process of open innovation. To illustrate, it gives suggestions for certain decisions when Technology X would be used as the pilot study.

7.2.1 Template for Openness Strategy
In the first phase of practicing open innovation the openness strategy for a project should be formulated. Based on an analysis of the external factors, it should be determined how open Department B wants to be in the project. Decisions that need to be taken are whether outside-in or inside-out innovation will be performed, whether financial rewards play a role, whether the innovation process and innovation outcome should be open or closed, and what mode will be chosen to collaborate. These choices form the basis of the business model for the project.

To set the openness strategy a template can be developed that helps to make the decisions. Within this template the models that were found in the literature review of Huizingh (2011) (Figure 30) and Dahlander and Gann (2010) (Figure 31) can be used and, when alliances is chosen as collaboration mode, a third model can be used that indicates what sub form of alliances to engage in, based on whether the project is core- or not to the company and whether it is strategically valuable and a long term issue or that it is a temporal problem (Figure 32). The template should be developed in collaboration of the structural team and management: to make sure choices are made they support.

For example, Technology X is a technology area that is requested by end customers, therefore it could deliver competitive advantage when Firm A would apply this more successful than competitors. However, there are market players (in other industries) that have more knowledge about these technologies than Department B. Appropriate openness strategy decisions are therefore to open up the innovation process for external knowledge, but keep the innovation outcome closed so only Firm
A will benefit from the developments. For the same reasons, outside-in innovation could take place for Technology X, whereby it is paid for the received knowledge to keep the developments exclusive.

Due to the external factors and industry characteristics as found in the analysis in Chapter 5, some closeness is needed in general in the current context of the department, and therefore in specific also for Technology X. To perform an alliance in the pilot study seems therefore appropriate. Since Technology X is a non-core technology; more two-communication is possible and the R&D department could give more insight into how the department wants to use the technology, so in the collaboration a technology can be developed that is more closely adjusted to the specifications of Department B. Also, the request for Technology X is a returning request from the end-customers (as was indicated in the interviews), therefore an alliance-type wherein the department is more integrated in the work of the partner is preferred so the department has more influence on it, for a temporal issue this will cost too much effort and instead an easily reversible alliance-type is more optimal. A description of the modes and alliance types can be found in appendix I & II. Using the matrix of Figure 32, it could be decided to set up a joint venture for Technology X.

7.2.2 Template for Project Management

In the next phase of practicing open innovation the strategy will be implemented during the set up and execution of a new project. In order for this to occur in a systematic and efficient way a project template could support this. Department B has already a template for the process of project management, however open innovation is not part of this and collaborations are not explicitly taken into account. It is however advisable to do this, since it facilitates managing the collaboration within
the project. For a practical, hands-on handbook on the collaboration process and the issues that should be taken into account, see Duysters et al. (2002). The analysis of the current project execution at Department B showed that in the management of collaborations most attention is given to technological aspects, while social aspects are very important too (Osborn & Hagedoorn, 1997). Trust is crucial for the performance of knowledge-sharing routines (Henke Jr. & Zhang, 2010), which in turn are a determining factor for supernormal performance that cannot be achieved by an individual firm (Dyer & Singh, 1998). The social and business aspects are also important to stay the preferred partner for potential future collaborations. The strong brand position of Firm A is helpful for finding collaboration partners, however this image could be damaged by bad collaboration experiences with department B at the partners’ side.

7.2.3 Project Evaluation
When a collaboration is finished, it is important to go through an evaluation phase to reflect on whether the right choices are made in formulating the openness strategy (in light of the external factors) and to learn from the new experiences. Fetterhoff and Voelkel (2006) propose a model (the six C’s model) to evaluate external contributions based on six assessment dimensions: Company (fit with strategy), Customer utility, Competition (uniqueness of the opportunity), Commerce (market size), Capital cost and Copyright (intellectual property). When these dimensions are assessed the conclusions need to be translated to lessons learned and result in action points that are performed in the modification phase. After this is done, the open innovation practice-cycle starts again for a new project.

7.3 Conclusion
This chapter has given an idea where to start the integration, it has given the practical idea of what needs to be done in order to integrate open innovation. An overview of the recommendations is given in Figure 33.

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<th>Activities for Integration Process</th>
<th>Unfreeze</th>
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<th>Institutionalize</th>
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<td>- Set up implementation Team</td>
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<td>- Question status quo</td>
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<td>- Involve other functions</td>
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<td>- Set up structural group</td>
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<td>- Tools</td>
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<td>Who: Implementation Team</td>
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<td>- Pilot Project</td>
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<td>- Answer impediments</td>
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<td>Who: Structural Team, Top management</td>
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<td>Who: Structural Team</td>
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<th>Activities for Practice Process</th>
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<td>- Formulate template innovation strategy</td>
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<td>Who: Teams, Top management, Boards</td>
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<td>- Formulate template project management</td>
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<td>Who: Teams &amp; Project management</td>
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<tr>
<td>- Open Innovation Routine</td>
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<td>• Formulate strategy</td>
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FIGURE 33 OVERVIEW OF RECOMMENDATIONS
8. Conclusions

This report presents the findings of the study that investigated: *What activities need to be done in order to integrate open innovation?* The objective was to formulate the process of open innovation integration and to identifying specific activities that need to be performed to integrate open innovation in process R&D Department B.

The literature review found that open innovation is the use of purposive flows of knowledge between different companies. It is a paradigm for innovation management that recognizes innovation is faster and smarter when the own knowledge base is combined with the external knowledge base. For innovation routines open innovation means that business models, partners and modes become important, and that the culture should be open to external knowledge and opportunities. The processes of open innovation integration are an implementation process and a continuous practice process. For the first process the current level of openness and the impediments to open innovation are of importance. For the second process the balance between open and closeness and the performance of collaborations are of importance.

The study on a real-life context found that open innovation activities already done are collaborations with external partners, searching the market for and enriching the internal knowledge base with external knowledge. However, what is not yet done is deepening these collaboration with external partners, exploiting external knowledge, building business models and retaining relationships. The mindset is open to external knowledge but is also rather closed, due to the need for protection. This creates a tension and ambiguities as ‘what knowledge to share and what not’, ‘how much are we willing to give in a collaboration’ and ‘which projects are appropriate to collaborate in and which less’ hinder doing these activities.

Currently, Department B tries to maintain the balance of open and closeness by performing ‘alliances’ as collaboration modes. These dyadic, somewhat closed collaborations seem appropriate, since the external factors encourage some closeness: there is stable growth, not many new business models arise, knowledge leverage is uncommon, industry is asset intensive, knowledge leakage is difficult to prevent, effectiveness of protection strategies is low, partners have to shift to a niche market and process innovations signal a weakness in production process. At the same time industry dynamics of high technology intensity and fusion of technologies encourage open innovation activities. The collaborations that are currently performed are set up and managed with a focus on technical aspects, and success and failure factors related to social and business aspects are not taken into account.

Activities that need to be done by Department B in order to come to an open state are; deepened inbound activities, perform outbound activities, use business models, extend range of collaboration modes and create an entrepreneurial culture. In order to realize the integration of open innovation an implementation team and structural team should be established in combination with a pilot study. To support a consistent open innovation practice a template for openness strategy, adapted project management template that supports collaborations and a standard for project evaluation should be set up.
9. Discussion & Future Research

The last chapter of this report discusses the contributions of this study to management and the academic community, it outlines limitations and it gives suggestions for future research.

9.1 Managerial Contribution

The contribution that this study offers to management is that it provides insights in what open innovation is and what processes and activities have to occur to integrate it in the innovation routines. In interviews managers have said that open innovation is perceived as ‘everything and nothing’. This study gives a handheld on what it is, what activities have to be performed to integrate it and where to start.

The study also shows that open innovation is not just a tool that you can add on as a supporting process: it is the innovation process. It is a paradigm that changes the way of thinking how the innovation process should be managed. Within performing open innovation still different levels of openness can occur.

The study also showed that for the integration of open innovation two processes have to be performed. An only once-occurring implementation process and an ongoing continuous practice process. This gives the insight that the first process, the implementation process is actually an organizational choice to go through the organizational change or not, and when the choice is made to practice open innovation the second process is a by-the-industry-influenced process of how to perform open innovation, since external factors have effect on it. This aligns with literature, where on one hand studies find that the implementation is industry independent (Keupp & Gassmann, 2004; Chesbrough & Crowther, 2006), and on the other hand studies argue that industry characteristics determine the appropriateness of open innovation (Chesbrough et al., 2006; Gassmann, 2006).

9.2 Theoretical Contribution

In terms of theoretical contribution, this study contributes to existing literature by filling the gap of unifying studies that address how to integrate all integration aspects together. It connects internal company issues regarding the integration of open innovation, like strategy setting, business model building, creating a suitable culture and establishing an organizational change, with external issues like partnership management, alliance management, trust building and IP management. It offers a structure to position the literature that focuses on aspects, and puts existing studies in perspective.

Another theoretical implication of this study is that it gives insight in defining when open innovation is implemented. Studies as the one of Laursen and Salter (2006) measure whether organizations use external knowledge sources and make choices regarding partners and modes, this study makes clear that only looking at this is not enough to judge whether a company has integrated open innovation. One must also look at the implementation of the open innovation culture, use of business models and the structure of modes and partners used.

Department B clearly deals with what Salter et al. (2014) call the ‘paradox of disclosure’; there is a need for controlling IP and fear of knowledge leakage, and at the same time there is a need for external collaborations and therefore knowledge has to be shared. This study contributes by revealing that unique characteristics are associated with process R&D, which strengthens the need for controlling
knowledge. This implies that the open innovation team should not only distinguish between different R&D functions of Basic R&D and Applied R&D (Mortara, 2009), but it should also distinguish between process R&D and product R&D.

9.3 Limitations and Suggestions for Future Research

The choices made on the research method and scope for this study have their limitations that call for future research.

The choice for a case study has been made for all the reasons given in Chapter 3. However, a limiting consequence is that the results are only valid for the studied context. In order to generalize the claim that this is the way to integrate open innovation to other organizations, the process model should be tested in large data set studies. The underlying generative mechanism that explains the causes of consequences of the even sequence, must be studied in these large scale studies (Van de Ven, 2007). Mechanisms that could be investigated regarding this study are for example; ‘what are the most influential external factors’, ‘what other moderators influence this process’ and ‘what tools are optimal in the decision making in these phases’ to fine tune the model.

Another reason that makes that the results should be interpreted with some limitations in mind, is that this study is focused on the specific context of a manufacturing firm and process innovations. Due to these focus areas, future research is required to investigated whether this is also the optimal integration process in other organization contexts. Contexts to be thought of are those of, for example, product R&D departments, smaller/national organizations, less renown and less powerful organizations.

Due to the limited duration of this research the performed case study was cross-sectional. The resulting model and recommendations are verified on the base of existing literature and experience of employees of the department, but they have not (yet) been implemented and empirically tested. A longitudinal case study is therefore required to proof that this process model generates the augmented outcome; a successful integration of open innovation.

The unit of analysis of this study was Department B. A limitation of this is that dynamics that are important company-wide are considered out of scope. It is for example known that to capture the benefits of open innovation, the internal knowledge transfer must also be good (Vanhaverbeke et al., 2007). The integration of open innovation was initiated by the R&D department. The IfM report (2009) states that this a rare observed approach; although it is theoretically possible that a group of R&D managers autonomously creates a community of practice for the implementation of open innovation, it is often top-down strategically driven and open innovation activities are centralized managed. This calls for future research whether the developed process is also valid when the integration of open innovation would be initiated by other parts of the organization.

This study considers context characteristics that determine the appropriateness of open innovation. The identification of important context characteristics for process innovation shows that secrecy makes sense in certain situations of this context. Although the habit in the past might have been to assume too easily exclusivity as desirable (Henkel, 2006, as cited by Huizingh, 2011) this supports that too much openness will hurt too (Laursen & Salter, 2006). This result makes curious to more research on how open organizations can be and how open organizations have to be (O’Conner, 2006; Knudsen
& Mortensen, 2011), it could be interesting to find out what the minimum of openness is and what knowledge and information needs to be shared in order for open innovations to work.

This study could give organizations understanding which processes they go through when implementing open innovation. It could also be interesting for future research to investigate whether this insight could shorten the integration process. It is hypothesized that experimentation, adaptation and learning to define the business environment (Chiaroni et al., 2010) could go faster when the integration process of open innovation is better understood.
References


Appendix I. Modes

In this appendix the different distinguished open innovation modes, as mentioned in Paragraph 2.1.2.2 are further discussed. More in-depth information and practical examples are given to get a better understanding of the different modes.

Knowledge community

Knowledge communities are “groups of people with a common interest, problem, or experience. They exchange and share knowledge interactively, often in non-routine, personal, and unstructured ways, as an interdependent network” (Earl, 2001, p. 223). These communities are designed and maintained for a business purpose. They can be intra- or inter organizational, but in the context of open innovation only inter organizational knowledge communities are considered. This mode requires little formal commitment, and since the relationship is largely based on trust it is also easier to reverse (Van de Vrande et al., 2006). As places for business communities to meet, one can think of conferences, congresses and online forums.

A knowledge community is in practice often supported by technology, but can be arranged in different forms. An often cited example is Procter & Gamble. They developed an intermediary called ‘Connect and Develop’. On this website problems and issues are posted and a network of customers, suppliers and globally dispersed employees can comment on this and propose solutions (Dodgson et al., 2006; Huston & Sakkab, 2006; Hansen & Birkinshaw, 2007). IBM developed another example of a technology supported knowledge community. Their ‘Innovation Jam’ creates an online place where employees can participate in brainstorm sessions on new ideas and new ways to use them, and in a second step employees can give suggestions for refining the ideas in order to speed-up to market (Chesbrough, 2003a; McQueeney, 2003; Bjelland & Wood, 2008). These idea-collecting websites are called ‘intermediaries’, of which also public examples exists; such as InnoCentive founded by Eli Lilly, NineSigma and YourEncore (Huston & Sakkab, 2006).

A knowledge community can also be built with universities and research institutes. These partners are especially useful in the fuzzy stage to explore alternative design configurations (Chesbrough & Prencipe, 2008). Universities generally perform fundamental research which could form a foundation for fundamentally different solutions. These collaborations often depend on weak ties and are often relatively informal by nature (Pertuzé et al., 2010). Business communities are engagements between market players with long-term perspectives and are often precursor of alliances (Gulati, 1998 & 1999; Blankenburg Holm et al., 1999; Gomes-Casseres, 2002).

Venture Capital

Connections, based on funding external knowledge development and in turn getting access to knowledge and/or value creation, are grouped under the term ‘venture capital’-modes. Venture capital could be provided by private sources; like business angels and traditional venture capital firms, or by corporate sources; then often called ‘corporate venturing’ (Schildt et al., 2005). Corporations can do this in different forms, ranging from awards to autonomous business units. Dushnitsky and Lenox (2005) found that corporate venture capital investments can increase patenting outputs of the incumbents when there is a weak IP regime and when the firm has sufficient absorptive capacity. This will hold when the collaboration objectives are strategically and focus on harnessing novel
technologies (Dushnitsky & Lenox, 2006) and not financial (Chesbrough, 2000; Ernst et al., 2005). Separate new venture divisions are considered to be especially suitable for disruptive innovations (Keil, 2002).

Intel is a well-known example with a corporate venturing-program in Silicon Valley. It is one of the largest corporate investors in R&D in the world (Dushnitsky & Lenox, 2005) and they accomplished to build strong connections with the start-up community with the program (Chesbrough, 2003a). DSM is another example of a firm which founded a venturing and business development group which provided venture capital funds to research projects in innovative regions, and made equity available to start-ups (Kirschbaum, 2005). Recently this group became part of the DSM Innovation Center (DVBD Home, 2011). In 1997, Lucent also had set up a New Ventures Group, to commercialize technologies that did not fit with the established business and to speed up the time for technologies to go into mainstream business (Chesbrough, 2000). This group could be thought of as a half-way house which would enable people or ideas, which are not ready yet to go out directly to the market, to further develop in a safe environment.

Alliances
Moving down in the innovation funnel uncertainty is reduced; this tightens intra-organizational relationships in order to secure the capture of the value creation. Formal commitment and active cooperation characterizes this group of open innovation modes (Gulati, 1999). Alliances include different forms of partnerships as; joint research (Teece, 1986), joint ventures (Stuart, 2000), licensing (Christensen et al., 2005), and all variations of contractual agreements. Joint ventures are a unique form of alliances since a new legal entity is created (Steensma & Lyles, 2000; Schildt et al., 2005). Alliances do not have to be limited to collaborations with one partner (Gomes-Casseres, 2002). They can be set up for numerous reasons, but they will only be considered as an open innovation mode when they involve at least partly R&D. There is an increasing trend in these kinds of cooperation, especially in high-tech industries since there the R&D intensity is high (Hagedoorn, 2002).

The studies on alliances are often industry wide with large samples and less are case studies or best practice analysis. Christensen et al. (2005) describe two collaborations between an amplifier start-up and an incumbent. The collaboration between ICEpower and Bang&Olufsen started as a joint research and later ICEpower licensed to other companies, and the collaboration between Toccata and Texas Instruments started as an exclusivity license agreement and ended as an acquisition. Gassmann and Enkel (2004) mention the exclusivity co-developing contracts between General Motors and their suppliers and the open collaborations of Magna Steyr with European automotive companies, like Volkswagen, BMW and Saab, of which all individual collaborations profit from the value creation of other collaborations.

Acquisitions
Towards the end of the funnel, where ‘commercialization’ of the new developed knowledge takes place, practices become relatively closed (Christensen et al., 2005). This is because organizations try to capture as much of the created value, which is now relatively certain to predict. Therefore, in this stage mainly inbound processes take place. Small organizations are spun in for internal development or diversification (Huston & Sakkab, 2006). Between biotech start-ups and large pharmaceuticals, acquisitions are the most common mode (Hagedoorn, 2002; Dushnitsky & Lenox, 2005).
Acquisitions also occur earlier in the development process, it is actually possible as soon as an idea is tested by an external party. However, when this is done the transition of the innovation through the funnel will often stay within the four walls of one company and the closed paradigm comes into place (Huston & Sakkab, 2006).
Appendix II. Alliance Forms

This appendix gives additional information on the different alliance forms that are found in the literature review and that can be formed when practicing open innovation. By explaining Figure 13 on page 17, repeated below, in more detail all forms will be addressed.

A first thing that could be seen in the figure is that ‘acquisitions’ are not considered as an alliance. The reason for this is that in this joint activity two, once separate companies are combined into one company (Barney, 1991). The corporate identity of (at least one of) the partners is lost and therefore do not meet the definition of an alliance. On the other side ‘simple market transactions’ are also not considered to be an alliance since it is not an evolutionary, flexible organization form.

Between those extremes there are different forms of contracts. Contracts that have a longer time-span than market contracts, like licensing agreements and R&D contracts are examples of alliances, although it incorporating mostly one-way communication and are therefore only a unilateral collaboration. Contract-based alliances with more interaction between the partners are a bilateral collaboration. Non-equity alliances are about investments in the technology and are associated with less commitment than equity alliances. In equity alliances investment are made in a partner’s financial assets and therefore parts of ownership are traded. A unique form of alliances are joint ventures, since a new legal entity is created (Steenisma & Lyles, 2000; Schildt et al., 2005). It could be said that higher levels of integration and commitment, have higher risks associated. Each form demands different competences and capabilities for the collaboration to become a success.

Overall, alliances are set up to acquire know-how and other resources (Stuart, 2000) or to get access to new markets (Kale et al., 2001; De Man & Duysters, 2005). A benefit of alliances, over other growth strategies as M&As and organic growth, is that alliances can aim at a very specific piece of knowledge (De Man & Duysters, 2005). By combining resources and sharing knowledge (Doz & Hamel, 1998), strategic alliances can provide flexible and efficient, fast to build solutions for the acquisition of new technologies in today’s turbulent environment at low cost (Duysters, 2001; Kale et al., 2001).
Gulati (1998) found that the social network, existing of all external contacts of an organization, determines which alliances are formed. Alliances can be formed with buyers and suppliers; so called vertical alliances, and with other (manufacturing) companies; so called horizontal alliances. The outcome-objectives can be explorative (to discover new knowledge) or exploitative (to leverage the technologies and discoveries of others) (Rothaermel & Deeds, 2004).
Appendix III. Success and Failure Factors of Alliances

In this appendix the success and failure factors of alliances are addressed. It gives more in-depth information on the factors mentioned in Table 1 on page 18.

Without commitment, an alliance is not likely to become a success (Duysters et al., 2002). Management support is essential (Rigby & Zook, 2002), and also commitment to learn from the experience is crucial. Kale et al. (2001) argue that proactive learning is, next to experience, a good predictor of alliance success. Managers could stimulate learning and building superior alliance skills by creating a dedicated alliance function that monitors formal process structures and support systems. These structures should manage and coordinate alliance activities according to the 4 C’s (Kale et al., 2001): 1) Capture tacit knowledge, 2) Codify the knowledge so it is accessible to others, 3) Communicate it to coworkers so it reaches others and create lessons and insights associated with these alliances experience so 4) managers and executives on alliances can be Coached. Advantages of dedicated alliance functions is that it gives a signal of importance of alliance management and it could enforce resources and commitment from higher management.

Another necessity for alliance success is trust. Trust is a prerequisite for knowledge sharing and innovative performance and its added value over a formal contract is that it reduces uncertainty between partners, frequency of interaction and so overall transactions costs (Aalbers, 2010). Lack of trust could result in fear of helping a competitor to develop a new technology, which could be an incentive to hold back in the alliance and lead to not striving for optimal joint value creation. This is what Duysters (1996, as cited by De Man & Duysters, 2005) calls ‘entering an agreement with a ‘secret agenda’. These firms do not participate in the co-operation for mutual benefit but have the incentive to absorb the other partner’s knowledge, skills and other assets. Therefore managers should work for establishing a trustful alliance.

Not participating in an alliance for mutual benefit will disrupt the synergy of a collaboration. It breaks the balance between partners and the relationship could be destroyed. Opportunistic behavior could be beneficial on short-term, but it will only harm the organization in the long run (Christensen et al., 2005). Therefore a trustful, collaborative relationship should be built with the collaboration partner.

Participating in alliances only to absorb the other partner’s knowledge, skills and other assets will also lead that the organization is ‘focused on internal alliance-issues’. Capturing value for own use is then more important to the organization than creating mutual benefit. This will bring the relationship out balance and break the synergy.

Weak cultural and/or operational integration of both partners in the collaboration can also reduce the likeliness of success. When partners only have superficial contact and working methods are not compatible value creation and value capture is difficult, since learning from the other’s knowledge is hard. De Man and Duysters (2005) state that intensive collaborations are more successful than loose collaborations, so regular meetings and interaction moments should be scheduled to increase the likelihood of success.
Another factor that could lead to failure is the lack of flexibility. When partners do not have a flexible attitude, while due to the knowledge development and market dynamics goals can change, friction will arise and the willingness to co-operate will be reduced. Managers should be willing to adapt the collaboration to changing environmental factors in order to succeed.

In contrast, to raise the likelihood of success managers should make sure that there is a strategic fit between the alliance partners. Stuart (2000) found that ‘the benefit gained from a portfolio of strategic alliances is determined in part by attributes of the partner firms that make up the portfolio, potential advantages of a relationship depend upon the social and material capital possessed by the contact.’ The resources and skills of the partner that are brought in the alliance should therefore be advanced and complementary to the resources and skills of the own company (Barney et al., 2001). In this way the knowledge base of both companies could be increased and new innovations can be developed by combing knowledge. A side note has to be made by this notion, since De Man and Duysters (2005) also found that partners having overlapping or similar knowledge outperform alliances in which companies have no similar knowledge background. This can be explained by the fact that if partners do not have knowledge in common, it is hard for them to understand the other. For a strategic fit partners should therefore have useful complementary knowledge that should match with the own knowledge base. This fit should not be determined by only looking at the needs for a project but by looking into the overall alliance portfolio (Duysters, 2001).

In order to stimulate success in an alliances it is also important that there is chemistry between the partners. Not only a technological fit is important but also a social fit. Partners have to get along with each other, otherwise value creation is very unlikely. Good chemistry is the result a positive, team oriented and trustful mindset in the collaboration (Duysters et al., 2002).

A crucial factor that could determine the success of an alliance is also the selection of the partner. A partner with compatible incentives and compatible culture should be chosen in order to ease the collaboration. Reasons for engaging in the alliance, level of commitment and willingness to allocate resources should be aligned. Gulati (1998) said that organization should use the information available within that social network on the credibility and competences of potential partners. He also said that, due to the importance of finding the right partner, building the right relationships becomes a key managerial challenge.

Alliances have the benefit over M&As that they can have a strong focus (De Man & Duysters, 2005). Collaborations can be directed to a very specific part of knowledge development and value creation, guided by a clear goal. This can help the alliance becoming a success, especially when the goal also creates the most value in the eyes of the customer.

The final success factor identified by Duysters et al. (2002) is ‘commitment to long term win-win’. Alliances are rather intensive collaborations (Duysters, 2001) and along the way different bottlenecks will be encountered. Willingness to take risks and to put effort in the collaboration is necessary to overcome these bottlenecks and to be able to eventually share the benefits. These benefits also have to be shared in an equal and fair way to let both partners perceive the collaboration as a win-win. Flexibility and creativity are needed along the way, and therefore partners should be willing to adjust the strategy of the alliance when necessary.
Appendix IV. Interview Guides

This appendix contains the interview guides used in the research. There were two guides developed for the exploration phase: one for the team members of the specific project on Technology X and one for involved general management. For both guides a form was constructed that could help interviewees to answer questions, this form is also given. For the descriptive phase a third interview guide was developed. In this order the guides and form are presented below.

Interview Guide 1: Explorative phase, project level

Interview Guide
This interview guide is to guide the interviews gathering data on project level. Interviews will be held with team members of the project on Technology X. This interview session is followed by interviews with managers on a higher level (these interviews will have another interview guide)
Both these interview sessions are in the exploration phase of the research; the goal of the interviews is to identify topics that should be further investigated in the descriptive phase of this research. The potential topics can vary from strategic, structural and process (under which also cultural aspects are assumed) level.
- 1 hour interviews
- In English
- Audio taping & notes making
- A form is made which could give the participant support in answering the questions. In yellow the related picture is indicated

General Introduction: (10 min)
- I am Franka van Breemen, from NL,
- performing my Master Thesis at Team C, until December. On open innovation; will explain OI in a minute
- First some general notes:
  - do you mind when this interview will be taped?
The purpose of this interview is
- to explore the current situation how they work and get insight in which activities are done.
- It will be anonymous: no names mentioned. I will code the interview so that only I will know with who the interview was
- the interview content will be analyzed and marked on its topics, together with other interviews, and these markings will indicate important topics for 2nd phase
- in this 2nd phase will be looked for activities within the situation pointed out in the 1st phase interviews, and come with suggestions what need to be done. These ‘what need to be done’- suggestions will be verified again in another round of interviews
- My research question deals with how OI could be implemented and support Department B. And I will investigate what activities need to be done for that. Specifically focusing on Technology X as example project, and Department B project wide.
- Short presentation of OI:
  http://prezi.com/dqwtr0e0ymgo/?utm_campaign=share&utm_medium=copy

Introduction questions: (10 min)
- What are his/her tasks & responsibilities? Background?
- What is his/her role related to the project?
- Can you explain me the project process of Technology X?
- Can you give a couple of examples on successes so far within the project?
- Can you give a couple of examples on bottlenecks so far within the project?
Open Innovation questions: (5 min per question; 30 min)

Collaboration
- Is there involvement of other people other than the Technology X team? Are they internal/external to Department B?
- Who are they, what is their role? Table IV.1 & IV.2
- Can you walk me through such collaboration?
  - How does this involvement take place? What are strength and weaknesses?

Customer
- Who are the customers of this project?
- Could you elaborate on the importance of involvement of the customer?
  - Could you explain how you address the customer needs?

Openness Picture IV.4
- Between the score of 1 and 10, can you explain how open vs closed the team is?
- Between the score of 1 and 10, can you explain how open vs closed the group is?
- Could you explain how open Department B could be to your opinion?

Development
- Can you give some additional information on the time planning of a Department B project? How long does it take to reach which TRL level?
- Can you share your idea on how many of the Department B inventions will eventually be implemented?
- Till when is Department B responsible for the development? When and how should others take over?

External potential
- What external knowledge (to Department B) could be useful for the Technology X project? In what stage of the project could that be useful? Picture IV.3 What kind of competences does …(partner type) … have that could be useful for Technology X? Funnel
- Could successes be due to the collaborations with those other people? How (much) did the other contribute to the success? And how (much) did your team contribute?

Closing questions: (10 min)
- What is your opinion about the opportunities of OI for the project?
- What is your opinion about the barriers to OI in the project?
- Is there anything else you would like to add?

Closing comment:
See you for the 2nd round of interviews, to give feedback on suggested activities and preliminary conclusions

Probe Questions:
- Would you give me an example?
- Can you elaborate on that idea?
- Would you explain that further?
- I’m not sure I understand what you’re saying
- Is there anything else?

Interview Guide 2: Explorative phase, General level

Interview Guide

This interview guide is to guide the interviews gathering data on group level. Interviews will be held with managers within Department B. This interview session is preceded by interviews with team
members on the project level of the knowledge area Technology X. (These interviews had another interview guide)

Both these interview sessions are in the exploration phase of the research; the goal of the interviews is to identify topics that should be further investigated in the descriptive phase of this research. The potential topics can vary from strategic, structural and process (under which also cultural aspects are assumed) level.

- 1 1/2 hour interviews
- In English
- Audio taping & notes making
- A form is made which could give the participant support in answering the questions. In yellow the related picture is indicated

**General Introduction:** (10 min)
- I am Franka van Breemen, from NL, TU Eindhoven, Innovation Management
- performing my Master Thesis at Team C, until December. On open innovation; will explain OI in a minute
- First some general notes:
  - do you mind when this interview will be taped?

The purpose of this interview is

- to explore the current situation how is worked and get insight in which activities are done.
- It will be anonymous: no names mentioned. I will code the interview so that only I will know with who the interview was
- the interview content will be analyzed and marked on its topics, together with other interviews, and these markings will indicate important topics for 2nd phase
- in this 2nd phase will be looked for activities within the situation pointed out in the 1st phase interviews, and come with suggestions what need to be done. These ‘what need to be done’ suggestions will be verified again in another round of interviews
- My research question deals with how OI could be implemented and support Department B. And I will investigate what activities need to be done for that. In the master thesis project I will investigate both Technology X as an example project and Department B project wide.
- Short presentation of OI:
  [http://prezi.com/dqwtr0e0ymgo/?utm_campaign=share&utm_medium=copy](http://prezi.com/dqwtr0e0ymgo/?utm_campaign=share&utm_medium=copy)

**Introduction questions:** (10 min)

- What are his/her tasks & responsibilities; your background related to Department B?
  - How are you involved in a project?
- Can you describe for me what the tasks and responsibilities of Department B are to Firm F and where those responsibilities end?
  - When (at what TRL level) and how should others take over? How long does this take (in years/months)?
- Can you define what a successful Department B project is to you? Can you give an example?
- What are common bottlenecks in a Department B project? Are these mainly related to 1) the generation of ideas, 2) selecting the right ideas or 3) development of technologies to a final project?

**Innovation Strategy**

- Could you describe the innovation strategy to me?
- Can you explain me the role of a business model? What is the business model of Department B? Why is, why not a business model relevant for Department B?
- Is there an IP strategy? If yes, could you explain me this strategy? If not, why not?
- Can you elaborate on how innovation is rewarded in Department B?
- How is performance measured in Department B: financial measures, perceptual factors, internal efficiency factors?
- What are in your opinion the three most important aspects for innovation?

**Collaboration**
- Is there involvement of other people in Department B projects from outside Department B?
  - Who are they, what is their role? Table IV.1 & IV.2
- Are those collaborations for idea generation or for gathering in depth information that we do not have ourselves?
- What are strength and weaknesses of the collaborations done?

**Culture** Picture IV.4
- Could you please explain the culture of Department B to me?
- Between the score of 1 and 10, can you explain how open vs. closed Department B is, and why? Is it TOO closed/open?
- Do you rather develop your own technology or do you rather use existing external technologies? Why?
- What is your opinion on risk-taking? Are risky activities common in Department B?
- Can you give your idea on whether external knowledge could be useful for Department B?

**Development**
- Can you share your idea on how many of the Department B inventions will eventually be implemented?
- All the adoptions done in the manufacturing processes, do they originate from Department B projects? Should they?
- What is the balance between new technologies introduced and improved existing technologies? Is Department B doing radical or incremental innovations?
- How satisfied are you with current performance regarding innovation?

**Customer**
- Who are the customers of a Department B project? Can you describe the relationships with internal customers?
- Could you elaborate on the importance of involvement of the customer?
  - Could you explain how customer needs are addressed?

**Closing questions on Openness: (10 min)**
- What is your opinion about the opportunities of OI for Department B?
- What is your opinion about external exploitation of knowledge?
- What is your opinion about the barriers to OI in Department B?
- Is there anything else you would like to add?

Closing comment:
See you for the 2nd round of interviews, to give feedback on suggested activities and preliminary conclusions

**Probe Questions:**
- Would you give me an example?
- Can you elaborate on that idea?
- Would you explain that further?
- I’m not sure I understand what you’re saying
- Is there anything else?
### Table IV.1 Partners

<table>
<thead>
<tr>
<th>Universities</th>
<th>Company Suppliers</th>
<th>Group Suppliers</th>
<th>Industrial Institutes</th>
<th>Internal Customer</th>
<th>External Customer</th>
<th>External Manufacturing Firms</th>
<th>Competitors</th>
<th>Distributors</th>
</tr>
</thead>
</table>

### Table IV.2 Modes

<table>
<thead>
<tr>
<th>Knowledge Community</th>
<th>Venture Capital</th>
<th>Alliances</th>
<th>Merger &amp; Acquisitions &amp; Spin in</th>
<th>Spin off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Closed</td>
<td>Open</td>
<td>Thermal &amp; Technological Similar</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td>Funding Start Ups</td>
<td>Funding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incubator</td>
<td>Joint Research</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awards</td>
<td>Joint Venture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Licensing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technological Complement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Figure IV.3 Funnel stages

![Funnel stages](image)

### Figure IV.4 Continuum Open vs Closed (x-team, x-Department B)

Open .................................................................................................................. Closed
Interview Guide 2

Introduction:
After the previous interviews, the goal was to find a focus point within the broad scope of open innovation. By going more into depth within an area, I can then come with practical suggestions about what activities are needed to implement open innovation. This interview is to get more in depth information.
- the interview will again be taped
- and for the report the answers will be anonymous

Topic: So what will this interview be about: It will be about how collaborations are organized. And then I am talking about formal ways of collaborations that I call ‘alliances’. I am aware that this is already done at Department B, but in the context of open innovation things can be different. What I talking about is that in the formal way of collaborating (definition Duysters et al. 2002) there can be different levels of collaborations: Picture (See final page)
- Explain different levels of integration, commitment and reversibility
- Do you understand this picture?

Type of alliances

- Can you reflect on the level of commitment/amount of resources in the collaboration that you are involved in?
  o What investments are made in a collaboration?
  o Why is the level of commitment the way it is?

- Can you reflect on the level of integration in the collaboration that you are involved in?
  o How close involved in the partners activities?
  o Is equity shared, or is it solely based on contracts?
  o Strategic, joint project, outsource work in project, idea scanning

- With who are those collaborations performed? Supplier, external collaboration partner, SME, universities? Is the technology you work on, an end product of the partner?

- What is the reason for setting up this collaboration (Aalbers, 2010)
  o Efficiency: R&D costs sharing, uncertainty/risk reduction, exploit synergy & economies of scale
  o Competences: technology exchange, capture knowledge spillover, promote technical standards
  o Positioning: co-opting or blocking competition, facilitate initial expansion of inexperienced companies/increase market power, access markets and create new investment options
    A Regulations, Reducing profit/market share (Extern, Reacting: Threats)
    B Limited capacity/finance, Low quality (Intern, Reacting: Weaknesses)
    C Service, Innovativeness, Technological capabilities (Intern, Proactive: Strength)
    D Commercializing technology, globalization, Customer needs (Extern, Proactive: Opportunity)

- What is the duration of such collaboration? On average, maximum, minimum
- Is the absence of internal competence a deciding factor for choosing alliances?
- Are alliances formed for one-time problems and/or for long term technology development solving multiple problems?
- If a technology is patentable, do you have a preference for a more independent alliance? (shared vs. individual patents) (Barringer & Harrison., 2000)
- Could you gain more (knowledge) by sharing more about the problem? Are you willing to share more about the problem with the customer, and would that change you choice for alliance type? (Barringer & Harrison., 2000)
- How easy is it to copy process technologies? For Technology X? We have done it, how long did it take?
Do you see possibilities for bilateral alliances? Co-operation, from open-innovation mind-set

Success & Failure Factors (Porter Lynch, 2001 as cited by Duysters et al. 2002)

- Can you tell me something about success and failure factors in a collaboration?

Success factors:
1) Strategic fit partner characteristics
   Strategic synergy,
2) Good chemistry
   Good relationship, similar culture, trust
   How is the communication working? Does it work ok? Why is it not working / or working. Are there cultural differences that make it more problematic?
   - Can you reflect on the team work? (team experience, team skills, team stability)
   - How do you perceive knowledge sharing in the collaboration?
   - How is the mutual commitment in general for alliances? is it in balance?
3) Adequate partner selection
   Complementary reasons for collaboration
   How do they select partner?
   Complementarity in resources (Barringer & Harrison, 2000)
4) Create win-win
   Focus on maximal value creation for the customer
   Split execution, risks and revenues equally and honestly
5) Long-term Win-win
   Willing to take risks and commitment to flexibility and creativity, willing to transform the structure of the alliance
6) Dedicated alliance function/ alliance management system
   Facilitating alliance learning, experience in alliances increases success
7) Strong focus
   To focus, specific, concrete goals, time schedules, responsibilities and measurable results are needed

Failure factors:
1) No commitment
   Management support, available resources, legitimacy within the partner firms
   Change in strategy of the partner
2) Lack of trust
   More focused towards competition rather than cooperation: not n win-win. (Avoiding opportunistic hazards)
   - How is knowledge tried to protect? : which control mechanisms: contract, equity, layered collaboration scheme (Aalbers, 2010)
     - What role do contracts play, what kind of contracts are there? NDA all the same?
     Did you formulate the contract with your alliance partner as complete as possible?
     Does the contract form the core of your relation with the partners? (Nooteboom et al., 1997 as cited by Aalbers, 2010)
     Are the specific investments to meet the objective of the alliance equally shared between your company and your alliance partners? (Aalbers, 2010)
   - What role does trust play? Does it reduce the need for a contract? (Bierly & Gallagher, 2007)
     - Contractual trust, competence based trust, goodwill trust
     Did you partner always stick to promises that had been made? (Aalbers, 2010)
     Do you hold a lot of confidence in the expertise of you partners, and did this confidence increase through time? (Aalbers, 2010)
     Is there much specific technological know-how required to effectively cooperate with you alliance partners? (Nooteboom et al., 1997 as cited by Aalbers, 2010)
3) Bad cultural/operational integration
   Similar incentive systems, way of working, procedures, goals, difference in culture: evaluation on the relationship often ignored (potential partner assessed on quantitative criteria such as technical and financial capabilities)

4) No strategic synergy
   Wrong choice of partners; secret agendas, unexpected lack of skills, overestimated financial situation of the partner, goal divergence

5) No flexibility, no flexibility/adjustments in collaboration
   Room for Growth opportunities, Are alliances adjusted over time to changes in the environment?

6) Focused on internal alliance-issues, as organizational mission/customer
   More attention is paid to the preparation and negotiation than to the actual management. No evaluation and adjusted to reach goals. Hinder crisis management

Introduction to second picture: (Duysters et al., 2002)
One can organize strategic alliances in 5 steps. These steps themselves consist of different sub activities.
   - Show picture of steps and explain a bit (see final page)
   - Do you understand this picture?
   - Can you elaborate on how these steps are performed at Department B?

Supporting Questions:
   - Is in the roadmaps an idea/plan/vision included on external collaborations? How have you identified it? Are gaps in internal competences identified
   - How was the relationship established? Did it develop over time? (Aalbers, 2010)
   - How is a potential partner identified? (Bierly & Gallagher, 2007)
   - By who are collaborations initiated:
     - Top management, project management, specialists, external partner
   - Is all information available to judge the fit? Are alternatives analyzed? How long does it take to identify a partner and assess the appropriateness of the partner?
   - How long does it take to set up an alliance?
   - What is arranged in this time?
   - How is the collaboration integrated in the project?
   - Does the collaboration has an own ‘plan’? How is that plan built up? Is there a vision/mission formulated for the collaboration?
   - Do you have anything else to add?

Thank you for your time and answers. Next week, Thursday 19th, 15.00 I will give a presentation about my study, hope to see you there.

Duyster et al. 2002, Wildeman & Kok 1997
## Appendix V. Observation Guide

**Project:**  
**Name:**  
**Week:**

### Observation Guide

In the observations I want to observe the project process. How open is the way of thinking? And what are barriers in open thinking? From another perspective then the interviewees.

**How is dealt with a problem?**

<table>
<thead>
<tr>
<th>Was there a problem last week</th>
<th>Technical Difficulty</th>
<th>Information Lacking</th>
<th>Resource Lacking</th>
<th>Not allowed to do something</th>
<th>Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What actions were taken to try to solve this problem</td>
<td>Solved it yourself</td>
<td>Contact the Manager</td>
<td>Contact a Co-worker</td>
<td>Called Someone Externally on the phone</td>
<td>Other:</td>
</tr>
<tr>
<td>Did new ideas arise for this problem of the project</td>
<td>Yes and included in project</td>
<td>Yes but not used</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**What Open Innovation aspects come into play during a work week? External Contact:**

<table>
<thead>
<tr>
<th>How many contact with external</th>
<th>0-2; once a week</th>
<th>3-5; daily</th>
<th>6-9; almost twice a day</th>
<th>10-15; more than twice a day</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Who</td>
<td>Factory</td>
<td>Business Unit</td>
<td>External customer</td>
<td>Supplier</td>
<td>Other:</td>
</tr>
<tr>
<td>What was discussed</td>
<td>Project specific Problem/question</td>
<td>Depth: Deepen knowledge</td>
<td>Breadth: inspirations &amp; ideas</td>
<td>General Problem/Question Depth</td>
<td>Breadth</td>
</tr>
<tr>
<td>External contact initiated by:</td>
<td>Respondent him/her-self</td>
<td>Manager</td>
<td>External Partner</td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>What information was given?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What information was received?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was goal of contact obtained:</td>
<td>Yes</td>
<td>Partly</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Why: | | | | |

| Is there anything that would have been helpful if you got it, in case you would not have it yet/enough? | More resources | Extra knowledge | Management Support | Other: |

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Appendix VI. Observed Modes

This appendix analysis in what types of modes the R&D Department B engages. This is an extension of the information given in 4.1.4.

In the first stages of R&D, the department participates in knowledge communities. These modes are rather informal and mainly observing and absorbing information rather than actively sharing problems and knowledge is possible. Documents and interviews revealed that Department B visits conferences and congresses, organizes them and is member of several consortia spread over different technology areas. Information and ideas gained from these activities are kept through the system of gatekeeping. Online versions of knowledge communities are perceived less suitable among the employees of Department B, since specialist knowledge is required to understand the problems at hand and contribute to the technology development. Especially the open communities, like InnoCentive, might therefore not be suitable. Firm A has however an internal version of ‘posting problems and employees who can contribute with ideas and solutions’ on its intranet. Although, it was indicated in interviews that this is not much used and totally not by R&D department B.

An interviewee stated that Department B has contact with a venture capitalist related to a university. They have been asked to send in ideas, so the venture capitalist could set up the projects and invest in it. This is however not yet used, since no suitable ideas have been found to put in here. Internally, Department B has created a venturing space for the very uncertain stages of new ideas. They called this ‘the greenhouse’ and it supports promising ideas that are generated in the gatekeeping. It has similarities with the New Venture Group of Lucent as described by Chesbrough (2000), although the Greenhouse does not have the objective to spin out ideas and involve others in the development. Ideas ventured can be inspired by external knowledge, but the greenhouse is focused on internal ideas and internal development of these raw ideas. It could be said that Druckers traditional view of separating new and existing business (Chesbrough, 2000) is therefore a more leading reason for the existence of the greenhouse, than the willingness to be open.

Interviews showed that in the later stages of R&D, Department B forms alliances with different partners, mainly suppliers and other manufacturing firms (who are potential future suppliers). These alliances can be judged rather closed. Department B requires a lot of control and prefers ‘to say less than more’. Not much integration of the partner in the business of Department B is allowed and partners are given specific requests about what they should develop. Just like policies stress that in all external contacts NDA very important, ‘nothing is done without an NDA’ in alliances.

The mode ‘acquisitions’ is not observed at Department B. Documents showed that acquisitions are made organizational central, but not by the department itself, for the benefit of R&D and acquiring technologies. It is considered that ‘the R&D department itself does not invest in this’. Department B is about ‘doing research for technology development and that is why the business units invest in this R&D department.’ This attitude stimulates a rather traditional, internally focus mind-set.