

Master Thesis

R&D OPENNESS CONFIGURATION – THE ROLE OF APPROPRIABILITY, COMPETENCE LEVEL AND CULTURE

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Abstract

Title: R&D Openness configuration – the role of appropriability, competence level and culture

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Thesis purpose: This thesis aims to explore how an organization configures its R&D openness and determine which role the factors of appropriability, competence level and culture play in this context. However, instead of considering R&D openness as one general concept, it is divided into four different types of openness. The objective of this study is to contribute in solving the literature gap of providing better insights on the different combinations of openness within a firm and how certain factors influence such a configuration. This will further academic understanding of a firm's R&D openness decisions.

Methodology: A case study design was applied as the authors conducted an internship at an organization (Bona). Through informal interviews, talks and observations within the company, and the conduct of a preliminary literature review, three influential open innovation factors were identified: appropriability, competence level and culture. Subsequent to this process, a literature review was conducted which was followed by the empirical data collection that was initiated through qualitative interviews with key persons within the R&D department of the case company. This allowed for in-depth insights into understanding why this firm settled for an R&D openness configuration – through the lens of the three factors. Thereafter, the empirical data was analyzed by comparing it with the concepts from the literature review – and a set of conclusions were drawn that have a degree of theoretical generalizability and may thus apply to a wider range of organizations than the case company alone. Consequently, this study aims to be a bridge between rich qualitative insights and deductive, quantitative follow-up studies.

Theoretical perspectives: The overarching concept within this thesis is Open Innovation (Chesbrough, 2003, Dahlander and Gann, 2010, Lichtenthaler, 2011) within an R&D setting (Fey and Birkinshaw, 2005; Enkel, 2009; Gassmann, 2010). It is specifically looked into how organizations can configure their R&D openness (Dahlander and Gann, 2010) and how this configuration is influenced by factors like appropriability (Teece, 1986; Cohen, Nelson and Walsh, 2000; Dufresne and Offstein,

2008; Anderson, 2011), competence level (Drechsler and Natter, 2012; Cohen and Levinthal, 1990; Zahra and George, 2002; Clausen, 2013; Berchicci, 2013; Lin, 2012; Schmidt, 2010, Barge-Gil, 2010) and culture (Herzog, 2011; Katz and Allen, 1982; Gilbert, 2005; Chesbrough and Crowther, 2006).

Conclusions: The research indicated that organizations can display different configurations of R&D openness with regards to the different business areas or resource classes they deal with. Appropriability and competence level were found to have different influences on different types of R&D openness, and hence, are important factors in explaining the selected configuration. Additionally, it was found that culture is heavily impacted by these concepts – and it is proposed that this may be an exacerbating factor that may bias otherwise rational considerations when setting the configuration of R&D openness. The study has further developed academic understanding of how a firm's R&D openness configuration is explained by the influences of appropriability, competence level and culture. In addition, several interesting areas for future research were identified also.

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Sven & Vanessa

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1 Introduction

1.1 Background

Closed innovation is a practice that proved to be a valuable strategic tool for most of the twentieth century (Chesbrough, 2003). Companies that applied this concept usually emphasized that organizations need strict control in order to successfully innovate and hence kept all organizational activities in-house (Chesbrough, 2003a; b). However, this isolation paradigm is believed to be outdated when it comes to today's innovation management (Chesbrough, 2003). Due to the rise of the internet, communication technology has advanced substantially making not only market information more readily available but also facilitating market interaction (Knight and Cavusgil 1996; Aspelund and Moen 2005). As a result, information flows more freely and cheaply over the uncountable channels supplied by the internet and human resources are more widely dispersed as today's technologies are more closely connected than ever before (Chesbrough, 2003). Another consequence of this fast paced business landscape can be observed in shorter product life cycles and windows of opportunities becoming increasingly smaller (Kuratko et. al, 2011). This has fueled increased global competition, where agility, flexibility and specialization are now the cornerstones of competitive advantage (Gassmann, 2008; Bughin, 2008).

Consequently, Chesbrough (2003a) argues that firms need to become accustomed to the concept of OI (OI) by 'accessing and exploiting outside knowledge, while liberating their own internal expertise for others' use. OI can enhance an organization's responsiveness towards the environment (Chesbrough, 1996) and allows systematic accessing of resources outside a firm's boundaries (Hoffman, 2007).

1.2 Problem discussion

As the field of OI has enjoyed extensive attention during the past years, many aspects of the concept have already been investigated. Clausen (2013) for example examined the required organizational capabilities to engage in OI whereas Lazzarotti, Manzini and Pellegrini (2011) and Chesbrough and Garman (2009) considered different models for opening up the innovation process. Further, Kang and Kang (2009) investigated the relationships between the acquisition of external knowledge and performance of innovation. However, since the OI discussion is rather new, there are still areas that have not been addressed yet. While Dahlander and Gann (2010) identify the various types of OI in regards to inbound and outbound activities, they also voiced the need to further elaborate on the different combinations of openness within a firm. As this configuration can be assumed to be triggered by certain contextual factors, we will examine three factors that are believed to be of influential nature in regards to a firm's types of openness.

As an over-encompassing framework, a recent model by Dahlander and Gann (2010) is applied. In the course of their research the author duo identified four different types of openness that a firm can display simultaneously. However, the authors do not provide any prescriptive value by investigating factors that may influence the decision to settle

for a certain configuration. Next to this, a theoretical framework is built from academic literature, which is largely based on a model of Drechsler and Natter (2012) that is aimed at understanding a firm's openness decisions. While their model mainly discusses "the underlying drivers of a firm's degree of openness", it does not distinguish between the different kinds of openness that Dahlander and Gann (2010) identified. Additionally, Drechsler and Natter (2012) do consider appropriability and competence level in their study, yet the notion of culture was neglected as an influential factor. However, as several authors have identified culture to be a crucial variable in explaining openness, it was decided to further include this element in our research (Katz and Allen, 1982; Laursen and Salter, 2006; Herzog, 2011). Further, since Drechsler and Natter (2012) used a quantitative approach to this matter, it is believed that qualitative insights will add additional understanding to the proposed relationships.

Consequently, combining parts of these two frameworks is expected to enhance the understanding of a firm's R&D openness decisions. For example, it could be that certain factors inhibit a particular type of openness, but this may not be influential in other areas. This would be very interesting for organizations to know since their situation may be ill-suited to engage in a particular type of openness, but they may be well-prepared for other forms of openness – and still reap benefits of OI.

1.3 Research question

Through informal interviews, observations and a preliminary literature review we identified three factors, appropriability, competence level and culture, to be of influential character when determining the openness configuration of an R&D department. As a result, the main data collection focused on these three elements and their relationship in regards to the four types of openness identified by Dahlander and Gann (2010). Based on a literature review and the provision of a brief background of the case company, the research question will lead through the various steps of this study. While firstly the "how" part of the R&D configuration will be answered by categorizing the firm's OI activities according to the identified four OI types, subsequently the "how" character of the factors of appropriability, competence level and culture will be addressed.

Consequently, the resulting research question reads as follows:

How does a firm configure its R&D openness and how is this influenced by the factors of appropriability, competence level and culture?

1.4 Purpose

Conducting a six months internship within an organization provided the thesis authors with a unique opportunity to examine a phenomenon in-depth and understand its underlying contextual determinants. This describes the objective of this thesis rather well: to add understanding of the configuration of R&D openness by investigating how a set of contextual factors (competence level, appropriability, culture) influence such decisions. Therefore, a case study design was picked as this research method may provide 'rich, empirical descriptions of particular instances of a phenomenon'

(Eisenhardt, 2007). The inductive element of this research design allows filling of the aforementioned gap by extending institutional theory. Additionally, Morrison (2000) argues that culture is complex, amorphous, ethereal and multi-layered – ‘the ability of qualitative data to explicate the complex social process involved’ is another reason why a case study design lends itself perfectly to investigate the phenomenon (Eisenhardt, 2007). Through looking into a particular case, new theory may be built; the case study may then be ‘a bridge from rich qualitative evidence to mainstream deductive research’ (Eisenhardt, 2007). Overall, this research will not only add to literature because it addresses an issue that has been voiced as an interesting avenue for further research, but also because it further builds upon existing studies by combining different areas (types of R&D openness with contextual factors) in a way that, to the author’s knowledge, has not been done before. While this research aims to fill this gap, it may also add knowledge in regards to a practical point of view as a better understanding of a firm’s effective management of R&D openness may be gained.

Even though the generalizability of this study is limited, some findings may still prove to be of use to firms that operate in a similar environment. The subject of investigation for this thesis is a Swedish chemical and coatings producer, called Bona. As the company is heavily dependent on its R&D practices to differentiate its offering from competitors, it is strongly committed to innovation practices. Since Bona management is very interested in OI, they have made conscious decisions about the openness configuration of their R&D practices. Consequently, this case study provides a solid foundation to investigate decisions with regards to R&D openness.

1.5 Key concepts

The overarching topic of this thesis is OI, defined by Chesbrough (2003a) as ‘accessing and exploiting outside knowledge while liberating own internal expertise for others’ use.’ This topic is broadly considered in the literature review as to get a clear understanding of this wide phenomenon. Subsequently, the various types of R&D openness that a company can engage in simultaneously are considered according to the Dahlander and Gann (2010) model, which is supplemented with additional academic literature. In order to understand and explain the R&D openness configuration, three concepts will be examined in this context: appropriability, competence level and culture. Each of these factors are explained individually and founded in academic literature. To provide an initial understanding of these concepts a brief introduction to each concept will be given: appropriability is an important issue as firms that engage in value creation activities also need to apply mechanisms that capture the respective value created, because otherwise commercial success is impaired (Fischer and Henkel, 2012; Teece, 1986). Further, competence level of an R&D department was included as it may be a strong influential factor on the degree of openness, since firms with strong in-house R&D capabilities were found to be better positioned to absorb information from the external environment (Lin, 2012; Hagedoorn, 2012; Caloghirou, 2004; Berchicci, 2013). Finally, as Herzog (2011) proposes, ‘the move from closed innovation to OI needs to be accompanied by a change in the underlying culture.’ An

organizational shortcoming known as the ‘not-invented-here syndrome’ and its counterpart the ‘not-sold-here syndrome’ may severely inhibit OI practices (Katz and Allen, 1982; Herzog, 2011).

2 Literature review

2.1 Overview of the phenomenon

This paragraph serves as a general introduction to the phenomenon that is labeled ‘Open Innovation’ in academic literature. According to Chesbrough (2003a), internal R&D capabilities were a strategic asset, based on the assumption that successful innovation requires control. In order to maintain such control, organizations adhered to a closed innovation philosophy that “embraces a strategy of vertical integration and exclusive control”, an approach that according to Chesbrough (2003a), worked well for most of the twentieth century.

However, substantial advancements in communication technology has not only made market information more readily available, but also facilitated market interaction (Knight and Cavusgil, 1996; Aspelund and Moen, 2005). As a result, information flows more freely and cheaply over the uncountable channels supplied by the internet, and widely dispersed human resources are more accessible than ever due to connectedness (Chesbrough, 2003a). Increased global competition has infused agility, flexibility and specialization practices as the contemporary fundamentals of competitive advantage (Gassmann, 2006; Bughin, 2008).

The change towards a global economy implies that specialized organizations can now serve international markets: the dynamics of several high-tech markets are altered as small, flexible specialist companies challenge large, generalist competitors (Iansiti, 1997), increasing the pool of competitors. This more dynamic, competitive, fast-paced business landscape can be observed in shorter product life cycles and windows of opportunities becoming increasingly smaller (Kuratko et. al, 2011).

Consequently, responsiveness is an indispensable quality in order to survive in this new global economy (Gassmann, 2006). As a final product may incorporate technology from a variety of fields, it is a misconception to expect that organizations can master all activities, and achieve competitive superiority in each link (Iansiti, 1997). The main fallacy of the closed innovation principle is an organization’s belief that it controls the best resources in its respective field (Chesbrough, 2003a). Even if organizations would achieve a specialized level in all of its business activities, the organization would grow excessively large, which in turn would exacerbate bureaucracy and impair responsiveness to the market (Greiner, 1998; Chesbrough, 1996). Therefore, Sampson (2007) argues that the enhanced responsiveness of small external actors needs to be injected into bigger organizations.

In order to prosper, Chesbrough argues that firms need to become accustomed to the concept of OI: “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively” (Van de Vrande, 2009). This implies that organizations cooperate with, and benefit from, ‘sourcing external ideas and knowledge from suppliers, customers, competitors, consultants, universities and public research organizations’ (Dahlander and Gann, 2010). As the R&D departments of many organizations are the ‘innovation hubs’ of the firm, much of the academic literature interchangeably talks about OI and open R&D (Chesbrough, 2003a; b; Enkel, 2009; Gassmann, 2010). Fey and Birkinshaw (2005) recognize that R&D settings may be most suitable for OI research, as ‘R&D departments rely to a greater degree than most departments on new sources of knowledge on an ongoing basis. Because innovation primarily occurs through new combinations of resources, a fertile R&D environment relies on a constant inflow of knowledge from other places.’

Through OI, companies can benefit from increased responsiveness towards the environment, but also avoid their own bureaucracy (Chesbrough, 1996). Additionally, OI practices allow organizations to systematically access resources outside a firm’s boundaries (Hoffman, 2007), which may ‘deepen the pool of technological opportunities’ (Laursen and Salter, 2006). This is in line with Iansiti’s (1997) findings stating that it is virtually impossible for organizations to acquire the status of core competence in all of its activities. Consequently, OI allows an organization to tap into the relative strengths of other players in the market. As Brez (2009) proposes, ‘OI brings to light creative ideas and dramatically expands the innovation network outside of the usual experience base.’ Further, Keupp (2009) proposes that organizations are generally better at exploitation of their current competitive advantage than at exploration behavior to detect future competitive advantages. Organizations need formalization, low complexity and high centralization in order to exploit their current competitive advantage to the fullest and ensure organizational continuity in every-day practices. However, exploration requires conditions of low formalization and low centralization, which organizations find hard to handle within their bureaucratic machines (Kuratko et al. 2011; Datta, 2011). Hence, organizations can use OI initiatives as a tool for exploratory activities.

As Lichtenthaler (2011) reports, organizations in many industries show a tendency towards acquiring external technologies to complement their in-house competence pool – this is the most common view of OI. Organizations may solely engage in such inbound OI, but they may also engage in outbound OI. Outbound OI is more concerned with external commercialization or exploitation of in-house inventions (Huizingh, 2011; Lichtenthaler, 2011). In this instance, organizations may ‘attempt to sell ideas and resources in the market place’ (Dahlander and Gann, 2010). As McGrath and Keil (2007) propose, firms may sell or license out inventions if they prove no strategic fit for the selling organization, which facilitates a solution to still extract value out of an invention.

Next to a series of benefits, the concept of OI is subject to organizational risks as well. As Chesbrough (1996) proposes, distributing responsibility for innovation also lowers the degree of control over the process – coordination failures may evaporate innovation efforts. Keupp (2009) and Christensen (2005) argue that OI practices may be subject to considerable transaction costs as many external actors may be involved. Research by Laursen and Salter (2006) demonstrated that innovation search may be time consuming, expensive and arduous. They observed an inverted U-shaped relationship between the number of external sources applied in innovation and innovation performance – too little or too many external parties may negatively impact innovative performance. Another risk of relying too heavily on external actors to perform innovation for you is that organizations develop as hollow entities (Chesbrough, 1996). They have coordination capabilities as a core competence, but fail to develop strong internal capabilities and are subject to strategic hazards, especially if cooperation with external actors becomes problematic or ceases (Chesbrough, 1996; Windahl, 2006; Davies, 2007; Matthyssens, 2008).

Perhaps the biggest risk of OI is related to appropriability: organizations need to make sure that they can capture the rents from dispersed technological development, because otherwise there is no value in cooperatively realizing inventions – external parties can even steal innovations or ‘free-ride’ on the innovator’s investments by using the innovation in their business (Teece, 1986; Helfat, 2006; West, 2006; Lieberman, 1988). Since this matter is of influential power when it comes to engaging in OI activities, it will be discussed more in detail later on in this thesis.

2.2 Types and configuration of R&D openness

When discussing the configuration of R&D openness, it has to be considered that openness ‘is not a binary classification of open versus closed’ (Chesbrough, 2003a). To the contrary, a firm’s openness is distributed between internal and external innovation strategies, which can be located along a continuum ranging from closed to open (Drechsler and Natter, 2012; Huizingh, 2012; Dahlander and Gann, 2010). A firm’s position on this openness continuum is not rigid, as some parts of the innovation activity are open while others are closed (Chesbrough et al., 2006; Enkel et al., 2009). Several authors have proposed different models to captivate the configuration of openness. Pisano and Verganti (2008) propose a model with four different collaboration modes: the desired choice of openness depends on ‘how open or closed membership in a collaborative network should be – and how flat or hierarchical the collaborative governance structure should be.’ In contrast Lichtenthaler and Lichtenthaler (2009) classify openness by relating internal/external knowledge flows to absorptive capacity, dynamic capabilities and knowledge management. Another model is proposed by Chesbrough (2003a) in which the innovation outcome is linked to the innovation process; both dimensions range from closed to open. In this thesis, the model proposed by Dahlander and Gann (2010) is applied to classify the types of openness and thus determine the configuration. The authors conducted a thorough literature research amongst a 150 scientific publications with regards to OI - and

grouped the types of openness they observed. Based on this, a composite framework was established with four areas through which organizations can display different types of openness simultaneously. This framework is relatively recent (2010), is well-founded on earlier literature and the four factors provide a reasonable research load considering constraints in time. This model is elaborated on in further detail in the next paragraph.

2.3 R&D openness: a configuration model

Dahlander and Gann (2010) developed a model that consists of four different types of openness. Each type is shortly elaborated on in this paragraph. This is important in answering the first part of the research question *‘How does a firm configure its R&D openness and how is this influenced by the factors of appropriability, competence level and culture?’*

2.3.1 Inbound innovation: sourcing

Dahlander and Gann (2010) define sourcing as the degree to which organizations utilize external sources of innovation. It is about ‘leveraging the discoveries of others’ – and does not include payment as the primary tool to acquire knowledge. As Chesbrough (2003a) argued, not all smart people work in one company; organizations can access resources through external networks (Datta, 2010). ‘Firms that manage to create a synergy between their own processes and externally available ideas may be able to benefit from the creative ideas of outsiders to generate profitable new products’ (Dahlander and Gann, 2010). Sourcing may allow organizations to become more responsive to the environment (Chesbrough, 1996) and allows ‘firms to complement internal R&D with external initiatives to increase returns on innovation, which allows mature organizations to capture the strategic value of emerging technology and entrepreneurial ventures’ (Battistini, 2013; Hoffman, 2007). It allows firms to tap into the relative strengths of others (Iansiti, 1997). Next to the prevailing view of OI research focusing on businesses and associations, collaboration with customers may be an important source of external input into innovation practices as well. Differentiation is increasingly dependent on depicting customers as the epicenter of doing business, and hence, involving customers generates more market-driven innovation (Vaisnore and Petraite, 2011; Vargo, 2004). Customers can play a role in different stages of the innovation model, for example, in idea generation, development and product commercialization (Vaisnore and Petraite, 2011). Such customer involvement is found to be significantly correlated with higher levels of innovative sales (Laursen, 2011).

2.3.2 Inbound innovation: acquiring

Dahlander and Gann (2010) define this type of openness as ‘acquiring input to the innovation process through the market place; licensing in and acquiring outside expertise.’ Although both types of inbound innovation have a very high degree of similarity, there is one main difference: this transaction involves money. Hence, instead of R&D cooperations in which both parties contribute with knowledge resources, the company that acquires technology pays for it with financial resources – and may get full ownership of the invention.

2.3.3 Outbound innovation: revealing

Dahlander and Gann (2010) propose that organizations can reveal their resources to the external environment for indirect benefits: as OI practices are usually transactions, organizations need a ‘currency’ in order to realize inbound innovation. As Henkel (2006) found, organizations can selectively reveal innovations in order to get developmental support from external players – the revealing organization basically gets resources in return. Dahlander and Gann (2010) also propose that organizations may gather legitimacy from the external environment for their innovation – by assessing how the external environment responds to it. Next to this, this innovation type can give an industry the ‘ability to build upon each other’s work which may result in a steady stream of incremental innovation across the community of firms’. This is especially valuable in cases in which ‘the innovation provided by one firm makes the product invented by another firm more valuable’ (Levin, 1987), for example, through a bigger installed base of users (Schilling, 2010). Dominant design adoption, defined as a market’s acceptance of a standard product design architecture that defines the product category (Srinivasan, 2006; Tegarden, 1999) may also be speeded up through selectively revealing resources to lure competitors into adopting a company’s design.

2.3.4 Outbound innovation: selling

As Dahlander and Gann (2010) propose, this type of OI refers to “how firms commercialize their inventions and technologies through selling or licensing out resources.” McGrath and Keil (2007) argue that technologies that prove no good fit with the firm’s strategy may be interesting to organizations that possess the infrastructure to turn it into a success. Teece (1986), Helfat (2006) and Fosfuri (2006) indeed propose that other parties may have a better organizational set-up and commercialization capabilities to fully exploit the technology and hence may be interested in such intellectual property. The selling firm then gets financial resources for it and in this manner further exploits its potential by extracting value out of its non-marketed resources (Chesbrough, 2003a). As Lichtenthaler (2005) found, there are major imperfections in knowledge markets that create opportunities for organizations to commercialize their ‘excess’ innovations. This is a growing trend and some pioneers in this field, like IBM, ‘realize annual licensing revenues of more than one billion US dollars.’ However, selling technology is a complex endeavor and ‘extracting revenues from the sale of technology remains a challenge for most firms’ (Bianchi, 2011; Lichtenthaler, 2005). Lichtenthaler (2005) suggests that it is hard to sell technological resources as they are intangible, idiosyncratic, have uncertain cash-generation potential and have poorly defined property rights. Additionally, the predominantly tacit nature of technology resides in individuals and is difficult to articulate and to transfer.

2.4 Theoretical model: factors influencing the configuration of R&D openness

A theoretical model is compiled to examine the second section of the main research question ‘*How does a firm configure its R&D openness and how is this influenced by the factors of appropriability, competence level and culture?*’ Based on an extensive

literature review, three areas are identified that may explain the configuration of R&D openness. Each of these areas is presented and elaborated on in this paragraph.

2.4.1 Competence level

Having high competence levels is a powerful organizational ability and is believed to be of influential character when it comes to OI activities. Firstly, as Drechsler and Natter (2012) found, companies with high competence levels are regarded as more attractive partners when it comes to knowledge sharing or other collaboration works. Further, the competence level of an R&D department is strongly related to the concept of ‘absorptive capacity’, which is ‘the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends, which is critical to its innovative capabilities.’ This is largely a function of the firm’s level of prior knowledge (Cohen and Levinthal, 1990). Hence, the higher the competence level of an R&D department, the better suited it is to make sense of external knowledge that flows into the company, indicating strong absorptive capacity. Zahra and George (2002) provide a similar definition by dividing absorptive capacity into two different groups: potential absorptive capacity and realized absorptive capacity. While the former includes knowledge acquisition and assimilation, the latter is a function of transforming and exploiting the acquired knowledge. “Acquisition” ‘refers to a firm’s capability to identify and acquire externally generated knowledge that is critical to its operations’, which mainly relates to partner identification (Zahra and George, 2002). Lin (2012) found that partner selection is essential since R&D alliances were most successful if the technological distance between the actors was moderate. A small difference would create a substitutive effect, whilst large differences may be beyond the firm’s absorptive capacities. In addition, Clausen (2013) found that internal R&D, training and an educated workforce are core aspects of a firm’s absorptive capacity. Assimilation is the next step in the absorptive capacity chain and is defined as “the firm’s routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources” (Kim, 1997a,b; Szulanski, 1996; Zahra and George, 2002) which is followed by the “transformation” that is characterized by internalizing and converting the foreign knowledge to the firm’s existing structures (Zahra and George, 2002). The final step of absorbing external resources is represented by “exploitation”. As acquiring, assimilating and transforming all portray time-consuming and costly processes, this last stage is characterized by harvesting and benefiting from the attained knowledge (Zahra and George, 2002). Both forms of absorptive capacity, potential and realized, have “separate but complementary roles that co-exist at all times” (Zahra and George, 2002). In other words, firms can be good at transforming knowledge, yet this does not necessarily mean that they are good at acquiring knowledge. Consequently, firms have to be adept at all four absorptive capacity stages in order to capitalize on external resources.

Many studies have proven that if organizations build strong in-house R&D capabilities, they are better positioned to absorb information from the external environment, (Lin, 2012; Hagedoorn, 2012; Caloghirou, 2004; Berchicci, 2013). Hence, R&D intensity is

often employed as the parameter to determine an organization's in-house R&D capabilities (Lin, 2012; Hagedoorn, 2012). Schmidt (2010), however, found that absorptive capacity is cumulative and that continuous R&D activities are far more significant in building absorptive capacity. Therefore, absorptive capacity is history and path dependent (Cohen and Levinthal, 1990). Further, an informal, knowledge-sharing culture and a highly skilled labor force proved to be significant in building absorptive capacity (Schmidt, 2010).

Hagedoorn (2012) indicated that firms with weak in-house R&D capabilities risk a substitutive effect when engaging in external R&D; at the other end of the continuum, Berchicci (2013) found that after a certain threshold, companies risk a substitution effect also which is even stronger for organizations with high R&D capabilities. Laursen and Salter (2006) observed such relationships as they found an inverted U-shaped relationship between the number of external sources and innovation performance indicating that too little or too many external actors may negatively impact innovation performance. Barge-Gil (2010) found that firms with strong R&D capabilities have 'great capacity to absorb external knowledge, but their need for it is usually smaller'. As a result, they exploit it 'but it is not at the core of their innovation assets' (Barge-Gil, 2010).

Consequently, considering the above findings it can be assumed that a firm's competence level will have an effect on a firm's attitude towards OI activities.

2.4.2 Appropriability

Fischer and Henkel (2012) recognize that firms engaging in value creation activities also need to apply mechanisms that capture the respective value created as otherwise, commercial success is impaired. In other words, the firm is confronted with various threats with regards to capturing the value that they created by moving R&D activities beyond company walls (Teece, 1986). As Drechsler and Natter (2012) found, the higher the perceived effectiveness of IP protection, the more likely firms are to engage in OI. Research by Li and Xie (2011) indicated a similar relation as they found firms to prefer "setting up wholly-owned and closed R&D labs in regions with poor IP protection, and cooperative ventures where protection was more robust.' Hence, the risk of external players taking a disproportionate share of the generated value appears to be an important inhibitor of open R&D (Li and Xie, 2011).

As a means to protect intellectual property during OI practices, organizations can consider filing a patent. Patents grant an innovator the exclusive user right for the particular innovation for a fixed time span. According to Fischer and Henkel (2012) "the classic purpose of patents is to prevent imitation through blocking competitors." Patents, however, are also used to facilitate technology selling or licensing (Fischer and Henkel, 2012). Through a patent, the patent-holder can claim ownership of an invention and be the only economic beneficiary of it. However, patenting also has clear downsides. Filing a patent requires the organization to disclose the composition of its innovation (Erkal, 2005), which 'should contain sufficient information to allow a

skilled person to reproduce the particular innovation (Kultti, 2007). Innovators may fear that the information that is revealed may be used to the benefit of competitors (Zhang, 2012). As patent protection is usually imperfect, organizations also fear that patents will educate competitors so that they can find ways to legally invent around the patent (Arundel, 2001; Cohen, Nelson and Walsh, 2000). Such practices may allow duplication of a firm's competitive advantage. Next to this, Dufresne and Offstein (2008) claim that 'maintaining, guarding, controlling, and even mainstreaming patents all require an investment – financially, politically and socially.' Hence, apart from having to disclose possibly sensitive information in a patent, organizations also need to incur costs to police a patent – infringement needs to be proven and then the offender needs to be sued for any damages. A way to prove patent infringement is through reverse-engineering, defined as 'deconstructing a unit and analyzing it in detail, so that the original can be duplicated (Minagawa, 2007; Denicolo and Franzoni, 2004). Through such activities, it can be determined whether a competitor is in violation. Since this is often a time-consuming and costly endeavor a study by Cohen, Nelson and Walsh (2000) indicated that in many industries, secrecy is the key and most widely employed appropriation mechanism - especially within the chemical industry in regards to process innovations. However, the authors also indicate that "of all the appropriability mechanisms, secrecy lends itself the least to R&D spillovers" rendering OI impossible. Organizations that operate under a secrecy policy enjoy no legal protection (Anderson, 2011). Hence, a company's secrets may be revealed through independent innovation of competing firms, but also through reverse-engineering. A secrecy policy provides no legal barrier for organizations to adopt the 'secret' within their business practices – second inventors may even patent 'their' invention and prevent the original inventor from using the invention in its business. Hence, Kultti (2007) and Amara (2008) propose that organizations need to estimate the probability that certain technologies may be imitated by competitors in the short-run, and protect these with patents, whilst secrecy may protect innovations that are not expected to be copied within shorter time frames.

Despite this large disadvantage, secrecy has considerable advantages over patenting as well (Anderson, 2011). Secrecy can provide firms with a potentially limitless lifespan, whilst patents only last a certain time. Second, a secrecy regime requires no costly legal formalities that characterize patents. Finally, secrets require no broad disclosure, because widely known information cannot qualify as a 'secret'. As Lane and Wegner (1995) propose, 'secrecy is a form of intentional deception or an act of deceptive omission.' As opposed to this, patenting requires aforementioned disclosure of possibly sensitive information.

Concluding, it can be said that appropriability with its different mechanisms of capturing the value created by an organization, is very likely to have an influence on a firm's OI configurations.

2.4.3 Culture

Organizational culture can be defined as ‘a collection of values, beliefs and norms shared by its members and reflected in organizational practices and goals’ (Hofstede et al., 1990; Khazanchi et al., 2007). Culture “transcends every aspect of an organization”. It is to a large extent an outcome of a firm’s historical and current operations. Cultures can be deeply rooted, which makes them not easily changeable (Kuratko, 2011). In a company context, culture has been found to be a bilateral concept as it was found to be of contributing nature to the occurrence of innovation, but also acted as an inhibitor (Khazanchi et al., 2007; Martins and Terblanche; Ahmed, 1998). As Herzog (2011) proposes, ‘the move from closed innovation to OI needs to be accompanied by a change in the underlying innovation culture.’ In order to create an OI culture, organizations need to avoid that their culture is falling victim to the ‘not invented-here syndrome’ (NIH-syndrome). Originally termed by Katz and Allen (1982), NIH-syndrome is defined as the “tendency of a project group of stable composition to believe it possesses a monopoly of knowledge in its field, which leads it to reject new ideas from outsiders to the likely detriment of its performance.” Their research indicated that communication with external actors gradually decreases as the tenure of staff increases. Laursen and Salter (2006) also argue that ‘the greater attention to openness for external sources confronts internal resistance from technical staff.’ Further, Veugelers (1999) examined NIH syndrome amongst Belgian manufacturing firms and found that organizations suffering from this phenomenon were significantly less likely to engage in OI. Other studies found empirical support for such a syndrome as well (Mehrwald, 1999; Di Minin et al., 2010; Chesbrough and Crowther, 2006). Based on a thorough literature research, Herzog (2011) identifies several other antecedents of NIH-syndrome. At first, resistance to sourcing innovation may occur as staff perceives it as violation of their own identity. For example, R&D scientists may resist sourcing innovation as they want to focus on technical discoveries, instead of integrating external technologies (Slowinski et al., 2009). Additionally, Herzog (2011) proposes that individuals aim to create a stable working environment (routines) which leads to stress and uncertainty reduction. As no experiences at all with technology sourcing may create uncertainty, a negative bias towards OI can arise (Herzog, 2011). Finally, on an organizational level, OI cultures require a higher degree of risk tolerance than is necessary for closed regimes. Mehrwald (1999) also found a number of factors that correspond with the aforementioned antecedents of NIH-syndrome: ‘the degree of trust in one’s own technological competence and the relative performance of external technology.’ Gilbert (2005), Chesbrough and Crowther (2006) argue that the absence of a strong perception of threat or a clear articulation of the necessity to be open is fueling NIH-syndrome as well.

Opposed to NIH-syndrome, which is mainly concerned with inbound innovation, there is also a counterpart to this phenomenon referred to as the ‘not-sold-here’ syndrome (NSH-syndrome). According to Herzog (2011), the antecedents are equivalent to NIH-syndrome, but the main reason for the NSH-syndrome is different. It constitutes the fear that competitors will strengthen their relative position by further building upon the

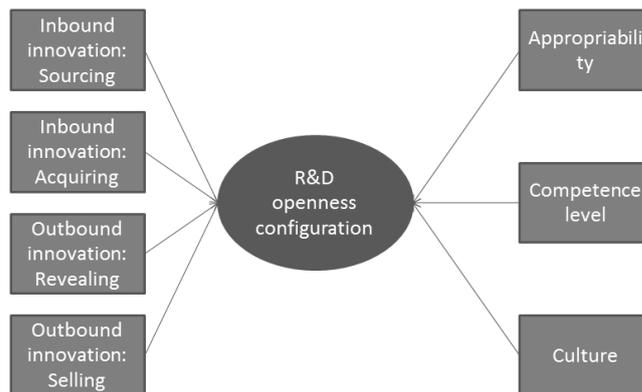
technology provided by the selling organization. It is a ‘systematic overestimation’ of negative outcomes of selling technology – emotional appeals influence normally rational economic considerations (Herzog, 2011).

Concluding, culture and in particular the concepts of NIH and NSH appear to substantially influence a firm’s openness set-up.

2.5 Merging models into a research paradigm

The main research question that guides this study reads as following: ‘*How does a firm configure its R&D openness and how is this influenced by the factors of appropriability, competence level and culture?*’ This will be done by investigating the four different OI innovation types in regards to the influential character of the above discussed three contextual factors of appropriability, competence level and culture.

In order to visualize our approach, our corresponding conceptual model is provided below:



3 Methodology

3.1 Purpose and background

As the thesis authors conducted an internship within an organization for six months, a unique opportunity emerged to delve into a phenomenon in an in-depth manner and understand the contextual factors surrounding it. Consequently, a research question that allows for such an investigation was selected: to add understanding of the configuration of R&D openness by trying to understand the ‘contextual factors’ (competence level, appropriability, OI culture) that influence such decisions.

3.2 Research philosophy

The research philosophy ‘has importance implications about the way in which the researcher views the world. These assumptions will underpin a research strategy and the methods that are selected as part of that strategy’ (Saunders, 2007). This thesis aims to explain the decisions that an organization makes with regards to the configuration of its R&D openness – which are influenced by the interplay of contextual factors. In the course of this research the following stance is adopted stating that “the social world of business and management is far too complex to lend itself to theorizing by definite laws in the same way as the physical sciences, because rich insights into this complex world are lost if such complexity is reduced entirely to a series of law-like generalization” (Saunders, 2007). At the same time, it is tried to allow the outcomes of this thesis to claim a degree of theoretical generalizability (Bryman, 2007) so that it forms a bridge for quantitative follow-up research to make law-like inferences from (Eisenhardt, 2007). Based on the field of epistemology, a position in between positivism (laws) and interpretivism (every situation is unique) is occupied: critical realism relates to scientific enquiry, but also points out that researchers must understand the social structures (context) that have enabled a phenomenon to unfold, if a complete understanding of the social world is desired (Bhaskar, 1989; Saunders, 2007).

3.3 Research approach

While in the course of the thesis it is regularly switched between induction and deduction, the ultimate aim is to build new theory from observations within the organization (Saunders, 2007). Hence, the final set-up of the thesis will be of inductive nature. However, the researchers do not intent to build new theory without considering what has already been reported on in academic literature; consequently the application of theoretical models plays a large role as well. The initial stages of the research project are strongly influenced by observations, talks, preliminary interviews and academic literature to build a theoretical model, which mainly follows an inductive logic. The influence of this theoretical model on the organization’s R&D openness configuration is then tested by engaging in the official data collection round, which shows signs of theory-testing, thus, this resembles a deductive approach as well (Saunders, 2007). These findings are then compared to the theoretical framework in order to generate new theory, which will manifest the final inductive character of this thesis.

3.4 Research strategy

In line with the philosophy of ‘critical realism’, qualitative research methods are employed as they lend themselves best to explore the complexity of the social world within an organization (Saunders, 2007). Qualitative research methods are characterized by their richness and fullness in studying a phenomenon, which make them very appropriate in order to get deep insights into a phenomenon, and to understand the contextual factors influencing it (Bryman, 2007; Saunders, 2007; from Robson, 2002) portraying the aim of this thesis. Additionally, the inductive approach requires some flexibility to iterate between different stages of the research. Qualitative

methods are most appropriate in this as they are ‘not hindered by the rigorous and rigid methodology of quantitative methods that ban out any flexibility’ (Saunders, 2007).

As a research strategy, the case study design is applied, which facilitates an in-depth examination of a phenomenon occurring within a single entity, in this instance an organization (Bryman, 2007) thus, a case study accommodates a qualitative research design very well (Bryman, 2007; Eisenhardt, 2007). Through immersion within an organization, a more in-depth view can be created than a quantitative survey would allow. Perry (1998) found that a case study is most suitable to a researcher following a research philosophy of critical realism, which is the chosen approach of this thesis. Eventually, a well-executed case study may be a strong bridge from qualitative evidence towards deductive research (Eisenhardt, 2007), which constitutes the final objective of this study.

3.5 Research process

The research process strongly aligns with the model by Eisenhardt (1989) about building theory from cases, but also with the model by Bryman (2007) about conducting qualitative research in general. At first, already based on unofficial observations within the case company, a preliminary research question was formulated. Subsequently, a thorough literature review was conducted to serve as a theoretical frame of reference. After this, a process of selecting data collection tools, and the actual collection of empirical data commenced. Next, the empirical data were analyzed and compared to the theoretical frame of reference to see where comparison or conflicts occur – which allows the findings to be benchmarked against, but also positioned within existing academic literature. Then, conclusions are shaped that may provide a bridge from qualitative data towards deductive testing. As aforementioned, the collection and analysis of qualitative data is an iterative process (Bryman and Bell, 2007), which means the research switches between data collection and data analysis during its life cycle, in which the research question is also further narrowed down or additional academic literature is looked into. Additionally, preliminary work within the case company also facilitated the discovery and pinpointing of the most interesting features of the case, defined as an idiographic approach (Bryman and Bell, 2007) – in this way we identified appropriability, competence level and culture to be essential elements in a department’s openness configuration.

3.6 Data collection

Within the spectrum of qualitative data collection tools, semi-structured interviews were applied to collect empirical data. Semi-structured interviews ensure that the respondent answers questions in each area of interest (interview guide see appendix I), while the flexibility is maintained to follow-up on interesting findings and thus to understand the reason of the response (Saunders, 2007). When considering the role of the interviewer, the best practices (Saunders, 2007) with regards to certain factors are applied to minimize biased responses: solid preparation, demonstrable knowledge as interviewer, appropriateness of location, appearance, interview introduction, unbiased questioning, appropriate behavior, attentive listening skills, data recording/note-taking

and cultural differences are all points of attention for administering the interviews. One of the interviewers is partially a note-taker and partially a second interviewer in case he/she detects something interesting; the other interviewer is solely focused on conducting the interview and oversees the broader picture – all interviews were audio-recorded.

3.7 Sample selection

As frequently used for a qualitative case study design, a purposive non-probability sample was chosen: by using judgment, expert interviewees were selected that were believed to be most suitable to provide answers to our research question. This, in turn, raises the reliability power of the empirical findings (Saunders, 2007). As the R&D department of the case company is considered, eight members from this unit were selected that are believed to provide a ‘complete picture’ of the phenomenon. It was ensured that both a management and a staff view were acquired, whilst a fair distribution between employees with short and long tenures was selected. As there are 16 employees within this department, it is believed that in-depth interviews with eight members can provide a fairly reliable portrait as long as the results indicate a high degree of alignment between the different views that are obtained.

3.8 Method for data analysis

All interviews were audio recorded and subsequently transcribed to verbatim text (Saunders, 2007). Subsequently, it was necessary to categorize the transcribed data according to the theoretical framework, which means the responses of the interviewees are categorized according to the subtopics of interest – a process of unitizing data (Saunders, 2007). Through this, it was possible to recognize relationships between the different categories (Saunders, 2007).

3.9 Reflections on research methods

As a result of the case study set-up, this research will provide a very detailed description of the situation at Bona and their corresponding open R&D practices. However, investigating one single company and solely concentrating on the situation at Bona may restrict the generalizability of the final conclusions. A similar problem may arise as the Bona employees served as our primary source of data collection. While it was tried to validate essential parts of information by the means of triangulation (Bryman and Bell, 2007), such measures could not always be taken as little market information could be obtained, neither by the means of a desktop research nor by Bona itself. Consequently, the study will be heavily influenced by and hence reflective of the thoughts and views of the respective eight participants. While the final conclusions may not be applicable to organizations operating in different kinds of environmental settings, the case study will provide interesting insights into a firm’s R&D configuration and its determining factors to companies that work under similar organizational conditions in regards to the three identified elements of appropriability, competence level and culture, as Bona does.

4 Findings

This chapter describes the empirical research findings. At first, a background of the case study company will be given in order to provide a good overview of the firm's historical development and current activities. Subsequently, the company's R&D openness configuration will be depicted by categorizing their open activities according to the four identified types of openness. After that, it is described how appropriability, competence level and culture influence the configuration of R&D openness. It needs to be noted that the findings are at times supplemented with analytical elements. This is done so as to better contextually place the findings, which will later facilitate the transition towards the analysis.

4.1 Background of the company: Bona

Bona AB is a family-owned company that was founded in 1919. Next to its headquarters in Sweden, Bona is represented in more than 70 countries around the world. Bona's focus lies with the provision of a full system solution for the installation, maintenance and renovation of wooden floors, dividing their business portfolio into five segments: sanding, finishing, fastening, maintenance and industrial coating. Bona's customer base consists of three segments: professional floor contractors, parquet producers and floor owners. Furthermore, Bona communicates innovation to be of great importance to their operations, which is reflected in half of their turnover being generated from products launched within the past 5 years.

Bona operates in the coatings industry, which is a segment of the general chemicals industry. This segment is very R&D intensive and technology-driven: after the pharmaceutical industry, the coatings industry invests most resources into R&D (Rehnberg, 2013b). The fundament of remaining competitive in this industry is the R&D function within Bona – five R&D centers collectively generate the demanded innovation efforts. This case study focuses on its oldest and most predominant unit: R&D Malmö. This R&D department focuses on development of finishes, which constitutes Bona's most profit generating and thus most important segment. For better understanding, a brief introduction of this product is provided: a finish is a coating product - it is a chemical fluid that is applied on the surface of a wooden floor. After the application of a finish, the wet content of a finish will evaporate in the air – and a thin protective layer is formed on the floor (Lindell, 2013b). Hence, a finish serves as a protective mechanism, while it also beautifies a floor (Rehnberg, 2013b). Eventually, it needs to be noticed that finishes development is a highly advanced technological endeavor, requiring a high knowledge plateau (Persson, 2013b).

Historically, R&D Malmö already developed finishes in the 1950's. However, at this point the unit was quite diversified as it developed other wooden floor products, but also products for other flooring types and other industries. In 1975, in response to growing public environmental concerns, R&D developed a discontinuous innovation: waterborne finishes, which were both health and environmentally conscious. This was the starting point of a significant growth process for the entire organization – and put a stronger strategic emphasis on the finishes department (Persson, 2013b).

In 1987, R&D Malmö initiated a project that would become the backbone of Bona's current competitive advantage (Tonell, 2013a; Persson, 2013a). It was felt that the dispersions available in the market did not comply with what Bona thought was possible in this area. Dispersions are the chemical building blocks of a finish and attribute different properties to a finish, like scratch resistance or waterproofness. Between 1987 and 1995 the unit managed a backward integration that allowed it to develop its own dispersions. This move would soon become Bona's main tool in differentiating themselves from the competition and allow them to develop their future competitive advantage. This backward integration allowed them to produce their own dispersions and thus being able to act faster and in a more efficient and flexible manner while it also provides them with the option to tailor the dispersions to their own unique needs (Persson, 2013a). Despite this being an extremely difficult and time-consuming initiative, R&D Malmö managed and up until today, no competitor has been able to accomplish such backward integration (Persson, 2013b). By pursuing this approach, Bona has managed to build a strong market presence with high market shares for the greater part of their product portfolio. This business model reconfiguration also highlighted R&D Malmö's gradual process of increasing its focus on finishes development for wooden floors – whilst spinning off other activities. This process was completed around 1994, when R&D Malmö almost solely focused on finishes development – and a process of focus and long-term specialization on finishes started that has been going on until today (Persson, 2013b).

4.2 Configuration of R&D openness

This paragraph describes in which types of openness R&D Malmö engages as to get a good picture of the configuration of Bona's R&D openness.

4.2.1 Inbound innovation: sourcing

Customers (flooring contractors)

The finishes that R&D Malmö develops are primarily used by professional flooring contractors that either install or renovate a wooden floor. R&D incorporates the customers in the late stages of product development by jointly testing the innovations out in the field. Additionally, customers are an important source of ideas for future innovations. Customers cannot give insights into the technology of a finish, but give feedback with regards to applied product characteristics, like performance, application or viscosity (Rehnberg, 2013a; Persson, 2013b). Hence, flooring contractors play an important role in ensuring market-driven innovation.

Customers (component purchasers)

Bona has recently engaged in partial commercialization of its technology by selling individual components, which is historically not Bona's end-product: Bona used to solely sell an end-product (finishes) which consists of many of these individual components. This new endeavor puts R&D in contact with other industries than floor coatings alone, like furniture and plastic, which generates non-traditional industry ideas that may have value for Bona's coatings business (finishes) as well (Högvall, 2013).

Suppliers

Although R&D Malmö develops its own dispersions and finishes, it purchases bricks from suppliers. As an intentional simplification, a group of bricks form a dispersion, and a group of dispersions form a finish. In many occasions, suppliers are in a stage of development with regards to a new or improved brick and want to sell it to Bona or request Bona to test the brick – and funnel back the test results. A new brick may contain new or better properties and consequently, provides R&D with more enhanced tools to innovate (Persson, 2013b; Rehnberg, 2013b). Through these interactions, R&D is able to get deep technological insights from suppliers into the bricks. In many instances, the testing that Bona does for the suppliers may lead to the unexpected discovery of new properties, which the supplier was not aware of and that were not part of the properties that were requested to be tested. Hence, these interactions allow for extra value creation for Bona. (Rehnberg, 2013a; Fagefors, 2013a). Consequently, suppliers have a usefulness in the early stages of R&D's innovation process, but have no value in latter stages (Rehnberg, 2013a). The development (formulation) of a finish is something they cannot assist with, because the mixing of components is an interrelated activity; component A may give a certain property that the supplier is aware of, but when it is mixed with component B, component A may react very differently. Other benefits that suppliers offer consist of ideas and industry contacts. Hence, suppliers provide early-stage technological resources, ideas and networks (Persson, 2013b).

Trade shows

R&D scientists visit trade shows through which staff can witness small and big industry trends. These events are about scanning the environment and generating ideas, finding market opportunities and getting industry contacts that may be valuable in the future. Trade shows from other industries are visited as well as this may generate ideas that are applicable to Bona's field as well (Persson, 2013b; Linton, 2013; Tonell, 2013b).

Environmental agencies

R&D maintains close relationships with environmental agencies in order to anticipate future amendments that may influence Bona's business. The chemical industry is subject to strong environmental and health legislation, which also changes regularly. As product development cycles in R&D may take years, it is important for Bona to gather information that allows it to predict which compounds to exclude from its finishes (Rehnberg, 2013c; Persson, 2013b; Erkselius, 2013; Jens Persson, 2013). Links with environmental agencies thus allow more responsiveness to the environment.

Universities and research bodies

Bona has a long-standing relationship with the chemistry department of Lund University. At first, the majority of the scientists in the R&D department are alumni, which makes the university an important supplier of qualified human capital. Several

students do their master degree project within Bona, which provides Bona with insights into non-core technological areas. Additionally, R&D is able to leverage Lund University's expensive analytical tools and specialized staff that know how to operate these instruments. R&D also engages in research projects funded by the European Union that, for example, promote the development of greener starting materials. Such activities create company awareness in the market place and hence contribute to image building. Consequently, universities and research bodies provide Bona with human capital, contacts, technological insights into non-core areas, access to expensive capital goods, open research publications and public trends (Rehnberg, 2013a; c; Persson, 2013b; Erkselius, 2013).

4.2.2 Inbound innovation: acquiring

Patent-holders

Sometimes Bona encounters situations in which it develops a component which has already been patented by another firm. In principle, it can occur that an external player has a patent on a small part of a chemical or a process – which is a fraction of the total package of a single product. If the value in using that 'part' is significant, Bona approaches the patent holder to negotiate a license agreement or Bona simply purchases that company's products if that party's interest is in selling products with embedded technology instead of selling or licensing out technology (Rehnberg, 2013b; Persson, 2013b).

4.2.3 Outbound innovation: revealing

Customers (flooring contractors)

Bona wants its customers to be able to offer competitive services in their market. Therefore, Bona provides the contractors with best practices training and support, which is mainly about successfully applying Bona's products on the flooring surface. By providing such training and support, R&D has a 'currency' to source customer ideas and feedback (Persson, 2013b).

Suppliers

As aforementioned, suppliers play an interesting role in Bona's R&D practices – more innovative input allows more innovative output. When Bona engages in testing of newly developed bricks, it reveals parts of the testing results to the supplier as 'currency' for sourcing valuable insights from this supplier. Occasionally, it can also happen that Bona has identified a potential innovation for its finishes for which no brick exists yet. In such an instance, Bona needs to communicate parts of the requirement for a new brick to the supplier and the supplier can use this information to develop the innovation that Bona needs as input (Persson, 2013b; Rehnberg, 2013b).

Universities and research bodies

Bona provides students with a master degree project – some non-core technological knowledge must be shared with the student, while the projects are usually in the range

of supporting knowledge. Additionally, some non-core technological knowledge must also be shared with the university in order to allow the university staff to successfully conduct analytics on the products that Bona provides (Persson, 2013b; Rehnberg, 2013b). When cooperating in research projects with the research bodies, Bona contributes with more general expertise (non-core technological resources) that it has obtained due to its experience in the coatings industry (Rehnberg, 2013a; b).

4.2.4 Outbound innovation: selling Customers (component purchasers)

As aforementioned, R&D has commercialized part of its technology through selling individual components, which is mainly based on financial grounds: Bona gets financial resources from something that has been predominantly developed for their finishes, but is assumed to also be valuable for other industries (Högvall, 2013).

4.3 Factors influencing the configuration of R&D openness

4.3.1 Appropriability

To understand appropriability in Bona's case, a small introduction to the chemistry of their products is necessary. As explained, R&D purchases bricks to formulate a dispersion, and by combining a set of dispersions, a finish is formulated (Rehnberg, 2013b; Persson, 2013b). The quality of the dispersions or finishes is not solely dependent on the inclusion of certain components. The real secret behind getting the full potential out of a set of chemical components is the formulation – the order and process of mixing the compounds (Rehnberg, 2013b; Persson, 2013b; Erkselius, 2013). Under normal circumstances, companies can defend their intellectual property by filing a patent – and sue offenders for infringement. However, a patent provides very poor protection for these process-related products, because it is very difficult to analyze a competitor's product in such an in-depth manner that infringement of a process can be proven. Reverse-engineering is ill-suited to determine the formulation process. Additionally, it can only reveal the fragments out of which a product is created, but not the exact components (Persson, 2013b; Rehnberg, 2013c). Also, reverse-engineering is terribly difficult and hence extremely costly (Persson, 2013b; Fagefors, 2013b). Next to not being able to police a patent, there is also the issue of having to reveal the development process of the innovation if a patent is filed. Generally, only 10% of Bona's output can be protected effectively by a patent. However, as Bona still wants to avoid disclosing too much information, they write these patents in a broad and complicated way so that it is difficult for patent-readers to really understand the development process (Persson, 2013b; Rehnberg, 2013b).

Outbound innovation: revealing

Bona's core competences are based on the technological development of finishes. Due to the process-dependence of this activity, patents can only provide little IP protection, and hence their core activities are built on secrecy. A cooperation with a competitor would therefore be very dangerous, because giving external players insight into

'Bona's kitchen' would allow duplication of its competitive advantage, which would be fatal as exposure of these secrets is an irreversible process (Rehnberg, 2013b). The weak appropriability issue in this area is also displayed in Bona's interactions with suppliers. Bona's suppliers consist of large chemical companies that also sell their products to Bona's competitors. Thus, Bona needs to be very careful to only communicate in general terms as any core technological knowledge that is shared may be redistributed by the supplier to its other customers (Fagefors, 2013b; Tonell, 2013b). Trivial things, like Bona expressing interest in a supplier's brick, because it generates a property that improves the scratch resistance of a floor coating, can already backfire as Bona's competitors may become aware of this also (Rehnberg, 2013b). This risk is exacerbated, because there is high mobility of human capital within this industry (Högvall, 2013). Consequently, when suppliers cooperate with Bona in testing a new brick, Bona is very selective in the information it funnels back. If unexpected properties are discovered, Bona will in most cases keep this information to themselves (Rehnberg, 2013a; Fagefors, 2013a). Especially when Bona needs to approach a supplier to request a specific brick that is not available in the market yet, the interaction process becomes very difficult as Bona is forced to disclose at least some requirements (Fagefors, 2013b). The same accounts for when Bona needs to acquire parts of a patent or obtain licenses – the patent holder receives sensitive information that may fall in the wrong hands, hence, it needs careful assessment whether the value from the patent or license can be foregone on or not (Rehnberg, 2013b). All in all, this transforms outbound innovation (revealing) into a very time-consuming, secretive and very political game.

The weak appropriability issue is also reflected in Bona's cooperation with universities and research bodies. Bona is very careful to never share any core technological resources, but contributes with more general knowledge like commoditized non-core technological resources that hold no secrets. The knowledge that is revealed to customers is not about technology, but about best practices – disclosure of such information is not harmful to Bona's competitive advantage as it is much more commoditized and externally available than the technology to develop a finish (Persson, 2013b; Rehnberg, 2013c).

Outbound innovation: selling

The appropriability issue is also reflected in Bona's possibilities to commercialize its technology. Within Bona, less than 10% of its inventions can be properly protected by a patent, which greatly reduces the potential offer to the market (Persson, 2013b). However, Bona did find a way to commercialize some of its technology by selling some of their components, which cannot be reverse-engineered by competitors. However, the components used in Bona's most important and technologically advanced products are not considered, and prospects are carefully selected. It is ensured that no knowledge is shared that could be harmful to the core business (Högvall, 2012).

Inbound innovation: sourcing

In the broad chemical industry there is cooperative R&D and knowledge transferring between organizations. However, in Bona's specific type of industry, the coatings segment, this occurs a lot less as competitors experience the same appropriability issues as Bona does resulting from dealing with similar products (Persson, 2013b; Rehnberg, 2013b; Erkselius, 2013). Hence, cooperative R&D between coating industry players would impose a high risk of both parties unintentionally exposing their secrets. This makes appropriability not just an individual organizational problem, but an industry problem that impairs cooperative efforts between industry players in the technological area. Industry segments with better appropriability mechanisms are able to open up more towards R&D, whilst companies in other segments are more secretive (Högwall, 2012; Persson, 2013b). Bona's suppliers usually have effective patent protection or they deal with commoditized bricks that hold no secrets. As such chemicals are easy to detect through reverse-engineering, the suppliers can easily protect their bricks. Therefore, suppliers can be much more open than Bona can be in return as suppliers can give risk-free, deep technological insights into their bricks (Rehnberg, 2013a; Jens Persson, 2013; Tonell, 2013b).

Inbound innovation: acquiring

The same principles as for the aforementioned type of openness apply: R&D's possibilities to source or acquire technology are very limited within its own industry as competitors can also not protect their IP other than through secrecy; other industry segments such as suppliers, however, may have stronger appropriability mechanisms (Persson, 2013b; Högwall, 2013), allowing inbound innovation activities.

As achieving competitive advantage in Bona's industry is very dependent on the technology that is incorporated into a product, industry players are either secretive if appropriability is weak – or have effective patent protection. The supporting resources that R&D Malmö obtains from suppliers, customers, trade shows, environmental agencies, universities and research bodies do not suffer from appropriability issues, because they are patent-protected, contain no secrets, or are not essential to that party's competitive advantage. Alternatively, they are readily available from other parties as the knowledge is much commoditized, or the institutions serve a public function. As a result, the sharing parties do not need to consider capturing the gains when sharing resources rendering appropriability questions as redundant. Bona 'repays' these organizations with resources that cannot expose any of Bona's core technological resources.

4.3.2 Competence level

As R&D Malmö's core competence is based on the technological development of finishes, Bona has established a very high competence level within this area which can be demonstrated by various activities. Firstly, R&D Malmö has been involved in developing finishes from the 1950's up until 1994 – when it spun off all other R&D activities and solely focused on finishes development. From 1994 up until the present,

R&D followed a process of tight focus and long-term specialization on finishes, allowing for the building of high competence levels. Further, R&D Malmö was the inventor of the waterborne technology for finishes in 1975 – a technology that is still applied within the industry. Over the course of the years, R&D Malmö continued to introduce breakthrough innovations that are still at the top of the industry, like Bona Mega, Traffic, Novia and Traffic HD (Persson, 2013b). This constant launch of innovative products indicates that Bona's competence level is rather high. Also, Bona is still the only company in this industry that mastered the competences for a backward integration.

Internally, R&D Malmö is recognized as the R&D center that is most crucial to Bona's competitive advantage, sales and profitability. As a result, it gets most managerial attention and resources (Persson, 2013b; Rehnberg, 2013b; Tonell, 2013b). Bona's ambition is to be the most innovative company in this industry that provides the best products that are also most environmentally conscious. The owner of the company specifically addressed that R&D Malmö has failed if it develops "me-too" products, as Bona products should be unique. R&D Malmö is adequately funded to support these ambitions, demonstrating Bona's commitment to innovation. (Rehnberg, 2013b; c). Beyond, the R&D workforce is characterized by very long tenures, which is important in this field as experience is the most crucial factor in mastering finishes development – it is so complicated that it requires 2 to 5 years of experience before R&D scientists can independently complete a project (Fagefors, 2013b; Linton, 2013; Erkselius, 2013). Hence, the workforce is very well educated – R&D scientists generally have either a master or a PhD in chemistry before getting employed at Bona. From there, most junior scientists are assigned a senior mentor and it is worked on projects cooperatively (Jens Persson, 2013; Erkselius, 2013; Fagefors, 2013b).

The R&D attitude is also characterized by excellence and innovation – scientists have the ambition to provide the best products, the most innovative products and the most environmentally conscious products (Rehnberg, 2013c; Fagefors, 2013a; b; Jens Persson, 2013; Linton, 2013; Erkselius, 2013). R&D has an innovation portfolio that includes some long-term projects that run for several years and are aimed at radical innovation. Bona is very persistent with this and does not just cease a project if the results do not live up to the initial expectations– the goals are changed when the underlying assumptions change. Additionally, R&D scientists experience a moderately high degree of autonomy in determining how to achieve a goal – and have freedom to work on interesting findings that are obtained during a project also (Tonell, 2013b; Fagefors, 2013b; Linton, 2013; Erkselius, 2013), allowing to further deepen their understanding of interesting outcomes.

To summarize, the described historical development and organizational practices have shaped an environment through which a high competence level within R&D was established. The next step is to look at how this competence level relates to Bona's competitors. At first, it needs to be acknowledged that, when considering the broad chemical industry, the competences required for developing finishes place such a

company already at the higher end of the continuum– the technological entry level to compete in Bona’s niche is much higher compared to many other segments (Persson, 2013b). Bona R&D scientists generally believe that they have the highest competence level within their industry niche (Persson, 2013b; Rehnberg, 2013b; Tonell, 2013b; Jens Persson, 2013; Erkselius, 2013). This claim appears well-supported by evidence from competitor product analysis: R&D continuously analyzes competitor product launches and benchmarks the result against Bona’s own products. According to Bona staff, competitors’ products usually excel at one or two product properties but are underdeveloped in others. Bona, however, is believed to be the only company that has the competences to keep all the properties at a high level (Rehnberg, 2013b; Fagefors, 2013b; Jens Persson, 2013; Erkselius, 2013). This view is shared by the majority of the scientists and hence they claim that their finishes are the best available in the market place. This attitude also emerges from the fact that Bona’s relatively expensive finishes have obtained finishes market leadership in many geographical regions with constant market shares between 35 to 40 percent (Bona, 2013b). In addition, Bona scientists state that their company is being used in the industry as a benchmark of what is possible with regards to technological innovation (Persson, 2013b). Further, many external players wish to work with Bona, hence, the market acknowledges Bona’s competence level (Persson, 2013b; Rehnberg, 2013c; Tonell, 2013b; Linton, 2013).

As a good example for Bona’s apparent superior competence level serves an open competition with external players to provide an innovative solution to new tightened environmental legislation – R&D Malmö came up with a solution way faster than what any external party could manage (Högvall, 2013). This example serves as a good illustration for Bona’s superior internal innovation competences. This is further proven by the number of new product introductions. In the past two years Bona has launched significantly more new products than competitors (EHA, 2012). The impressive innovation levels of 55 percent and 59 percent of Bona’s gross margin originating from new product launches or significant modifications to existing products in 2011 and 2012 illustrate this point. Although many organizations outsource innovation to realize speed and responsiveness, Bona’s superior competence level combined with backward integration guarantees speed and responsiveness in NPD. In order to improve a finish, Bona can adjust the dispersion within 2 days. Competitors cannot do this themselves and are dependent on external parties, which may take 3 to 4 months (Rehnberg, 2013a).

Inbound innovation: sourcing

Most sources that Bona utilizes provide resources in terms of market intelligence, ideas, human capital, access to expensive capital goods, application feedback and initial stage, non-core technological resources. These are all valuable resources, but they hardly relate to R&D’s core competence: the technological development of finishes. Although the technological resources from suppliers provide value in the early stages of innovation, R&D does not utilize any external sources in the formulation of its finishes (Linton, 2013; Persson, 2013b; Jens Persson, 2013; Rehnberg, 2013a). For this,

it solely uses its in-house core technological competences. Although staff suggests that there is no dogmatic attitude towards OI, there is a moderately strong belief that incoming knowledge streams may not add much in its core technological area of formulating finishes (Persson, 2013a; Rehnberg, 2013b; Tonell, 2013b; Fagefors, 2013b; Jens Persson, 2013). As explained, analysis of competitor products indicated that Bona's products are technologically superior, which raises questions about how much value a cooperation can generate (Rehnberg, 2013b). It was found that R&D scientists experience very few knowledge gaps that cannot be solved internally (Rehnberg, 2013b; Tonell, 2013b; Fagefors, 2013b; Jens Persson, 2013; Linton, 2013). R&D Malmö has extreme difficulties to identify potential external partners. It is believed that there are not many sources that are knowledgeable about such advanced chemistry, especially when discussing the more complex parts.

However, apart from limited perceived value that can be attained, a high competence level may also have strong advantages with regards to inbound innovation. Bona's competence level appears to be an attractive force towards external players, which are eager to cooperate with R&D Malmö (Persson, 2013b; Rehnberg, 2013c; Tonell, 2013b; Linton, 2013). In some cases, this is very interesting: there are instances in which suppliers have an advanced innovation (new brick) which generates an advanced property, like biodegradability and they contact Bona for testing. The user is required to have an advanced skill set if it wants to incorporate such a property in its finishes. Bona is then able to assimilate such a brick in its endeavors and benefit from the new property (Persson, 2013b). Hence, by having a high competence level in R&D, organizations may be well-positioned to make use of advanced innovations by others. Through this, the firm with strong R&D capabilities is able to further raise the standards of its product, whilst the firm with lesser R&D capabilities cannot incorporate such an advanced external innovation within its business – the technological gap between both parties is enhanced.

Inbound innovation: acquiring

The same principles as for sourcing apply to this type of openness as well.

Outbound innovation: revealing

Having a high competence level gives Bona an excellent currency to engage in outbound innovation – as many external parties are interested in cooperating with Bona. However, concerns were voiced with regards to the knowledge give and get tradeoff; it is believed that Bona would contribute more than the external partner with R&D eventually educating the other partner to a higher standard without Bona receiving anything in return (Rehnberg, 2013a; b; Tonell, 2013b; Linton, 2013).

Outbound innovation: selling

The same principles as for the revealing outbound innovation type apply. Bona has a great pool of knowledge that is of interest to others (Persson, 2013b). In the case of

R&D's partial commercialization of technological components, Bona's competence level functioned as a strong amplifier – within one year, R&D was able to establish a prospect list with 15 to 20 companies – with 5 actual organizations already actively purchasing (Högvall, 2013).

It needs to be acknowledged that the above findings focus on its competences regarding its core technological resources. However, organizations can have competence in many other areas as well (cost-efficient production, marketing, sales). In Bona's case, despite having such a high competence level with regards to technological development of finishes, Bona's OI practices still allow the company to harvest other resources that are valuable contributions to its resource base surrounding its core, like market intelligence, ideas, human capital, access to expensive capital goods, application feedback and non-core technological resources. To 'repay' these inbound practices, R&D Malmö shares its non-core technological resources.

4.3.3 Culture

R&D Malmö's culture was explored to assess how well this culture is suited for OI practices. At first, it was found that staff is generally employed for a longer time and that employee turnover is very low – the workforce composition is very stable as since 2004 only one R&D scientist left the company (Rehnberg, 2013b; Persson, 2013b). As aforementioned, R&D Malmö has been very successful in terms of supplying Bona with the highest-quality, most innovative finishes – which accounts for the bulk of Bona's profits. This success has established a strong sense of pride and accomplishment within R&D (Rehnberg, 2013b; Persson, 2013b; Högvall, 2013; Fagefors, 2013b; Jens Persson, 2013; Linton, 2013; Tonell, 2013b). R&D scientists get a lot of reinforcement from their interactions with suppliers – as they learn they are being benchmarked against in the industry (Persson, 2013b). Apart from the technological resources that are collected from suppliers in the initial stages of NPD, R&D Malmö is able to do everything itself with regards to the formulation of the finishes. Part of the strong pride within R&D is based on the fact that the employees perceive that their department hardly needs external technological resources for its innovation practices – Bona is very self-sufficient in its core technological area (Erkselius, 2013; Högvall, 2013; Fagefors, 2013b; Jens Persson, 2013; Tonell, 2013b; Rehnberg, 2013c). This strong R&D attitude has also been confirmed by two non-R&D sources (Högvall, 2013; Saalbach, 2013). Coupled with this pride, there appears to be a rather high level of confidence amongst R&D staff in their own abilities also (Högvall, 2013; Rehnberg, 2013b; Persson, 2013b; Tonell, 2013b; Jens Persson, 2013), although some scientists also add some moderation to this as they feel that R&D is also humble and is not overconfident (Tonell, 2013b; Erkselius, 2013; Linton, 2013). As is elaborated on rather extensively in earlier chapters, R&D staff also appears well aware that they develop the best finishes in the industry – the relative performance of external technology appears lower.

R&D scientists describe the culture within R&D as dynamic – due to its innovativeness, there is a constant degree of experimentation and change going on

(Fagefors, 2013b). Also, there is a high level of interaction between colleagues (Jens Persson, 2013) and employees are excited about their jobs as they learn a lot and experience personal development (Rehnberg, 2013c). Further, staff is experiencing alternation as scientists work on different kinds of projects, however, when doing so they remain in their department for finishes (Tonell, 2013b; Erkselius, 2013). Several attempts of the vice president of R&D of moving scientists from their “home” department to a “foreign” department, for example industrial coating, have failed (Persson, 2013).

In addition, R&D has a culture that is very acceptant of failure – there is no managerial punishment or resent amongst colleagues (Rehnberg, 2013c; Fagefors, 2013b; Jens Persson, 2013; Linton, 2013; Erkselius, 2013). Beyond, the work culture in R&D Malmö is typically described as very informal and cooperative. Teamwork and knowledge-sharing is far more valued than superior individual performance. Scientists can be as open-minded and honest as possible in this respect (Rehnberg, 2013b; Fagefors, 2013b; Tonell, 2013b; Jens Persson, 2013; Linton, 2013).

There have not been many instances in which R&D opened up in its core technological field –the need of secrecy is commonly understood. However, there is one well-known example within R&D where a supplier was entrusted with an important testing method – and betrayed Bona’s confidence by presenting the method at a conference. This incident further enforced the secretive attitude within Bona.

Risk-taking propensity with regards to innovation was confirmed to be positive within R&D Malmö. However, risk-taking within an OI culture is also about granting external parties responsibility for innovation – and partially giving up control. As R&D Malmö has had almost complete control over its innovation practices for such a long time, it may be hard for personnel to give up such control. Although some R&D scientists think that the R&D attitude towards this issue is positive (Erkselius, 2013; Linton, 2013; Jens Persson, 2013) other scientists think that R&D would not be welcoming to such a concept (Fagefors, 2013b; Tonell, 2013b; Rehnberg, 2013c) – and prefer complete control. Additionally, R&D is very low risk-taking when it comes to the quality of its products (Rehnberg, 2013c; Erkselius, 2013). Innovations are only commercialized if they are perfect and flawless (Högvall, 2013) – such an attitude appears to align more with maintaining complete control.

For R&D to involve external players within its core technological area, there should also be a clearly identified need. However, R&D staff seems perfectly aware that they are the industry leader in terms of innovativeness, quality and environmental concerns. When asking R&D scientists about where they see Bona within 10 years, no concerns were voiced with regards to not being able to maintain technological leadership. R&D staff is very aware of the need to be open to changes in customer demands or legislative amendments (disturbances in the external environment), but OI in the core technological area was never mentioned (Jens Persson, Fagefors, 2013b; Linton, 2013; Rehnberg, 2013c; Tonell, 2013b; Erkselius, 2013). When specifically asked about

whether R&D will maintain their top position through running it in the same way as now, R&D staff responded positively (Jens Persson, 2013; Linton, 2013; Rehnberg, 2013c; Erkselius, 2013). R&D is constantly trying to be open, but at the same time, it is not pursued actively enough – and it is realized that R&D could do much better in this respect. Hence, it seems there is no apparent need within R&D to pursue a higher degree of openness. This is surprising as it is confirmed that there is technology in other industry segments that would be of interest to Bona (Persson, 2013b).

As aforementioned, R&D staff is very aware of the need for secrecy – there is a high awareness that revealing core technological resources may reveal secrets that can be used against the organization. During the interviews, some scientists feel that acceptable risks can be taken with selling technology (Erkselius, 2013), preferably when there are high monetary gains and very low risks (Fagefors, 2013b). However, other interviewees pointed out that there may also be a fear within R&D that selling core technology could strengthen the relative position of competitors by further building upon the technology provided by the selling organization and thus deteriorate Bona's competitive position (Högvall, 2013; Jens Persson, 2013; Linton, 2013; Tonell, 2013b; Rehnberg, 2013c). A first step has been taken with commercializing individual components, since the related risks were found to be rather low. The main reason why this does not occur more is because Bona can only patent about 10% of their technology. Further, uncertainty about the value of those patentable products for external parties has been voiced (Rehnberg, 2013b). However, 95% of the shelved inventions are not used again – and eventually destroyed (Fagefors, 2013a). It is at least questionable to which extent these decisions are based on rational considerations, and to which extent the vision is blurred because of 'fear'.

Another reason why commercialization of unused products has not been pursued so far is that R&D management has simply not thought about this opportunity (Persson, 2013). As they are doing very well in their core activities, they did not consider commercialization activities beyond the core.

As culture is of such intangible nature, we will not categorize it into the four boxes of OI, but instead will only distinguish between inbound and outbound innovation in general.

Inbound innovation – sourcing and acquiring

As the findings above already suggest, little inbound innovation is to be expected within Bona's R&D department when looking from a cultural perspective. Among others factors such as high beliefs in the R&D's own capabilities as well as considering themselves as the market leader combined with high levels of pride of producing everything on their own are all attributes for a reluctant attitude towards inbound innovation.

Outbound innovation – revealing and selling

Despite shelving 95 percent of Bona's inventions and seldom using them later for other purposes within company walls, little has been done so far to further commercialize those ideas. As an underlying reason, R&D's culture does not seem to be supportive of outbound innovation – as a fear within the department was determined with regards to allowing competitors to build upon Bona's technology in order to strengthen their position against them.

The above described OI culture only applies to Bona's core technological resources. As was explained earlier, working with these core technological resources comprises R&D's core competence and generates its competitive advantage. Hence, it can reasonably be assumed that the culture is most strongly impacted by R&D's goings with its core technology. Additionally, the appropriability issue and competence level also heavily affect R&D's openness with respect to its core technology, which makes it interesting to see how a culture transforms under such conditions. With respect to the supporting resources that R&D obtains through its open R&D activities, Bona actually cooperates with such external bodies, which indicates a supportive culture towards using such resources. The same accounts for the resources that Bona shares – as long as it does not concern core technological resources, R&D displays a supporting attitude towards sharing knowledge. As the aforementioned findings indicated, R&D does seem very aware of the need to be open to disturbances in the market, like changing customer needs, different offers that suppliers can make and changing environmental legislation.

5 Analysis and discussion

In the following chapter the findings of the empirical research are analyzed in regards to the main research question. In order to do so, it is firstly pointed out how R&D Malmö applies the different types of openness and their resulting benefits. Thereupon, it is discussed how each of the three factors identified, appropriability, competence level and culture, influence R&D openness. As the findings did not indicate significant differences between 'sourcing' and 'acquiring' (inbound innovation) and 'revealing' and 'selling' (outbound innovation), the analysis mainly distinguishes between inbound and outbound innovation.

5.1 Configuration of R&D openness

5.1.1 Inbound innovation: sourcing

Dahlander and Gann (2010) propose that organizations can utilize external sources of innovation through leveraging the discoveries of others. Since not all smart people work in one company (Chesbrough, 2003a), organizations can access resources through external networks and benefit from creative ideas of outsiders (Datta, 2010). Through Bona's interactions with customers, it sources valuable ideas and customer feedback that is incorporated in order to ensure more market-driven innovation (Rehnberg,

2013a; Persson, 2013b). Several authors indicate that involving customers in innovation practices provides organizations with better tools to satisfy the customer (Vargo, 2004; Vaisnore and Petraite, 2011) and is significantly related with higher levels of innovative sales (Laursen, 2011). The resources that Bona sources with suppliers, trade shows, environmental agencies, universities and research bodies mainly concern trends and upcoming legislative amendments (Persson, 2013b; Linton, 2013, Tonell, 2013b). Through such activities, Bona becomes more responsive to the environment, one of the pinnacles of OI (Chesbrough, 1996).

As Iansiti (1997) proposes, it is virtually impossible for organizations to acquire the status of core competence in all of its activities. Through the component selling endeavor, R&D also generates ideas from other industries, which aligns with findings by Hoffman (2007) that organizations can systematically access resources outside a firm's boundaries. Tapping into the relative strengths of others is also done by R&D Malmö when leveraging Lund University's specialized staff and expensive analytical tools to get products analyzed (Rehnberg, 2013c; Persson, 2013b; Erkselius, 2013). Further, Bona is able to source technological resources from suppliers required in the initial stages of innovation, which allows Bona to capture the value of emerging technology (Battistini, 2013; Hoffman, 2007). This constitutes a great benefit as it allows deepening of the pool of technological opportunities available to the firm (Laursen and Salter, 2006).

5.1.2 Inbound innovation: acquiring

Dahlander and Gann (2010) propose that organizations can 'acquire input to the innovation process through the market place'. The main difference between sourcing and acquiring is the involvement of financial resources. In this respect Bona engages only in the occasional purchase of licenses from patent-holders. This is done when R&D unintentionally developed a process or product that has already been patented (Rehnberg, 2013b; Persson, 2013b).

5.1.3 Outbound innovation: revealing

Organizations can reveal their resources to external stakeholders for indirect benefits: as OI practices are usually transactions, organizations need a 'currency' in order to get inbound innovation (Dahlander and Gann, 2010). As Henkel (2006) found, organizations can selectively reveal innovations in order to get developmental support from external players, while the revealing organization gets resources in return. Bona provides its customers (flooring contractors) with training and advice on how to apply products and through this interaction the organization gets the aforementioned customer insights in return. Additionally, R&D Malmö tests suppliers' products and provides them with test results. In this way Bona establishes rapport with these players which will eventually lead to suppliers sharing valuable technological insights concerning their products in return. In line with Henkel (2006) Bona also sometimes has to reveal small pieces of their development process in order for the supplier to develop products according to Bona's needs. The same principle applies to universities and research bodies.

5.1.4 Outbound innovation: selling

Dahlander and Gann (2010) argue that this type allows “firms to commercialize their technology through selling or licensing out.” In Bona’s case, the company recently engaged in partial commercialization of its technology through selling certain components (Högvall, 2013). The company benefits from the major imperfections in knowledge markets that create opportunities to commercialize technology (Lichtenthaler, 2005). Teece (1986), Helfat (2006) and Fosfuri (2006) all propose that other parties may have a better infrastructure and commercialization capabilities to fully exploit the technology. While this is not necessarily the case with Bona as it applies these components in the formulation of its finishes itself, R&D Malmö’s initiative aligns more with the notion by Chesbrough (2003a) that external commercialization can further exploit the potential of a technological asset.

The empirical findings identified two different types of resources. The first is defined as (1) ‘*core knowledge*’: the technological resources that Bona uses in the development (formulation) of its finishes. This is R&D Malmö’s core competence, and the most advanced technological endeavor that is performed within the company, providing a competitive advantage in the market place. The findings indicated that Bona is very closed within this area - it does not share anything of this with the external environment (Rehnberg, 2013b) – apart from the components that are commercialized, which happens under strict conditions, so that there is no risk involved. Additionally, no components are sold that are used in Bona’s most important and technologically most advanced products (Högvall, 2013). Apart from very marginal outbound innovation, Bona has no inbound innovation for this activity at all.

The second type of resources that were identified is defined as (2) ‘*supporting knowledge*’: early-stage technological resources, human capital, access to expensive capital goods, and market intelligence (ideas, trends, customer feedback). While these are valuable resources, they hardly relate to Bona’s core competence: development (formulation) of finishes. Instead, they provide knowledge that surrounds its ‘core knowledge’.

5.2 Appropriability

5.2.1 Outbound innovation

Teece (1986) recognizes that organizations that move R&D beyond company walls are confronted with threats with regards to capturing the value. This is in accordance with Fischer and Henkel (2012), stating that firms that engage in value creation activities also need to apply mechanisms to capture the respective value that is created, otherwise commercial success may be difficult to achieve. As the findings in chapter four indicate, a crucial inhibitor for Bona to engage in outbound OI is the weak appropriability of Bona’s technological resources (Rehnberg, 2013b). Considering the outbound variants ‘revealing and ‘selling’, it was determined that Bona needs to be extremely careful in its interactions and exposure of resources to external players as such cooperations may leak sensitive knowledge out of the company. This is

particularly important with regards to R&D's core knowledge, which is most important to its competitive advantage, and is largely dependent on company secrets (Persson, 2013b). Drechsler and Natter (2010) found that organizations without effective IP protection tend to engage less in OI. This aligns with Bona's situation: when opening up to the external environment, it does not have such appropriability mechanisms that ensure that Bona's IP is protected and that a reasonable share of the value is captured (Rehnberg, 2013b).

As a way of protecting secrets, patents are available as they grant the holder the exclusive right for the particular innovation for a fixed time span. If effective, patents prevent imitation by competitors (Fischer and Henkel, 2012), which makes firms more likely to engage in OI (Drechsler and Natter, 2012). However, filing a patent requires the organization to disclose the composition of its innovation (Erkal, 2005), which 'should contain sufficient information to allow a skilled person to reproduce the particular innovation' (Kultti, 2007). Innovators may fear that the information that is revealed may be used to the benefit of competitors (Zhang, 2012). As patent protection is usually imperfect, organizations also fear that patents will educate competitors so that they can find ways to legally invent around the patent (Arundel, 2001; Cohen, Nelson and Walsh, 2000). Despite the fact that only 10% of Bona's output can be protected effectively by a patent, the danger of disclosing important information is an important consideration that is heavily discussed. In order to avoid disclosing too much information, they write these patents in a broad and complicated way so that it is difficult for patent-readers to really understand the development process (Persson, 2013b; Rehnberg, 2013b).

The main issue is that due to the process-dependence of Bona's product development, patents provide very poor protection for its secrets – if a competitor infringes Bona's patent, the firm will most likely not be able to prove this and thus cannot sue the offender. If Bona would like to prove patent infringement, it would need to reverse-engineer a competitor offering and determine that Bona's process was used. However, reverse-engineering cannot fully determine the applied process or exact components (Minagawa, 2007; Denicolo, 2004; Persson, 2013b; Rehnberg, 2013b), which means the end-product has a degree of inimitability (Barney, 1991; Collis and Montgomery, 1995) that prevents Bona from proving infringement. Although Bona can get reasonably far with reverse-engineering, it also needs to be noted that it is a terribly difficult process which requires enormous investments (Persson, 2013b). Hence, in line with Dufresne and Offstein (2008), 'maintaining, guarding, controlling and even mainstreaming patents all require investments' – policing an invention can be a very costly endeavor and thus are rather unsuitable for companies of smaller size, such as Bona.

Bona has thus chosen secrecy as its means of IP protection. Research by Cohen, Nelson and Walsh (2000) indicates that organizations find secrecy to be the most effective appropriability mechanism for the protection of new processes, especially in the chemical industries. Yet, they also point out that secrecy lends itself the least to R&D

spillovers, making OI rather difficult. Additionally, a secrecy policy provides no legal barrier for other organizations to adopt the ‘secret’ in their business practices. Hence, secrecy is rather unsuitable for OI practices. As Lane and Wegner (1995) propose, ‘secrecy is a form of intentional deception or deceptive omission’ – this is a poor base from where to engage in cooperation. Hence, organizations that have to operate under secrecy have a weak appropriability mechanism for engaging in outbound innovation, because it is uncertain if the desired amount of value can be captured (Teece, 1986; Helfat, 2006; Fischer and Henkel, 2012). Revealing too many resources may allow competitors to duplicate such an organization’s competitive advantage, whilst selling technology is impaired as none or few inventions can be patented. Without proper protection, it is hard to sell technology as Dahlander and Gann (2010) found that selling or licensing out IP forces an organization to disclose some of the details of its invention to the potential licensee. These details are necessary for a sales pitch, but the potential buyer gets a degree of information for free which may cause this party to ‘act opportunistically and steal the idea.’

5.2.2 Inbound innovation

Bona’s inbound innovation practices are also affected by appropriability issues as Bona’s entire industry segment needs to operate under conditions of secrecy. This greatly limits the potential to engage in cooperation with industry partners, because both partners experience high risks of unintentionally revealing their secrets (Persson, 2013b; Rehnberg, 2013b; Erkselius, 2013). This aligns with findings from Cohen, Nelson and Walsh (2000) who found that typically industries employ similar appropriation mechanisms since industry players deal with comparable products.

However, as the findings indicate, Bona gets deep technological insights into bricks from suppliers, which is only possible because these suppliers do have effective appropriation mechanisms (Fischer and Henkel, 2012; Drechsler and Natter, 2012). Hence, despite companies (Bona) having weak appropriability mechanisms that severely impair outbound innovation practices, such organizations may still benefit from inbound innovation practices, especially with organizations that have strong appropriability mechanisms. Consequently, organizations that suffer from weak appropriability in some area of their business can evaluate and pinpoint specific areas within their business in which appropriability is either strong or not an issue. Through this, they can use knowledge that is not harmful to their competitive advantage as a ‘currency’ (Dahlander and Gann, 2010) to take in knowledge from the external environment. In Bona’s case, the company is very secretive about its core knowledge, but tries to offer non-core technological resources in order to take in knowledge from the environment.

5.3 Competence level

5.3.1 Inbound innovation

The inbound innovation types of ‘sourcing’ and ‘acquiring’, are characterized by internalizing external knowledge. In order to do so successfully firms need to display

high levels of absorptive capacity (Zahra and George, 2002). Strong in-house R&D competence levels have been identified as prerequisite for absorptive capacity, ‘the ability to recognize value of new, external information, assimilate it, and apply it to commercial ends’ (Cohen and Levinthal, 1990). While absorptive capacity is largely a function of the firm’s level of prior knowledge, Schmidt (2010) found that absorptive capacity is cumulative and continuous R&D activities were found to be very significant in building absorptive capacity. As elaborated on in chapter four, it can be expected that R&D Malmö has built a very high competence level with regards to development of its core product. Considering that R&D Malmö has been developing finishes since 1950, it can be assumed that they satisfy Sanchez’ (1997) and Gupta’s (2009) requirements of core competences needing to develop over time and cumulatively, allowing for consolidation of its competence level and the incorporation of organizational learning (Persson, 2013b). The internal environment also seems suitable to establish a high competence level in R&D: staff indicated that the atmosphere is very informal and heavily emphasizes knowledge sharing, which are two attributes that are significantly related to building competence (Cohen and Levinthal, 1990).

Zahra and George (2002) provide a more detailed definition by arguing that absorptive capacity is a “dynamic capability that influences the firm's ability to create and deploy the knowledge necessary to build other organizational capabilities”, categorizing the process into two stages: potential absorptive capacity including knowledge acquisition and assimilation, and realized absorptive capacity represented by transformation and exploitation. While Bona seems to satisfy the pre-requisites of strong in-house R&D capabilities needed for high absorptive capacity according to Cohen and Levinthal (1990), they encounter severe problems in the first stage of absorptive capacity: partner identification and acquisition. According to Zahra and George (2002) this step “refers to a firm's capability to identify and acquire externally generated knowledge that is critical to its operations”. As the vice president of R&D Nils-Erik Persson stated “It is extremely complicated to get good OI collaborations in regards to the chemical side of the business. This is because there are not many people that are knowledgeable in this field and if they are, where can we find them? I would say that we need to learn a lot to ask the right questions – to find those to talk to”. Hence, despite a high competence level in its core segment of finishes, it is not enough to establish high absorptive capacity. Clausen (2013) examined the relationship between absorptive capacity and a firms’ ability to enter into innovation cooperation with external actors. The findings of this study suggest that internal R&D, combined with training and an educated workforce constitute key elements of a firm’s absorptive capacity which are “driving forces behind a firms’ ability to have innovation cooperation with a breadth of actors external to the firm” (Clausen, 2013). As illustrated in chapter four, R&D scientists generally hold a master degree or a PhD in chemistry, while junior scientists go through a long training route during which they are assisted by a senior mentor. Consequently, even though Bona applies all measures suggested by Clausen (2013) their partner identification activities are still hampered. Hence, other factors need to be at play when determining a firm’s ability to find the right OI partners. In this context the eleven year

older study by Zahra and George (2002) seems to offer more explanatory evidence to the factors that determine successful partner identification. They in particular refer to intensity and speed as determining elements stating that “the intensity and speed of a firm's efforts to identify and gather knowledge can determine the quality of a firm's acquisition capabilities” (Kim, 1997a,b; Zahra and George, 2002). This finding pinpoints Bona’s weakness in this respect: they lack speed and intensity in pursuing OI in this segment, as their high competence level dilutes their perceived value that external partners can deliver. Consequently, a high competence level is positively related to absorptive capacity and the engagement in OI initiatives, however it seems that there is a certain threshold of competence level that eventually hinders the establishment of absorptive capacity, thus making such organizations refrain from inbound innovation. Barge-Gil (2010) approaches this matter in a similar way by stating that “R&D intensive firms are likely to have great capacity to absorb external knowledge, but their need for it is usually smaller”. As a result they exploit it “but it is not at the core of their innovation assets” (Barge-Gil, 2010). This portrays Bona’s OI efforts quite well. While they do not engage in OI within their competitive advantage area of technological development of finishes, they actively seek for OI activities outside this segment. As the R&D scientists generally do not think that open R&D in the core knowledge area will add much value, the partner identification stage of absorptive capacity does not receive enough support. As a result, high competence organizations run the risk that they may not perceive the necessity to engage more in inbound innovation, leading to the identification stage of absorptive capacity remaining underdeveloped.

This thinking, however, is a fallacy as the literature suggests that even though organizations have very strong R&D capabilities, their innovative performance still increases if they involve external actors within their innovation practices (Berchicci, 2013). It is true that the stronger an organization’s R&D capabilities, the higher the risk to seize substitutive resources – every firm approaches a threshold of optimal performance, after which involving more external actors lowers innovative performance, and this threshold is closer-by for high competence firms (Berchicci, 2013). However, as R&D Malmö has completely sealed its core knowledge area, there is definitely potential to increase innovative performance.

However, advantages of having a high competence level in R&D in regards to inbound innovation can be identified as well. As the findings in chapter four illustrate, R&D Malmö’s high competence level appears to attract external players. Hence, in line with Drechsler and Natter (2012) who observed a similar relationship in their research, high competence organizations appear more trustworthy and attractive to work with. Additionally, whilst the initial stage of R&D Malmö’s absorptive capacity appears underdeveloped, the unit is very adept at assimilating and exploiting early-stage technological resources that it gets ‘handed’ by its suppliers. Hence, by having a high competence level, and thus having a strong ability to assimilate and exploit external knowledge (Cohen and Levinthal, 1990), firms may be better positioned to make use of

advanced innovations by others – as was observed when Bona seamlessly integrates advanced bricks into its innovation practices. This finding is supported by many other researches (Lin, 2012; Hagedoorn, 2012; Caloghirou, 2004; Berchicci, 2013). Through this, the high competence level organization is able to further raise the standards of its product – and the technological gap between the focal company and the weaker organizations is enhanced.

5.3.2 Outbound innovation

With regards to outbound innovation in the form of “revealing and selling”, a clear advantage of having a high competence level is that a firm has an excellent ‘currency’ to engage in open R&D (Dahlander and Gann, 2010). With regards to Bona’s component selling endeavor, it was clearly identified that the market place was well aware of its high-quality image – and demand for the components is high. At the same time, the outbound innovation of “revealing” may be hampered, because the high-competent organization may give more resources than it would eventually receive in return. Hence, the tradeoff between taking in and giving out resources may be unreasonable, which in turn may diminish the value for the high competence organization to engage in outbound innovation.

Concluding, Bona has built significant competence within its core knowledge area – development of finishes. As Iansiti (1997) proposes, it is virtually impossible for organizations to acquire the status of core competence in all of its activities. Hence, Bona does actively use open R&D to tap into the relative strengths of external players to take in supporting resources that are valuable contributions surrounding its core competence, like market intelligence, early-stage technological resources and access to expensive capital goods and qualified human capital. Hence, whilst companies may perceive less value in open R&D for their core competence as they perform very well in this area, other parts of their business in which it has less competence may be supplemented with OI initiatives so that the company reaches acceptable levels in these respects also (Hoffman, 2007; Chesbrough, 2003a, Brez, 2009, Lichtenthaler, 2011).

5.4 Culture

Organizational culture is defined as ‘a collection of values, beliefs and norms shared by its members and reflected in organizational practices and goals’ (Hofstede et al., 1990; Khazanchi et al., 2007). As Herzog (2011) and Kuratko (2011) argue, cultural values have an emotional attachment that can deviate from rational economic considerations. The amorphous nature makes culture hard to pinpoint, but it transcends every aspect of an organization. Martins and Terblanche (2003) and Ahmed (1998) argue that cultures may contribute to the occurrence of innovation, but may also be an inhibitor. Herzog (2011) proposes that ‘organizations that move from closed to OI practices need a change in the underlying innovation culture’ indicating that an OI culture needs to have different characteristics than a closed innovation culture. In many instances, organizations fail to cycle from closed innovation to successful OI practices, because the culture is subject to ‘the not-invented-here syndrome’ for inbound innovation activities (Katz and Allen, 1982; Laursen and Salter, 2006; Veugelers, 1999;

Mehrwald, 1999; Di Minin et al., 2010; Chesbrough and Crowther, 2006) or ‘the not-sold-here syndrome’ for outbound innovation (Herzog, 2011). The organizational antecedents of such cultural phenomena were investigated within Bona – and are compared to the literature.

5.4.1 Inbound innovation

At first, it was found that, in general, R&D staff has very long tenures and employee turnover is very low (Rehnberg, 2013b; Persson, 2013b). According to Katz and Allen (1982), this is dangerous as their research indicated ‘a tendency of a group of stable composition to believe it possesses a monopoly of knowledge in its field, which leads it to reject new ideas from outsiders to the likely detriment of its performance.’ Therefore, stable group compositions fuel NIH-syndrome.

The findings from chapter four also revealed a strong sense of pride and accomplishment within R&D Malmö, which was mostly based on their self-image of self-sufficiency in its core technological area. Additionally, a high degree of trust in one’s own technological competence was identified. Slowinski et al. (2009) argue that R&D scientists may resist sourcing innovation as they want to focus on technological discoveries, instead of acting as an integrator of external technology. If R&D Malmö is very accustomed to in-house R&D, and is proud of this as well, it can well be that external R&D is perceived as violation of their own identity, which triggers NIH-syndrome (Herzog, 2011). As Mehrwald (1999) proposes, a high degree of trust in one’s own technological competence is another contributing factor to NIH-syndrome. In the observed case, it is uncertain to which extent this fuels NIH-syndrome, but strong confidence in general may tend to alter the opinion an individual has concerning the usefulness of other knowledge sources.

Herzog (2011) also proposes that individuals tend to create a stable working environment (routines) for stress and uncertainty reduction, which fosters the establishment of NIH-syndrome as involving external R&D partners increases dynamism and uncertainty. The findings in chapter four indicated that the work place within R&D Malmö is rather dynamic, yet only in their own department. Moving scientists to other areas within the organization encountered resistance, indicating symptoms of an NIH-syndrome.

In this context Herzog (2011) also argues that negative or no experiences at all with technology sourcing may create a negative bias towards OI. As was found in chapter four, R&D Malmö is very self-sufficient and closed with regards to its core activity. At the same time, there is a well-known example of betrayal within R&D that further enforced the secretive atmosphere within the company (Tonell, 2013b). Hence, the limited experience in open R&D with regards to the technological area, and the prominent example of betrayal, do not indicate good prerequisites for further opening up R&D, while this may simultaneously cultivate NIH-syndrome.

It was also advocated that OI cultures require a higher risk-taking propensity (Herzog, 2011). Chapter four’s findings indicated that R&D Malmö takes substantial risks with

regards to realizing more radical innovations. However, risk-taking in OI is more about granting external parties responsibility for innovation and partially giving up control (Herzog, 2011). In this context, it was indicated that there is dissension amongst staff about whether R&D would be welcoming to a concept of assuming such responsibility to external parties – and giving up control. Additionally, R&D was found to be very low risk-taking with regards to the quality of its product (Rehnberg, 2013c; Erkselius, 2013) as innovations are only commercialized if they are perfect and flawless (Högvall, 2013). Such a perfection syndrome (Kuratko, 2011) aligns more with an attitude of maintaining complete control, indicating that R&D Malmö's culture appears to be reluctant in terms of open innovation activities.

In this regard Mehrwald (1999) also argues that the relative performance of external technology influences the proneness of an R&D department to adopt a NIH-syndrome. The findings from chapter four clearly indicated that the R&D scientists believe that they have the best finishes within the industry, an attitude that fosters the establishment of a NIH-syndrome.

The findings from chapter four further indicated that R&D scientists seem perfectly aware that they are the leading company in terms of innovativeness, quality and environmental concerns. Additionally, it is believed that Bona will continue its technological leadership within 10 years also – without changing the way R&D is currently managed. It was also acknowledged that R&D does not pursue OI actively enough and that it could do much better in this respect. Hence, there seems to be no apparent need to pursue a higher degree of openness. Gilbert (2005), Chesbrough and Crowther (2006) argue that a strong perception of threat or a clear articulation of the necessity to be open is essential to create commitment to OI. Within Bona, there seems to be an absence of such a need. Without such a need, staff may not perceive the benefit of OI, which again fuels NIH-syndrome.

Therefore, with regards to the inbound innovation practices of 'sourcing' and 'acquiring', R&D Malmö displays many organizational antecedents that can lead to the development of a NIH-syndrome – which the academic literature describes as a powerful inhibitor of OI (Herzog, 2011; Mehrwald, 1999; Di Minin et al., 2010; Katz and Allen, 1982; Veugelers, 1999). Due to culture's amorphous, complex and intangible nature, it cannot be determined exactly how far the influence of culture goes with respect to Bona's inbound innovation practices – and if there really is a NIH-syndrome. However, as many organizational antecedents are in place, it can reasonably be assumed that R&D Malmö's culture is not suitable to inbound OI practices in its core competences. Hence, other factors than rational economic considerations play a role here (Herzog, 2011; Kuratko, 2011). Behavior-wise, it speaks for itself that R&D has completely sealed its core knowledge area for inbound innovation. The earlier findings that R&D Malmö's inbound innovation practices are to a high extent inhibited by the belief that there is no value or clearly identified need, due to its high competence level, are very interesting in this context. As culture is not solely based on objective considerations, it can well be that NIH-syndrome exacerbates the influences that more

rational considerations impose. In Bona's case, despite having a high competence level, there may be valuable external resources that add to its core knowledge, however, a strong identity and pride of doing R&D on their own, very limited or negative experiences with open R&D, a strong need for control (low risk), high confidence in one's own abilities, the relative performance of external technology being regarded as inferior and the lack of a clearly identified need may all severely bias the reality. Hence, cultural factors seem to distort reality and this may affect inbound innovation, whilst there may be rational potential to benefit from external technology. As a result, organizations need to continuously 'assess' their culture and determine whether such influences do not bias inbound innovation activities, by for example, bringing in outsiders that have not been exposed to Bona's culture. Although culture is dynamic, it is also not easily changeable. For example, if a new leader is appointed that is very supportive of OI, it may take several years for that leader to change the organization's culture (Kuratko 2011). Hence, the cultural change cycles are longer than for other organizational practices that can be changed quickly – meaning while the organization or the environment is supportive of open R&D practices, it can be that the culture has not cycled to such a stage yet.

5.4.2 Outbound innovation

With regards to the outbound innovation types of 'revealing and 'selling', chapter four reported that R&D scientists display a high awareness of the need for secrecy when engaging in external interactions. Additionally, a lot of interviewees believe that the R&D culture houses a fear that selling technology could strengthen the relative position of competitors by allowing them to further build upon the technology that is provided. Hence, it is most likely that the weak appropriability of Bona's core knowledge area has played an essential role in creating this fear, as culture is again an outcome of organizational practices (operating under secrecy). According to Herzog (2011), NIH-syndrome and NSH-syndrome originate from approximately the same sources. Hence, again, competence level will play a part in the outbound innovation practices also: part of the fear may originate from the finding that staff perceives their technology as superior, which means there is much to lose when opening up. As Herzog (2011) argues, the 'systematic overestimation of the negative outcomes of external technology commercialization' is a strong antecedent of the NSH-syndrome. A secretive R&D environment and a high competence level may instigate a fear that externalizing technology may backfire on an organization's competitive position, and hence, NSH-syndrome may bias the rational perception of the employees within a firm.

As so many antecedents of NSH-syndrome were identified, it can reasonably be assumed that cultural factors are at play. Especially the finding from chapter four that 95 percent of Bona's inventions are not commercialized makes it questionable whether these inventions really render no commercial value – or if more cultural aspects underlie this opinion. Hence, it is possible that an NSH-syndrome distorts reality and this may affect outbound openness decisions in R&D. Especially since the NIH and the

NSH syndrome originate from largely equivalent sources, such cultural influences will play a role in both inbound and outbound practices.

Despite R&D Malmö being quite closed within its core knowledge area, the findings from chapter four indicated that R&D scientists do understand the importance of incorporating supporting external resources within its innovation practices, like market intelligence, human capital, access to expensive capital goods and non-core technological resources – as the company actively takes these resources in from the external environment, whilst ‘paying’ for them by sharing its own supporting resources. Hence, R&D’s culture seems more of a barrier towards complementing its core competence (finishes development) with external technological resources, but its culture seems supportive of sharing supporting resources. As was illustrated, a culture is affected by organizational factors like weak appropriability and a high competence level – and how the firm deals with these. As there are no appropriability issues with such resources, and Bona does not hold its core competence in such areas, the culture may also incorporate much more of a positive attitude towards utilizing supporting resources. Hence, organizations may display different ‘sub-cultures’ with regards to the business areas they deal with. They may be very adept and proud of their secretive core – and keep this closed. At the same time, they may have different areas in which they have less competence, and that are not affected by appropriability issues, which fuel a much more positive attitude towards open R&D cooperations in these areas.

6 Conclusion

In this paragraph, final conclusions from our analysis are drawn. After that, the limitations of this study are described – and interesting areas for future research are indicated. Finally, the practical implications to business managers are highlighted.

6.1 Conclusions

Through the analysis of the findings, it was at first indicated that organizations can have a different configuration of openness with regards to the different areas that R&D engages in – or the different resources that an R&D department deals with. The case study indicated that the focal company displayed a different configuration of R&D openness for its (1) core knowledge and for (2) supporting knowledge. This is an interesting finding as it emphasizes that an R&D department can be divided into several business areas – organizations can then determine per business area or resource class which openness configuration best contributes to their innovative performance. It was found that inbound R&D activities may allow organizations to take in a variety of resources, mainly related to technology, market intelligence, human capital, and access to expensive capital goods, which in turn filled knowledge gaps and enhanced responsiveness to the external environment. In return, outbound innovation gives organizations a currency for inbound innovation – and may also allow commercialization of technology that brings in financial resources.

Appropriability appeared to be both a driver and an inhibitor of open R&D. Weak formal IP protection forces organizations to adopt secrecy as its appropriability mechanism, which lends itself the least to open R&D. Hence, firms that are dependent on secrecy may experience severe difficulties in realizing outbound innovation. Opposed to this, there are no formal constraints for such firms to realize inbound innovation. It was found that inbound innovation within a focal company's own industry is cumbersome as appropriability was found to be an industry problem, but cooperation with industry segments with stronger appropriability mechanisms is a suitable option. The secretive firm then needs to determine in which business areas or resource classes appropriability is not an issue – and such resources may be used as a currency, if not financial resources (Dahlander and Gann, 2010). For the case company, its core knowledge area is dependent on secrecy, but it does share its supporting resources (which cannot hurt its competitive advantage) and through this is able to take in many external resources. The external parties through which it gets its supporting resources have no appropriability issues – and were able to share a relatively high degree of knowledge.

Competence level was also found to be both a driver and an inhibitor of open R&D. For inbound innovation, a high competence level in a business field or resource class first of all works as an attractive force in a sense that external actors are more willing to cooperate with the focal company. Additionally, a high competence level establishes high absorptive capacity to assimilate and exploit knowledge from external parties. The case company was able to integrate advanced innovations from its suppliers into its practices, which enlarged the technological gap with lower-competence organizations. As a clear downside, a high competence level may 'blur' a firm's vision as no necessity for inbound innovation is detected. Through this, the initial stage of absorptive capacity (partner identification) may be impaired – and the focal company foregoes on the possibilities of inbound innovation and the corresponding vast pool of knowledge externally available. For outbound innovation, a high competence level gives a company an excellent currency to engage in open R&D, but there is a clear trade-off issue: the high-competent firm may give more resources than it gets in return – and may educate the other party to a significant standard. As a firm cannot obtain the status of core competence in all of its business areas or resource classes, inbound innovation allows an organization to complement the areas in which it has a weaker competence level with external knowledge – so that these areas can also be improved to a higher level.

Finally, culture was found to be more of an outcome of the aforementioned two factors – but proved to be a significant influence that organizations have to consider. Hence, the contextual factors cannot be seen solely independently, but they are inter-twined. A high competence level in an area may contaminate a firm with the not-invented-here syndrome, as staff may perceive that there is no value in and no necessity for inbound innovation. A high competence level in combination with a secrecy policy (weak appropriability) may infect an organization with the not-sold-here syndrome, as staff

may fear that their technology may allow its competitors to strengthen their competitive position against the revealing or selling firm – outbound innovation may then be impaired. However, as a firm can display different configurations in different business areas and resource classes, it was noticed that the case company displayed a much more open attitude towards giving and taking in supportive resources, like market intelligence. As these supporting resources have no appropriability issues and are not the focal company's core competence, staff displayed a much more supportive culture towards inbound and outbound innovation in this area. Hence, an organization may also display different 'subcultures' with regards to open innovation in different business areas and resource classes.

Finally, the case company showed a high commitment towards internal innovation, their OI activities, however, varied from open in supporting and completely closed in core knowledge areas. Consequently, it needs to be acknowledged that a company being dedicated to innovation does not necessarily mean that they are susceptible to OI measures. Displaying a great infrastructure for internal innovation can hence not be taken for granted as an entry for OI initiatives.

6.2 Contribution to literature

Currently, there is a gap in academic literature in regards to providing better insights on the different combinations of openness within a firm and how certain factors influence such a configuration, hence our research question aims to address this issue: "*How does a firm configure its R&D openness and how is this influenced by the factors of appropriability, competence level and culture?*" The analysis, discussion and conclusion have further developed our academic understanding of how a firm's R&D openness configuration is explained by the influences of appropriability, competence level and culture. It is a further step in enhancing our knowledge about understanding a firm's R&D openness decisions by zooming in on openness and, instead of talking about openness in general, conceptualizing it in a framework of four different types. Additionally, this research has integrated culture as an influential factor in understanding a firm's openness decisions – whilst it was also found that culture is heavily influenced by the contextual factors appropriability and competence level. Consequently, since to the author's knowledge, these three contextual factors have never been related to the four identified types of OI, this study contributes to literature. Further new insights are provided in regards to the appropriability mechanism of secrecy and how this impairs OI activities.

6.3 Limitations and implications for future research

At first, it is to be acknowledged that no research is complete. As this was a case study, empirical findings are mainly retrieved from a single entity: the focal organization. The conclusions from this research can thus be supplemented in follow-up researches by investigating other contextual factors. Additionally, the conclusions may be tested in deductive, quantitative studies to determine if they hold true amongst larger populations – and can be generalized from. As the case company was able to employ its high competence level in order to realize outbound innovation without sharing its core

knowledge (suppliers bricks are analyzed using Bona's core competence; the results are funneled back without revealing how it was tested), it would be interesting to see how organizations with a low competence level engage in open R&D. Another interesting research area would be to investigate the relationship factor within R&D openness settings: if a party suffers from weak appropriability, how can strong relationships aid in overcoming this – how can organizations rely on an intangible concept like 'trust'? Further, a very interesting area for future research is proposed in studying the interrelatedness of all three factors that were found to influence the configuration of R&D openness. Whilst beyond the scope of this research, some interesting theoretical assumptions are made – that may be interesting for future research. For example, weak appropriability as an industry problem forces organizations to be secretive – and hence, they have to build significant competence in this area by themselves to become competitive (high competence level), which in turn may fuel a NIH and NSH-syndrome as it is believed that the organization already controls the best resources. Additionally, since appropriability was found to be an industry problem, it puts higher demands on a company's absorptive capacity as a firm needs to look beyond industry borders for resources. Consequently, the value of a company's high competence level may be diminished due to industry appropriability issues. Hence, to fully understand a firm's openness decisions, it may be necessary to investigate the interrelatedness of the drivers and inhibitors of open R&D.

6.4 Implications to managers

Our analysis indicated that being ill-suited for open R&D in one area does not necessarily mean that a firm's R&D department should be completely closed. To the contrary, organizations may still be able to reap OI benefits in other areas that are better suited for such practices. As core knowledge may need to be shielded, supporting knowledge can be greatly enhanced by OI activities – the case company gratefully imported and exported supporting resources, whilst keeping its core closed. Organizations need to carefully determine how well each area fares with regards to appropriability and competence level – and adapt its OI strategy accordingly. Appropriability may expose a company's secrets and allow duplication of its competitive advantage – this should be regarded very seriously before opening up R&D. Additionally, whilst a high competence level was found to arouse interest in cooperation from outsiders, and put the company in a good position to assimilate and exploit knowledge, it may also impair the identification stage of absorptive capacity. It is also important to see these factors in relation to the culture that resides within an R&D department – and is affected by such concepts. Culture transcends all aspects of the business, has deep roots, changes slowly and may bias the rationality of R&D openness decisions. Hence, organizations are advised to use the conceptual framework that was created by merging the Dahlander and Gann (2010) model with the concepts of competence level, appropriability and culture – and determine their desired configuration before actually engaging in open R&D.

7 References

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8 Appendix

8.1 Interview participants

Nils-Erik Persson – Vice-President of R&D

Nicola Rehnberg – R&D manager

Lars Högvall – R&D component selling director

Patrik Tonell – R&D chemist advanced

Johan Fagefors – R&D chemist advanced

Stefan Erkselius – R&D chemist

Jens Persson – R&D chemist

Peter Linton – R&D chemist

8.2 Interview guide

1. How long have you worked at Bona?
2. How did the R&D finishes department build up their current competence level?
3. What has been the historical position of R&D finishes? How has this department contributed to Bona's competitive advantage?
4. How is the organizational commitment towards R&D finishes?
5. How do you use external sources within your daily activities in R&D?
6. Does R&D finishes ever reveal internal resources to the external environment?
7. Does R&D finishes ever commercialize internal resources through selling or licensing out? For example, you have made a new discovery for which you have no use, and thus, sell it to someone
8. Does R&D finishes ever use external sources of innovation? For example, by using ideas, knowledge and technologies that are externally available?
9. Does R&D finishes ever acquire inventions by paying money for it?
10. Have you ever had negative experiences with opening up R&D?
11. How dynamic has the market been? For example, has the way that you develop a finish drastically changed over the years? Did R&D finishes have to look into many other fields during the years or were they relatively focused on exploiting your current competitive advantage?
12. Does that ever inhibit you to engage in innovation?
13. Technology push or market pull?

14. How is the competence level in R&D finishes? How does this competence level relate to your competitors?
15. Do you think there is value for Bona in opening up R&D activities? Do you think you can learn from others?
16. Can you think of anything that would be valuable to open up?
17. How do you think the tradeoff between getting and giving knowledge?
18. Do you think there is a need for you to further open up your R&D and utilize more external resources? What about the chemical side?
19. Which level of education do R&D scientists need to complete? How much training do you get internally?
20. How would you describe the culture within R&D?
21. Is there a strong sense of pride and accomplishment due to its success?
22. Is part of this pride, because you are so self-sufficient within your core knowledge?
23. How do flooring contractors perceive Bona in the market? Do you have a reputation in the market for doing things on your own?
24. How confident is the R&D department in its abilities?
25. What attitude does R&D have with respect to risk-taking in product development?
26. What attitude does R&D have with respect to risk-taking when it would come to giving external players responsibility for parts of R&D?
27. How do you deal with failure?
28. How stable is the R&D environment here? With this I mean, is there a high standardization of tasks? Is there a lot of uncertainty involved in the daily tasks of scientists? Are jobs very structured or do you have a lot of freedom to decide what you do on the job?
29. How is the relative performance of your finishes in the market?
30. Concerning selling technology, do you think that there may be a fear in R&D that competitors will strengthen their relative position by further building upon the technology that you provide?
31. What's your ambition within R&D?
32. Do you ever experience knowledge gaps? How do you go about solving these?
33. Where do you see Bona in 10 years? Which position will you have in the market?