Adoption, Use and Influence of Computer Based Information Systems for Product Development

Qualitative Studies of Small Firms within the Wood Industry

Daniel Örtqvist
ABSTRACT

Research about small firm product development has increased. Firm internal forces have earlier been mentioned to be crucial for success in product development management. A more recent approach has been to focus on firm external forces concerning product development. Studies have focused on sources for product development, and only very few studies focus on the information systems used for addressing external parties in product development related work. Techniques and methods for enhancing the management and work with product development are central, why it is argued to be important to concentrate on the role of the media for information and communication between the firms that develops new products and its environment. It has been argued that the media Computer Based Information Systems (henceforth CBIS) can improve business processes, although the fast emergence of the research area leaves few studies supporting their arguments and propositions with empirical material. Furthermore, few have come to address the small firm context. As a response, this licentiate thesis includes a pre-study, which questions how and why small firms use CBIS for product development. A part of the purpose with the pre-study is also to identify how further research, in the form of the main study, can address this research area. The results, from interviews with 36 CEOs of small firms in the wood industry, reveal two distinct usage areas of CBIS for product development: unilateral (i.e. information gathering) and multilateral (i.e. communicative) usage. The main study sets out to address questions such as: Why do some small firms use CBIS for product development? How do these small firms use CBIS for product development? How does these small firms use of CBIS influence their product development? The main interest in the main study is to have an in-depth focus of the empirical material; wherefore interviews with informants from two firms have been conducted. Interview technique resembling narratives have been used to focus on histories and processes of product development within the firms. The results are divided into three areas. 1) The adoption of CBIS in the firm and for product development. This seems to be influenced by the perceived necessity to use CBIS, the perceived benefits with using CBIS and the CBIS competence possessed or accessed. 2) The use and influences of CBIS on product development, which can be divided into unilateral and multilateral use of CBIS. Media selection theories are argued as important for understanding why CBIS is used, and the influence CBIS has on product development is related to the reasons for selection the specific media. 3) Contextual influences are discussed as influencing the use of CBIS for product development in the contexts of the product, the firm and the firm’s environment.

Keywords: Small Firm, Product Development, Computer Based Information System
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Daniel Örtqvist
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1. LITERATURE BACKGROUND AND RESEARCH OBJECTIVES

In the following sections, the importance of research about product development in small firms and the use of computer based information systems will be discussed. Furthermore, this chapter will present the research objectives that are of interest for this study.

1.1 Research about small firms and product development

Davidsson, Lindmark et al. (1994) have pointed out that research about small firms has been growing more important during the last years. According to their study there has been a shift of focus in society. Earlier, Swedish governments have pinpointed large firms as being the most important contributors to the Swedish economy; this based on the assumption that larger firms are more stable and healthy. Davidsson, Lindmark et al. concluded in their study on the dynamics in Swedish trade and industry that this traditional point of view must be revised. The main reason for this was said to be the fact that the overwhelming majority of small firms account for a substantial share of output and employment within Swedish industry, which makes small firms highly important for the Swedish economy. Story (1994) also argue the importance of the small firms for society. Following the line of reasoning, one of the causes for the importance of small firms is that they have a much higher potential to develop new products. On the other hand, small firms are claimed to lack the resources necessary for product development.

Still, most research that has been carried out focuses on larger firms. That type of research cannot be viewed as directly analogous to small firms. In fact, product development has been identified as one of the fields that differs the most when it comes to small and large firms. One motive behind this is that small firms are less likely to have as much competence and capacity for product development as large ones. Even so, small firms are more likely to introduce fundamentally new products than larger firms are (Story, 1994). Furthermore, Acs and Audretsch (1990; 1991) have shown that small firms are likely to bring about the most significant innovations and that research is important to improve the knowledge of these development processes. Several researchers have also revealed a strong connection between the development of new products and the growth for both firms and society (Gruenwald, 1988; Di Benedetto, 1999; González and Palacios, 2002). In fact, several researchers have argued that continuous product development is a key to survival, growth, and profitability for firms (Myrick, 1977; Chaganti and Chaganti, 1983; Varadarajan, 1986; Nonaka and Yamanouchi, 1989;
Oster, 1990). This has especially been pointed out as an important field for small firms which are cited to often lack the resources of larger organizations and this implies that their survival often relies on product development through continuously discovering new opportunities, and using resources of the entire organization for the purposes of the development projects (Kaish and Gilad, 1991). In addition, González and Palacios (2002) have in a recent study revealed that nearly 40% of all new products fail to succeed. A great deal of research has tried to address this problem and assess the characteristics of successful product development. In fact, “the accumulation and application of engineering knowledge (technology) in order to improve and change products and services, and how they are produced and delivered (technical change), have been central features of all recorded civilizations” (Pavitt and Steinmueller, 2002). Judging from this discussion it seems as if research has been trying to solve problems with product development processes since ancient times, and that many products still fail to succeed. This does not imply that research about product development has been done for no good. Rather, failure in development processes is something inevitable and will always exist. More importantly, knowledge about development processes can further improve the conditions for success in product development processes and therefore research about product development can be viewed as highly relevant for both firms and society.

Moreover, within product development research a traditional approach gives attention to the internal roles, resources and competences as being the prerequisites for the creation of new products. For more information see, for instance, Tushman (1977), and Jelinek and Scoonhoven (1990). Another research approach has given attention to the interactions with and between firms as the driving force of product development, see for instance Rothwell (1992), Shapira, Roessner et al. (1995), Lawton-Smith (1996), Malecki and Tootle (1996), and Freel (2000). The main interest in this study is the relational influences in small firms’ product development processes. The relational view of product development concerns the importance of information and communication as key issues in the development of products with the use of inter-organizational support (Wheelwright and Clark, 1995). Several different approaches to the relational view of product development have surfaced. For instance, it has been argued that ideas for new products emerge from the relations between firms in networks (Håkansson and Snehota, 1995). Another approach states that a firm’s strategic network can be of use for accessing those resources, knowledge, skills etc., needed to constitute product development (Freel, 2000). Several other approaches to the sources of innovation have also been presented (Urban and von Hippel, 1988). Thus, questions regarding how to use the information sources have been
addressed in this field of research. For instance, Hartman and Tower (1994) have expressed a need for future research to investigate if the number of sources used is more important than the depth of the sources. Another important question that can be linked to this, and which is central to this study, is the role of the media used for sending and retrieving information and communication in product development processes.

1.2 Research about computer based information systems

Research about Computer Based Information Systems (henceforth referred to as CBIS) has been present since the late 1950ies (Leavitt and Whisler, 1958), but the conditions and the possibilities to use this tool for information and communication purposes have increased with time, as new and improved technology has been incorporated together with more developed software. This implies that CBIS can be viewed as a somewhat new tool for information and communication purposes that in its present form has received much attention as a possible tool for almost any business process (Hammer and Champy, 1993). However, a few empirical investigations have discovered the strengths and weaknesses with using CBIS for information and communication. The research about the relative effects of CBIS is in its very beginning, and early obstacles towards the use of CBIS have diminished, as, for instance, the economical aspects of investments in hardware. This implies that the usage can be feasible even for small firms (Thong and Yap, 1995). At the same time, the development of different kinds of software packages has made it even more economically feasible.

According to Cragg and King (1993) the usage level of CBIS among small firms is high, but the same study shows that they are not utilizing the full potential of CBIS. Research has argued over the use of CBIS for business process since the 1970ies. For example, Murdick and Ross (1975) and Brunsson (1982) argued that computer systems could solve numerous of management problems. During the same decade, Hedberg and Jönsson (1978), argued, on the other hand, that computer systems rather make firms more rigid then more flexible. From their point of view managerial work which is seen as, among other things, creative, flexible, and as a forum for decision making cannot be supported by the usage of CBIS. Meanwhile, research shows dubious results about the usefulness of CBIS in business processes and management. The industry of computers and computer software has emerged fast. The principles of the hardware underlying the computers are still the same but the growing capacity to retrieve and process information, and the fast development of software packages, have made the computers more useful from a user’s point of view.
First, let us start by looking at research that has focused on what discriminates CBIS users from non-users. Adoption research has revealed that the adoption of CBIS for serving a specific task has been argued to depend on two criteria. The first one is the task relevance, which is the extent to which the end-user perceives the system as relevant to the task at hand. The second criterion is the task usefulness. That is the extent to which the end-user believes CBIS enhances the performance of the task. Additionally, the attitudes from management towards the use of CBIS have also been found to be associated with the adoption of CBIS (Howard and Mendelow, 1991). Due to small firms’ typical high degree of centralization, the manager at a small firm plays an important role. This influential role is also mirrored in the adoption and implementation process of CBIS, especially since CBIS projects in small firms are usually initiated at the top (Montazemi, 1987; Igbaria, Zinatelli et al., 1998). Also, CBIS experience has been shown to have a positive effect on users’ attitudes towards computer usage (Nickell and Seado, 1986), and it is subsequently assumed to increase adoption and usage levels. Hence, in order to understand the use of CBIS as fully as possible it is of interest to reveal what leads to non-usage of CBIS.

Research about the role of CBIS in business processes has, according to Dewett and Jones (2001), mostly been directed towards efficiency enhancing properties. The use of information technologies is argued to vastly increase the connections between actors and is able to increase a firm’s information processing capacity. The use of CBIS can enhance the capacity to process and retrieve more information. Due to the cost of recording all experiences, there are thus limitations to the overall capacity to process information. There must be a distinction between information that can be relevant or irrelevant for future outcomes (Levitt and March, 1988).

Several researchers have questioned the role of CBIS in the organizational context. Willcocks (1992) have expressed that it is of interest for future researchers to reveal the value of IT for organizations. Furthermore, several researchers state that the area of small firms and their use of CBIS is in need of more empirical research in order to achieve an understanding of how this specific information system is used by small firms (Thong and Yap, 1995; Igbaria, Zinatelli et al., 1998).
1.3 Combining the area of small firm product development with CBIS

Dewett and Jones (2001) argue that the role CBIS has for product development processes is important for research but is yet under-represented. The conclusion drawn from their study is that CBIS “is an important but neglected means of facilitating the innovation process. This is because IT moderates many aspects of the process of bringing ‘new problem-solving ideas into use’ given that it determines the way information is stored, transmitted, communicated, processed, and acted upon” (Dewett and Jones, 2001). Furthermore, several researchers have attempted to examine the use of different kinds of computer based systems for product development in firms. Most of these studies have their focus on the role of CBIS and its impact on large firms, leaving very few of these studies to the small firm usage. In fact, Öhrwall Rönnbäck (2002) has addressed the importance to reveal how the small firms use of CBIS facilitates product development processes. Due to the expressed need of empirical work and the relative absence of theoretical development on the link between product development and CBIS, it is of interest to question:

- Does small firms use CBIS for product development? If so:
- How is this use carried out in the small firm?

1.4 Purpose of the pre-study

The primary purpose of this licentiate thesis is to create an appreciation of how small firms can manage CBIS in product development processes. To achieve this, the purpose of the first study in this licentiate thesis is to identify how further research can address this research area. Therefore, the first study will identify areas of CBIS usage for product development in small firms, as well as identify motives for not using CBIS for product development in small firms.

1.5 Definitions of key terms

Clarifications and definitions of central terms are of great importance for all research. This section, therefore, aims to explain important theoretical terms that are used in this part of the study. The way in which these definitions will be elucidated can be resembled with what Hempel (1969) means by definition by stipulation. This kind of definition serves the purpose of using an expression in a determined way, which is the intention of this section.
1.5.1 The Small firm

Several different approaches are used in research literature to define and distinct firm size. Turnover, total assets, and number of employees are some examples. The main reason behind a distinction of firm size in this thesis is due to the fact that managing a firm is more or less arduous, depending on the size of the firm. Thus, the use of CBIS for product development entails that we are interested in the ongoing processes and activities in the firm. This also implies that we are interested in actors and action. It is therefore reasonable to assume that the number of actors in a firm would have a higher significance when determining firm size than, for instance, the totals of balance sheet, or the turnover. Number of employees will therefore be used as a discriminator for making the definition of the firm size in this context. Furthermore, literature on both computer usage and product development among small firms has often relied on the number of employees for the distinction of firm size, and this supports the intention to use the number of employees.

After emphasizing the point of using the number of employees as a distinction of firm size, the question of how many employees a small firm can have arises. This question has also been given different answers in research literature. From studying the literature on small firm product development, a number of definitions of firm size based on employees have been identified. Common are discriminators less than 50, 100, and 500 employees. In fact, Acs and Audretsch (1990b) and Acs (1992) found this issue confusing and used both 100 and 500 employees as discriminators for firm size because of the inconsistent use in the literature.

In the product development literature, several people have defined the small firm as having less than 100 employees (see for instance McAdam, Armstrong et al., 1998; Hine and Ryan, 1999; Chandy and Tellis, 2000; Hadjimanolis, 2000; Ledwith, 2000). Thong and Yap (1995), for instance, have made a distinction in firm size using the interval 1-100 employees as the limit for the small firm when they studied the adoption of information technology among small firms. This interval will be used in this thesis as well for its appropriateness and this partly for the reason that the definition has been used in several other research reports which makes it suitable to use. However, the main reason is the assumption that management activities alter with the number of employees and that this interval has been argued to be representative for what can be looked upon as small firm management.
1.5.2 Product development

There are numerous ways in which product development have been mentioned in research literature (see for instance Brown and Eisenhardt, 1995). In this section the specific meaning of product development in this specific context will be addressed. Moreover, the concept of product development will be described in order to give an enhanced understanding of its purpose and meaning in the following study.

Several definitions of product development exist in literature. In this context the product is viewed as something sold by a firm to its customers (Ulrich and Eppinger, 1995) with the notion that the “something” which is sold is a physical product, a type of goods. Product development can be defined as Krishnan and Ulrich (2001) state: “[...] the transformation of a market opportunity and a set of assumptions about product technology into a product available for sale.” Ulrich and Eppinger (1995) define product development as “[...] the set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a product.” In this licentiate thesis, the definition of product development is a synthesis of these two definitions. Similar to the opinion of Ulrich and Eppinger, product development begins with the perception of a market opportunity and in line with Krishnan and Ulrich (2001), product development is about the transformation into a product available for sale. Hence, the specific meaning of product development in this thesis refers to the transformation of a perceived market opportunity into a product available for sale. Furthermore, the definition separates products from services which are further illustrated in the table below. As illustrated, there is no sharp distinction between products and services.

<table>
<thead>
<tr>
<th>Products</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangible</td>
<td>Intangible</td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Heterogeneous</td>
</tr>
<tr>
<td>Distribution and production disparate from use</td>
<td>Use, production and distribution at the same time</td>
</tr>
<tr>
<td>A thing</td>
<td>A process or activity</td>
</tr>
<tr>
<td>Value created in production or operations</td>
<td>Value created in the seller and buying interactions</td>
</tr>
<tr>
<td>No external involvement in the production</td>
<td>External participants involved in the production</td>
</tr>
<tr>
<td>Can be held in stock</td>
<td>N/A</td>
</tr>
<tr>
<td>Ownership transfer</td>
<td>No ownership</td>
</tr>
</tbody>
</table>

*Table 1: Differences between products and services (Grönroos, 1984 in Hedman and Kalling, 2002)*

Product development is not only about the spectacularly new product, but is also about improvements of existing products. The terminology of product development ranges from modifications of existing products to the entirely new product.
1.5.3 Computer Based Information Systems

The terminology used for research about computer based information system has altered in literature. One common label in the research literature is information and communication technology (ICT). For instance, Boaden and Lockett (1991) have definitions of the term that have been briefly used in this section to define CBIS and for further comprehension about terms as information and communication technology, their work is a good departure for extended understanding about this.

Leifer (1988) has pointed out that CBIS and similar terms regarding computer based information systems differ among studies that have been made. In this licentiate thesis, Computer Based Information Systems (CBIS) will be used because the term refers specifically to the use of computers. Leifer (1988) has also used this term for emphasizing the specific use of computers.

CBIS refers to systems based upon the hardware of computers and software of computer applications. The physical part of a computer refers to the computer hardware, which is built up around a central processing unit (CPU) and memory. The CPU coordinates the operations in the computer (see Table II), and the memory contains the data and applications that is used by the CPU. (Hedman and Kalling, 2002).

Capture, i.e. to obtain a representation of data in a form that permits it to be transmitted or stored by e.g. keyboard, bar code scanner, optical character recognition, sound recorder, video camera, voice recognition.

Transmit, i.e. to move data from one place to another place by e.g. radio waves, telephone networks, data transmission networks, fibre optic cable, fax, electronic and voice mail, and Internet to mention a few.

Store, i.e. to move data into a specific place for later retrieval e.g. paper, hard disk, data base, file, floppy disk, CD, DVD, flash memory, USB memory chip.

Retrieve, i.e. to find a specific data that is currently needed from e.g. paper, hard disk, data base, file, floppy disk, CD, DVD, flash memory, USB memory chip.

Manipulate, i.e. to create new data from existing data through summarizing, sorting, rearranging, reformatting, or by other types of calculation with the support of computers and their software.

Display, i.e. to present data through printout, computer screen, or mobile devices.

Table II: Data-processing activities of a computer (Hedman and Kalling, 2002)
Besides from CPU and memory, a computer also consists of devices that serve to handle the interaction between human and machine. Input devices refer to the devices that make it possible to enter data into the computer, while output devices refer to the devices that make it possible to display and extract data from the computer. Figure I is an illustration of the computer and its components, which further clarifies the computer components. Besides from the physical components of the computer—the hardware—the computer also consists of software, which controls the operations conducted by the computer. (Hedman and Kalling, 2002)

![Diagram of computer components](image)

*Figure I: The components of computers (Hedman and Kalling, 2002)*

### 1.6 Reading directions and disposition of the thesis

This section can be viewed as a direction for how this research project has been carried out. In order to illustrate how this licentiate thesis will proceed, this section aims to define and create an outline of the licentiate thesis disposition, along with some reading directions. Firstly, we turn to the reading directions. There are several references to literature in Swedish, where quotation marks are used even though the text has been translated from Swedish into English. Secondly, this licentiate thesis is exploratory and is going to proceed stepwise. In order to reveal the documentation of the knowledge generating process we need to break down the disposition of this licentiate thesis in order to discuss the chapters and their connections. As mentioned earlier, this licentiate thesis is based on a research problem of which understanding is lacking. In order to study the phenomenon, an inductive approach was judged to be important, and a pre-study useful.
Chapter one  
Problem discussion

Chapter two  
Scientific positioning and overall research methodology

Chapter three  
The pre-study

Chapter four  
Research methods

Chapter five  
A literature review on product development and CBIS

Chapter six  
Empirical description of case one

Chapter seven  
Within case analysis of case one

Chapter eight  
Empirical description of case two

Chapter nine  
Within case analysis of case two

Chapter ten  
The results

Chapter eleven  
Conclusions

Chapter one  
Problem discussion

Chapter two  
Scientific positioning and overall research methodology

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Chapter nine  
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Chapter ten  
The results

Chapter eleven  
Conclusions

Presents the phenomena of interest, and outlines an introduction to literature on product development in small firms and to literature on CBIS in small firms. The presented research problem and the purpose deal with the lacking knowledge between these two research areas.

As a response to the research problem, a first step towards understanding is to gather empirical material about the phenomena of interest. This chapter consists of the phenomena of interest and outlines an introduction to literature on product development in small firms and to literature on CBIS in small firms. The presented research problem and the purpose deal with the lacking knowledge between these two research areas.

Describes the choices that have been made regarding research methods and their consequences for the main study. Furthermore, this chapter also outlines how this research project has been conducted with regard to literature searches and use for pre- and main-study, and also concerning the discussion about the quality of the pre- and main-study.

Contains a literature review on product development and CBIS, and aims to provide a knowledge overview useful for understanding the gathered empirical material.

Contains empirical within case analysis of the empirical material gathered, focuses on adoption, use and influence of CBIS on the product development processes described.

Conclusions and implications from the studies are presented.

Presents the results of this licentiate thesis, and uses both theoretical material as well as empirical material (from pre- and main study) for advancing the understanding of the use of CBIS in small firm product development.
1.7 Summary

This chapter starts out with a discussion about the importance of small firm product development. Techniques and methods for improving the work with product development are argued to be important. Recent literature regarding product development focuses on the relation between the firm and its environment, arguing the importance of information and communication in the small firm product development process. This type of literature has to a large extent focused on the sources of information and communication, but not on the actual media used for information and communication in the product development process. Therefore, it seems important to also focus on the information and communication media in the product development process.

One possible medium for information and communication during the product development process is CBIS (computer based information systems), which has retrieved more and more interest in the genre of small firm literature during the last decades. Few studies have focused on the role CBIS has for product development, but instead a large part of these studies has focused on large firm product development. It has been argued that this area needs empirical material in order to advance. Based on this, the research questions and purposes in this study regard the issue of whether small firms use CBIS for product development, and if so how, this use is carried out in these small firms. Furthermore, the central terms of this study are defined in this chapter, and the chapter ends with a description and disposition that illustrates the design of this licentiate thesis.
The aim with this chapter is to discuss the general beliefs about science. This chapter will therefore start with a discussion about ontology and epistemology, which, in turn, will lead to a discussion about the knowledge creating process in this licentiate thesis.

The task of science has been described as “a systematic and methodological search for new knowledge and ideas” (Molander, 1988). The meaning of ‘new’ is that it should be new to the public, and new knowledge does not imply that it has to be great new knowledge (Molander, 1988). Based on this reasoning, everything which uses systematic and methodological approaches would be scientific. This reasoning seems to need further clarification, because all new knowledge can not be labeled as scientific. There has to be a definition of what is relevant science. Molander (1988) argues that two aspects determine the relevance of science: 1) Knowledge about singular facts is of scientific interest only if the facts are relevant to an explanatory approach, and 2) if they answer questions that are worth answering.

However, the description of the task and relevance of science raise a number of questions regarding the philosophy of science. What is systematic? What is the world? How can knowledge about the world be generated? Depending on the answers given these questions, different ways of conducting research will be proposed. One central idea in the work of Burrel and Morgan (1979) is that all organizational theories are based upon a philosophy of science. Philosophical assumptions, whether implicit or explicit, are the basis for all social science, which makes it of interest to discuss the assumptions of ontological, epistemological, methodological, and human nature (see the following sections).

2.1 Ontological discussion

Ontological nature concerns the “very essence of the phenomena under investigation” (Burrel and Morgan, 1979). Hence, ontology deals with the beliefs of what the world is, and this section aims to reveal the thoughts and beliefs regarding this question that is essential in this licentiate thesis. According to Burrel and Morgan (1979), it is important for researchers within the area of social sciences to express a point of view regarding “…whether the ‘reality’ is external to the individual – imposing itself on individual consciousness from without – or the product of individual consciousness: whether ‘reality’ is of an ‘objective’ method, or the product of individual cognition: whether ‘reality’ is given ‘out there’ in the world, or the product of ones mind” (Burrel and Morgan, 1979).
As a response to this note by Burrel and Morgan, it is assumed that a reality exists which is objective, or at least objectively accessible. Burrel and Morgan (1979) discuss the ontological nature as an academic debate that can be described on a continuum with extremes in a perfectly subjective nature of the world and a perfectly objective nature of the world. Arnbor and Bjerke (1994) also describe the differences in perceptions of the ontological nature as a continuum with assumptions of objective and subjective natures of the world as extremes. According to the statement, or assumption, that an objective nature exists, or at least that reality can be objectively accessible implies that the ontological assumption is aligned closer to the objective extreme than to the subjective extreme. Making the assumption of a reality which is closer to the objective extreme implies that the goal with scientific research would be to reach explanations about phenomena (structures) of interest in this reality. However, in order to be able to explain these phenomena (structures) we first need to understand them.

2.2 Epistemological discussion

Epistemological nature concerns the “grounds of knowledge” (Burrel and Morgan, 1979). In Campbell’s (1988) words: “epistemology is a description of how people go about it when they think they are acquiring knowledge.” In this licentiate thesis the questions about epistemology will be dealt with in the manner that epistemology deals with the beliefs about how knowledge about the world can be created. This section aims therefore to discuss how knowledge in this licentiate thesis is going to be created in line with the underlying beliefs about how knowledge can be created about a world which is objective, or objectively accessible.

It is argued here that when the world is objectively accessible the knowledge creation process has to focus just on the term accessibility. In a reality where perfect accessibility exists it would be easy to use quantitative methods to collect data, because structures would be perfectly visible and possible to measure. However, when the world is not perfectly visible and when some structures are hard to obtain and visualize we need to choose methods based on the nature of the problem. For instance, a well known problem where structures are more or less known through the possibility to deduce the structures from earlier theoretical work would have the possibility of using quantitative methods to test (explain) theoretical models or connections. On the other hand, a study based on a problem that has received little or no attention where theories cannot be used to support structures, we need to use qualitative methods to induce knowledge about (understand) reality.
Science is creating knowledge about the world, and the goal is to achieve truths about the world. However, it is believed that a reality exists that is very complex to observe and analyze which—although the goal is to achieve truths—implies that a perfect truth with all its details not can be achieved (Campbell, 1988). The underlying assumption is thus that reality can never be known with certainty in all its detail. Hence, research is about creating and improving approximations of knowledge (Campbell, 1988). This assumption suggests that science can be viewed as a process of generating knowledge that improves and refines what we know. If we would compare science with the task of creating a map we would realize that if the map were to be perfectly complete with as detailed descriptions as the reality behind it, it would be as large as the world, and then what use would there be with the map? Similar to science, the world is so complex that the collection of all details is impossible, and perhaps even unwanted.

As mentioned earlier, the knowledge creating process depends upon the nature of the problem. In this licentiate thesis the interest is to reveal how small firms can use CBIS for product development and how this use can influence the product development process. It is stated that a theoretical understanding is lacking of these phenomena. How, then, can we create knowledge about this?

There are two main ways in which knowledge generating processes are described to function in science. Deduction, on the one hand, is a logical conclusion that builds upon reasoning from given premises to a singular case. Induction, on the other hand, implies that a conclusion is drawn from a number of observations (empirical phenomena) leading to a universal statement. A combination of these two described forms can be argued to be a third form of knowledge creation. This combination, called abduction, can be viewed as a means to use both inductive and deductive approaches shifting in the research process. (Alvesson and Sköldberg, 1994; Chalmers, 1995)

In this licentiate thesis it is argued that there is a lack of theoretical understanding (i.e. given premises) about the phenomenon of interest. The fact that we need to have given premises in order to deduce implies that it is hard, or even impossible, to deduce results. In order to reveal given premises we need to understand, and the act of understanding can be achieved through observations from which we can draw conclusions – induction. Hence, it seems logical to use an inductive approach to study a problem where theoretical understanding is lacking.
However, using induction as a label of how knowledge will be generated is not entirely enough. Several questions regarding what induction is have been raised, and several different inductive approaches have been described in literature. The above description of induction implies that an inductive approach starts with the observation of a phenomenon, which can be abstracted to theory. This notion implies that inductive reasoning starts in empirical observations. Eneroth (1987), for instance, has objected to this view of the inductive approach and argues that also inductive research starts out in theory, referring to conceptual induction. The different types of inductive reasoning are illustrated in Figure II below.

![Diagram of inductive approaches](image)

**Figure II: Description of inductive approaches**

The difference between induction and deduction is the way theory is used, rather than where the starting point of the research approach exists. Similar to Eneroth (1987), studies based on an inductive approach need to be rooted in theory in order to aspire to be scientific. However, theories may be used in different ways. Theories can be used to design a study, they can be tested, and they can be used to understand empirical observations. The difference between the ways theory is used is that theory in a deductive approach is the object for testing, and in inductive studies, it is the object for understanding empirical observations. The third mentioned way of using theory in order to design a study, is supposed to be of equal interest for inductive and deductive studies. What is then the use of theory for designing a study? In order to comply to the definition of what scientific is, one criterion is that scientific studies should be systematical. This creates the possible scenario of an entirely inductive study (starting from point ‘b’ in the figure above), based on empirical observations which reinvents the ‘wheel’. In comparison, studies which are rooted in theoretical problems (starting from point ‘a’ in the figure above), or in theoretical definitions, can extend the understanding within an area of research, with less risk of reinventing the ‘wheel’.
In order to clarify the meanings of these arguments it is useful to relate these arguments to the knowledge generating process within this licentiate thesis. This licentiate thesis contains two studies, where the main purpose is to create understanding for how small firms can use CBIS for product development. Furthermore, the purpose is initially for the pre-study to “identify areas of use of CBIS in small firms for product development, and to identify motives not to use CBIS for product development in small firms”. This study is based on two concepts (product development and CBIS) within a small firm context. The problem stated is that we know little about the connection between the concepts and, in order to reveal their connection, we need empirical descriptions. Taking these empirical descriptions into consideration, we can continue by using the results of the pre-study to design the main study in this licentiate thesis which aims to acquire a deeper understanding for the phenomena of interest for the purpose of analyzing reasons for how and why small firms use CBIS for product development. Finally, we will also be able to appreciate how this use influences the depicted product development activities and processes.

2.3 Methodological standpoint

Methodological nature concerns the ‘way in which one attempts to investigate and obtain knowledge about the social world’ (Burrel and Morgan, 1979). There are two extremes when one discusses methodology: ideographic and nomothetic theory. According to Burrel and Morgan (1979), the ideographic approach is influenced by the view that the world only can be understood through obtaining knowledge directly from the subject under investigation. By being a part of everyday life together with the phenomena under investigation, or in other ways achieving inside information it becomes possible to obtain and analyze subjective accounts. Hence, the ideographic approach is directed towards research methods that admit the subject to reveal its nature and characteristics during the process of obtaining empirical material. The nomothetic approach, on the other hand, focuses on the methods originating from the natural sciences. The approach centers on hypotheses testing and model testing with statistical measures and methods. Instead of basing research on subjective accounts, the nomothetic approach stresses systematized data collection, often through quantitative techniques for data collection and analyses (Burrel and Morgan, 1979). As already implied, this licentiate thesis can be positioned closer to the ideographic approach then to the nomothetic theory. However, the argument is that the research problem determines which data collection methods are suitable. Aligning the ontological view closer to the objective extreme would propose that the nomothetic approach would be of more use for explaining the phenomena of interest, although when there are uncertainties about the relationship between the
concepts of interest (CBIS and product development), a method admitting to the phenomena to reveal its nature and characteristics is presumed to be more suitable.

2.4 Human nature

Human nature concerns the ‘the relationship between human beings and their environment’ (Burrel and Morgan, 1979). The assumptions about human nature can be described along a continuum with two extremes, the determinist view and the voluntarist view. The determinist view assumes that human beings and their activities are completely determined by the environment. The voluntarist view, as opposed to the determinist view, assumes that human beings and their activities are completely autonomous, or free-willed. This licentiate thesis adopts a view that allows influence from both environment and voluntary factors. Thus, this licentiate thesis is not positioned in the extremes as a determinist or a voluntarist statement, but rather between these extremes, arguing that they are both of interest for understanding the relationship between the human being and the environment.

2.5 Summary

The purpose of this chapter was to discuss and clarify the philosophical assumptions about science, which have influenced the way in which this licentiate thesis have been carried out. In the beginning of this chapter, the field of science is argued to gather new knowledge about the world. Four questions are proposed to be important for discussing the philosophical assumptions in social science. These questions regard ontology, epistemology, methodological standpoint, and human nature. The ontological assumption in this licentiate thesis is directed towards an objectively accessible reality. The epistemological assumptions rest on a discussion about the ontology and the nature of the problem. It is argued that the main interest lies in the notion that reality is objectively accessible, which implies that the focus must be on the nature of the problem. The main argument of this study is that understanding about the area is lacking and there is a need of inductive methods for inducing new knowledge about the phenomenon of interest. The methodological standpoint, concerning how one obtains knowledge, is aligned to a method which allows for the phenomena to reveal its characteristics and nature rather than the opposite: a cause of the nature of the problem. The last proposed question concerns human nature, where a view is adopted that admits for influence from both the social environment and voluntary factors.
3. THE PRE-STUDY

In this chapter, the pre-study is presented. This chapter consists of three parts: 1) research methods, 2) analysis of empirical material gathered, and 3) the purpose of the study.

According to Edfeldt (1996), the results of a qualitative study should first determine whether or not a phenomena of interest exists in order to answer questions as to how and why a phenomena exists. To make this determination, empirical descriptions are of interest. The pre-study’s empirical material is presented in a table in appendix C. This table aims to provide an overview of the empirical data by presenting information regarding product development activities and processes within the firms, external relations during product development, and the attitudes and usage of CBIS within the firm. Based on the empirical material, it is possible to distinguish between use and non use of CBIS in product development as well as within the firm itself. How small firms use CBIS is also analyzed. Further, empirical examples are set in the context of relevant theoretical fragments in order to advance the understanding for why small firms choose to use or not to use CBIS as a tool for product development. Before concentrating on the results of the pre-study, the following section presents the pre-study’s research methods.

3.1 Research Methods for the pre-study

This section focuses on the research methods closely related to the selection, gathering, and analyses of the pre-study’s empirical material. Research methods regarding literature search and the quality of the pre-study is presented in chapter four, which contains the overall research methods for the main study.

The research questions examined in this study concern both whether or not small firms use CBIS for product development, and how these small firms use CBIS. The main argument of the problem discussion section is the lack of understanding and the lack of literature in this area. In order to determine the purpose of such a study, qualitative methods are useful (Miles and Huberman 1994). Stake (2000) believes that it is not the case in itself that is of interest for understanding such a phenomena, but rather how several cases together can give an understanding of a phenomenon.
3.1.1 The process of determining respondents

One issue of interest was the process in which the respondents were determined. The primary reason behind the selection of respondents for this study was to maximize what could be learned; acknowledging a limited time frame (Stake 1995). The respondents have, therefore, been strategically chosen to respond to criteria that were thought of as important to the study.

The first criterion for the selection of cases stated that the firms chosen should have conducted product development processes within the last two years. This criterion was important since an interest for this study regards the use of CBIS in the context of product development. Following this argument, one would think that CBIS usage should be a criterion for the selection of cases. However, CBIS usage was not a criterion. As firms not utilizing CBIS for product development are still of interest. Another important criterion for the selection of respondents was access given to the phenomena of interest (Yin 1994).

Since the purpose of this study is to understand CBIS usage and usage areas in product development, there is a need to look at different firm. A single case-study approach would have been too restrictive to capture a wide set of practices. Through active contacts with firms in the wood industry, it was possible to choose between 36 manufacturing firms. These firms were located in the mid-part of Sweden, and have between 1 and 90 employees on their payroll.

In order to study firms who develop new products, it was necessary to choose an industry where producing goods is the main line of business. As mentioned in the definition of product development, this study identifies a specific type of product developer. This definition limits the choices possible in the selection of informants. The wood industry is regarded as a suitable industry for the typology of product developers sought, and it has been noted that small firms within this industry are quite innovative (Acs and Audretsch 1990). Selecting informants from one specific industry also has some advantages. Industry specific influences, for instance, are not supposed to affect the results. This can also be seen as a disadvantage, but some affecting variables must be kept constant in order to make a study possible. Hence, the advantage is perceived as more important than the disadvantage in defining a point of departure for this study.

The number of firms can be chosen in several different ways in qualitative studies. One way is to continue until perceived saturation, which occurs when new cases do not increase understanding (Miles and Huberman 1994). Another way is to choose a number of informants and continue to generate empirical data until all informants have been questioned (Miles and Huberman 1994). The later way of determining the amount of respondents has been chosen for this study.
The CEO was chosen as the specific respondent within each firm. It has been well established that the CEO is a suitable informant within small firm research (Story, 1994). The main reason for this is that the CEO of a small firm often is influential in development processes and, according to Cragg and King (1993), often the most influential person in the firm when it comes to the adoption and use of CBIS. It seems, therefore, reasonable to rely on the perceptions held by the CEO about areas of CBIS usage by small firms for product development.

3.1.2 Empirical generated material

There are several possible sources of evidence when generating empirical data. Yin (1994) mentions documentation, archival records, interviews, direct observations, participant observation, and physical artifacts as possible sources of evidence. For this study, interviews were considered an appropriate way to collect empirical evidence. The motives for using personal interviews comes from the advantages these kinds of interviews are considered to have in the creation of understanding in comparison with other data collection methods. Another important motive towards the use of personal interviews is that it allows for probing techniques in which follow up questions can be used to direct and control the focus during the interview session (Yin, 1994). Further, personal interviews have the advantage of letting the researcher control the situation. For example, assuring the researcher that the informant does not hand over the task to someone else; or that the informant does not use information sources for giving answers that the informant believes the researcher wants. Personal interviews also allow for a dialogue in which the researcher can answer questions that the respondent may have.

Each interview started with a brief description of the research project after which the respondents were given the opportunity to ask questions and comment on both the research project, and on his or her participation in the project (See appendix A and B for the Swedish and English versions of the interview guides that have been used). The respondents were then asked about the firms product development processes and their use of CBIS. The foci of the interviews were to make the respondents discuss and reason about the topics of interest. The interviews were documented through note-taking during the interview sessions.

The personal interviews can be described as semi-structured, following an interview guide that contained questions about the topics of interest: the firms' product development, and the attitude, knowledge, and use of CBIS. Further, in
order to find different areas of use of CBIS in small firms, the interview guide1 contained broad topics and left space for follow up questions. One argument for the choice of semi-structured interviews is that it gives an opportunity to receive rich information, which is critical for understanding.

3.1.3 Analyses

In order to analyze the qualitative material, all empirical material was compiled into one table (See appendix C). This table contained a number of rows for each case and for the questions of interest. This approach facilitates analysis of qualitative data (Miles and Huberman, 1994). This technique is also recommended when dealing with a large number of respondents, and can result in an overview of the data. Further, categories of CBIS usage among small firms for product development can be discovered through the use of matrices for the analyzes of the empirical data (Miles and Huberman, 1994), also known as pattern matching. Several categories could be identified in the empirical data through the analysis of the data combined with an understanding of the literature in the field of CBIS and product development in small firms. After identifying these categories, the empirical data have been sorted and classified in pre-determined categories. By producing a standardized output, a visual format was created which made it possible to draw conclusions.

The following sections consist of some codified data (references to cases) with which the reader can make his or her own judgments about the research material presented. The data regarding the firm names is presented with a short code in place of their firm names in the results chapter. This code is constructed in a way that the first part (A[number]) refers to a given ID for the firm. The second part ([two letters]) is a code for the industry, where HF stands for ‘Home furnishings and furniture’, JO for ‘Joinery’, MW for ‘Millwork’, WH for ‘Wooden houses and building components’, and finally CA for ‘Cabinetry’. The researcher coded these firms through the descriptions of business fields given by the firms. These codes were further developed with research colleges involved within the same field, and tested on both colleges and on experts within the industry. The third, and final, part of the firm code (s[number]) identifies the firm size. The numbers reveal how many employees the firm has.

1 The guide for the interviews is enclosed at the end of the licentiate thesis in both Swedish and English as appendices A and B.
3.2 Use of CBIS for product development

The empirical material indicates that product development is both a firm internal and firm external process. Several firms mention the importance of their markets, suppliers and collaborating parties in their product development processes. Similarly, Von Hippel’s (1988) large quantitative study indicated the importance of external organizations in innovation. Other firms, however, indicate that their product development processes are all firm internal. The focus of this study, however, is how small firms use CBIS for product development. Based on empirical descriptions, CBIS is used in the gathering of information and for communication with others. The usage of CBIS can be divided into two forms: unilateral and multilateral. As indicated in the illustrations below, unilateral use of CBIS refers to the gathering of information with the direction into the firm, while multilateral use of CBIS refers to the exchange of information.

**Figure III:** Unilateral use of CBIS for product development

**Figure IV:** Multilateral use of CBIS for product development
However, one other usage area of CBIS for product development could be indicated through the case where a CEO mentions that CBIS could be used for documentation of the product development process (A3:WH:s15). Since this usage area received little attention, it will not be further elaborated in this section.

3.2.1 Unilateral use of CBIS

Several firms argued that CBIS (ie. Internet) could be of use for information gathering during product development activities and processes. These firms remarked that they had, in fact, used CBIS during the product development process in order to gather information. Although, there were different sources of interest for the unilateral use of CBIS among these firms (see table below).

<table>
<thead>
<tr>
<th>Firm</th>
<th>Source of interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2:WH:s7</td>
<td>Material and products</td>
</tr>
<tr>
<td>A6:MW:s90</td>
<td>Resources and contacts</td>
</tr>
<tr>
<td>A10:WH:s7</td>
<td>Customer needs, products and raw material</td>
</tr>
<tr>
<td>A11:CA:s4</td>
<td>Customer groups</td>
</tr>
<tr>
<td>A12:HF:s24</td>
<td>Other firms’ resources</td>
</tr>
<tr>
<td>A21:HF:s15</td>
<td>Market related information</td>
</tr>
<tr>
<td>A22:JO:s5</td>
<td>Other firms in the industry</td>
</tr>
<tr>
<td>A24:WH:s15</td>
<td>Market and collaborating firms</td>
</tr>
<tr>
<td>A28:JO:s12</td>
<td>Competitors’ products</td>
</tr>
<tr>
<td>A32:JO:s5</td>
<td>Market and products</td>
</tr>
<tr>
<td>A34:HF:s10</td>
<td>Market</td>
</tr>
<tr>
<td>A35:HF:s1</td>
<td>Competences and resources among collaborating firms</td>
</tr>
</tbody>
</table>

Table III: Sources of interest for unilateral use of CBIS for product development

According to the literature, the unilateral use of CBIS could be described as an activity of scanning. Scanning is seen as both a process and an activity through which necessary external information is gathered, analyzed and disseminated within the firm (Huber, 1991).

Furthermore, the results presented in the table could be compared to the literature on scanning, where the sources of interest could be classified into different groups: 1) commercial scanning, referring to activities to gather information about markets and customers, 2) competitive scanning, which refers to information gathering regarding competitors and industries, and 3) technological scanning, referring to
the gathering of information about production and information technologies and providers (Raymond, Julien et al., 2001). Furthermore, several of the firms indicated that a fourth group of scanning behaviour could be of use to reveal resources and competences needed for product development related activities and where CBIS could be used for collaboration scanning.

Regarding commercial scanning, one CEO remarked that information is gathered about market reactions to changes made in the products and the effects of advertising (A34:HF:s10). Another firm remarked that the Internet is used for information gathering about customers groups, and also that some information is shared with the customers on the Internet. According to the firm, it is information in the early process of product development that is shared with the customers through the Internet. The main reason cited is that the cost for information is low while the risk that the customer is not interested is high. When the customer becomes more interested, the information often becomes personal contact (A11:CA:s4). Another CEO remarked that the use of CBIS for commercial scanning could be viewed as complementary to other medias for information gathering. This CEO expressed that it is important to have a sharp ear for the market (A21:HF:s15).

Some information can be received through Internet. As I have said, it is important to have the ears of an elephant to keep up with the market. (A21:HF:s15)

Competitive scanning was indicated by several firms where CBIS was used in order to gather information about competitors’ products (A28:JO:s12; A32:JO:s5). Another firm indicated the use of CBIS for product development which could be labelled as technological scanning. According to the CEO, the firm scanned for information about existing material and products simultaneously making it possible for the firm to access knowledge about the competition (A2:WH:s7).

Several firms indicated a scanning behaviour that could be labelled as collaboration scanning. This form of scanning refers to the gathering of information about resources and competences from (potential) collaborating firms needed in later product development related activities and processes (A6:MW:s90; A12:HF:s24; A22:JO:s5; A24:WH:s15; A35:HF:s1).

One major motive to use a computerized system is the possibility to scan and receive information about competences and resources among collaborating firms. (A35:HF:s1)
Now that it has been established how CBIS is used for unilateral purposes in these product development processes, the question of why CBIS is used in these processes can be explored.

Several firms remarked that CBIS could be used for gathering information and accessing knowledge. One CEO expressed that the decision to use CBIS for activities like these was based on the qualities of the media (A10:WH:s7).

*It is an information channel that can be used freely (A10:WH:s7)*

Similarly, another CEO stated that it is more rational to use CBIS for information distribution, compared to other media. Another perspective on the use of CBIS was presented by a CEO that regarded the use of CBIS as a complementary media, (A21:HF:s15).

*Some information can be received through Internet. As I have said it is important to have the ears of an elephant to keep up with the market. (A21:HF:s15)*

Howell and Shea (2001) expressed that the most effective source of information is the personal network for environmental scanning for new product ideas. Their findings suggest that the use of documents, which has been argued as similar to computerized solutions, was perceived in a negative way by the manager when expressing confidence in innovation, involving and motivating others to support the innovation, and persisting under adversity. Fann and Smeltzer (1989) observed that most small firm managers obtain information in a highly informal way, by observing and analyzing their competitors' products, and also by talking to customers and suppliers. The results from this pre-study suggests that unilateral use of CBIS can be viewed as a complement to other mediums of gathering information for product development related activities.

### 3.2.2 Multilateral use of CBIS

Another area of CBIS usage in product development identified contains the firms who use computer systems for information distribution and communication between collaborating firms (A1:WH:s18; A2:WH:s7; A7:WH:s8; A8:CA:s1; A11:CA:s4; A13:HF:s4; A18:JO:s1; A24:WH:s15; A28:JO:s12; A31:WH:s15; A35:HF:s1).
Several firms remarked that the multilateral use of CBIS for product development could be described as communication with the use of electronic mail. Furthermore, a common remark was that the multilateral use of CBIS included making blueprints with the assistance of CAD applications, and electronically mailing these CAD-files for comments and changes. One empirical example of this can be illustrated from one of the firms.

*We ... use Internet to send information with electronic mail. A lot of our blueprints are made using CAD and we send them to constructors and architects. We find this most efficient when everybody can work on the material as they get it and send changes back, it doesn’t include any extra work for anyone.* (A1:WH:s18)

Other forms of using CBIS for multilateral purposes are described in the table below. Most examples of multilateral use of CBIS concerns the use of CBIS through electronic mailing, with or without attachments as CAD-files.

<table>
<thead>
<tr>
<th>Firm</th>
<th>Description of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1:WH:s18</td>
<td>Send CAD drawings with electronic mail to constructors and architects.</td>
</tr>
<tr>
<td>A2:WH:s7</td>
<td>We use CAD to create and redact blueprints. For distribution we mainly use electronic mail, but we also have other forms of distribution over internet.</td>
</tr>
<tr>
<td>A7:WH:s8</td>
<td>”A great deal of information is exchanged between the firm and the customers, due to the fact that we have customer driven production. The majority of the information (about 95%) is put out using ordinary mail or with fax. Only about 5% of the exchange comes from electronic mail and websites.”</td>
</tr>
<tr>
<td>A8:CA:s1</td>
<td>The firm use computer systems to handle distribution of information for product development purposes, such as CAD drawings.</td>
</tr>
<tr>
<td>A11:CA:s4</td>
<td>Some information is shared with the customers on Internet. According to the firm it is information in the early processes of product development that is shared through internet.</td>
</tr>
<tr>
<td>A13:HF:s4</td>
<td>The firm doesn’t use internet in development processes to any higher extant according to the CEO. “We receive some orders through Internet today and our customers often send information through electronic mail, but that’s about it.”</td>
</tr>
</tbody>
</table>
According to the CEO he sometimes receives blueprints through electronic mail and sometimes he use CAD or similar software to construct blueprints for new products. “That’s about what we use regarding product development with the use of CBIS”.

Use of computer systems to improve communication with the market and with collaborating firms’.

The firm uses mail to distribute information in collaborations

Some information has been sent and received through electronic mail.

The use of computerized systems today is mainly for sending and receiving information from other firms through electronic mail.

<table>
<thead>
<tr>
<th>Table IV: Sources of interest for multilateral use of CBIS for product development</th>
</tr>
</thead>
<tbody>
<tr>
<td>It seems to be possible to distinguish between clearly defined groups of reasons for multilateral use of CBIS in product development. These groups cite aspects of efficiency, effectiveness and the facilitation of communication as reasons for multilateral use of CBIS.</td>
</tr>
<tr>
<td>The first group could be labelled as efficiency with a focus on efficiency in collaboration and customer relations. One CEO cited using electronic mail to improve efficiency with customers. This CEO expressed that he would like to handle all blueprints electronically, this as he has had previous experiences with customers receiving ‘old’ blueprints due to communication problems. The CEO mentioned that he would like to keep all blueprints on a website, which would make it possible for the customer to always have access to the latest version of the blueprint (A1:WH:s18).</td>
</tr>
<tr>
<td><em>We find this most efficient when everybody can work on the material as they get it and send changes back, it doesn’t include any extra work for anyone.</em> (A1:WH:s18)</td>
</tr>
<tr>
<td>Another CEO expressed a reason for multilateral usage of CBIS as a move towards efficiency in customer relations. This CEO mentioned that the multilateral use of CBIS is distributed at the beginning of customer relations, due to the low cost of information versus the potentially high cost of customer dissatisfaction. Furthermore, the CEO mentioned that as the customer gets more interested, the</td>
</tr>
</tbody>
</table>
information leads to personal contact. This could be compared to a cost-benefit analysis of the use of CBIS versus other media for product development related activities (A11:CA:s4).

Another motive for the multilateral use of CBIS regarding product development related activities could be exemplified by one CEO that remarked that he used CBIS due to the ease of distributing information. For example, the distribution of CAD files through electronic mail makes it possible for collaborating firms’ to directly add information to the blueprint (A8:CA:s1).

*The use of blueprints is drastic decreased when it can’t be worked up.*

(A8:CA:s1)

A second group could be labelled as *effectiveness reasons for multilateral use of CBIS for product development.* One CEO expressed a concern regarding the consistency of information, which could be compared with effectiveness if defined as ‘doing the right thing’.

*I have experienced that customers have received blueprints that are out of date so to say because there have been some communication losses. I would like to have a website were the customer always can retrieve the last version of the blueprint so that these kind of sad mistakes doesn’t happen.*

(A1:WH:s18)

Court (1997) has pointed out the importance of maintaining consistency across different versions of information which may be possessed by different parties involved in the product development process. The use of CBIS would, in this case, therefore serve as a system that is able to maintain consistency in the information during the collaborative product development process.

The third group could be labelled as *efficacy.* Which can be defined as the means support the end. Two firms indicated that their use of CBIS for multilateral purposes was due to media’s ability to facilitate communication regarding product development activities. One CEO stated that, due to the remote geographical location of the firm, CBIS is perceived as a necessity to communicate with the market and collaborating parties (A24:WH:s15). The second CEO commented that the use of CBIS is preferable since electronic mail is asynchronous.

*Some information has been sent and received through electronic mail which could have been done through personal contacts, but it was more easy to use mail when I’m not dependent on persons to receive the information in the same time I send it* (A31:WH:s15).
3.3 Why is CBIS used for product development

In this study, firms were included that both use CBIS, and those that do not in order to understand why CBIS is used for product development. It seems to be possible to separate between the firms that do not use CBIS into two different groups. The first group consists of firms that have not yet adopted CBIS, while the second group includes firms that express reasons for not using CBIS in a certain forms of product development. However, the analysis of the second group includes firms that use CBIS in general, but that express reasons for not using CBIS in for product development.

3.3.1 CBIS competence as a perspective on CBIS adoption

One CEO remarked that their interest in adopting CBIS is a consequence of the firm having lost several orders in the last year. This has lead to the firm having to rework their business model. The use of the Internet has been considered one possible alternative for the firm. The CEO has, together with the factory manager, constructed a website for marketing purposes. The CEO expressed that he lacks the knowledge to handle CBIS, but that the factory manager has the competence to use it (A1:WH:s18). The importance of a prior knowledge of CBIS is also present in other empirical descriptions. Another CEO stated:

*We have to use the applications we are used with and have knowledge about to make it work.* (A2:WH:s7)

Another perspective on the importance of prior knowledge for CBIS adoption was expressed by a CEO who stated that the firm’s CBIS resources should be extended in the next couple of years. The reason for this is that the CEO believes that CBIS cannot be used for communication when so many people refuse to use it due to a lack of knowledge about how to use CBIS (A7:WH:s8). This was also expressed by another CEO, who remarked that it is important that all involved firms have knowledge about computers in order to collaborate with CBIS. The CEO mentioned that he has experience in collaboration using CBIS which did not work due to one firm not having the necessary knowledge to use it’s computers (A8:CA:s1).

Several firms remarked that they had not adopted CBIS due to either a low level of knowledge or low trust towards computer systems. One of the CEOs expressed that he is not interested in computerized solutions. Further, the CEO expresses that the firm has outsourced electronic mail in order to be spared computer use.
It is only bothersome with computers. (A16:WH:s2)

Another CEO express that he has low confidence in computers and that they are hard to learn to use. The CEO mentioned that he is too old to have a good knowledge of computers, and that he does not see any usefulness in CBIS (A23:JO:s1).

This is in line with Nickell and Seado (1986) and Howard and Mendelow (1991) who propose that adoption and usage of CBIS is closely connected to the users attitudes and knowledge about computers and computer systems. Furthermore, this also underscores studies which indicate that the age of the CEO is negatively correlated to CBIS usage.

The CEO mentions “I live for developing new products. It comes natural with my work and it's a combination between handicraft and inventor. My business is more about art than traditional work with wood and I must always develop new ideas and get them to the market.” The CEO continues by stating that “I have tried to develop products in everything between furniture’s in wood and metal to plates in glass. I'm always curious to try something new and there are seldom any similarities between the products.” Regarding external influences in product development, the CEO mentions, “I like to work alone. I want to follow my own inspiration and I certainly don’t want to be obstructed by what others think or feel is right. I don’t even test my ideas or concepts on others, it’s just about feelings about what’s right and I always follow my instincts. I have limited knowledge about computers and handling them is a prerequisite for getting any use of them. I still think that computerized systems can be good but according to my experience you have to know how to work the computers to receive the benefits from them.”

Some of the firm’s sales come from their website. The CEO is not satisfied with the website and he feels that he doesn’t support it in the way he should, which according to him, is due to his incompetence with computers. Further, cooperation or sharing information is not something that is considered due to the CEOs attitude towards cooperation (A5:HF:s2).

Perceptions about the future have also been argued to constitute reasons for adopting and learning about CBIS (A10:WH:s7; A13:HF:s4). One CEO expressed that he believed that Internet will be a necessity in the future, and that it therefore is important to learn to handle computers and to prepare for using the Internet before it is an absolute necessity to use CBIS (A10:WH:s7). Another CEO implied that the firm uses CBIS to some extent today, but believes that the use of CBIS will increase in the future.
3.3.2 A media selection perspective on CBIS adoption

The use of CBIS can be viewed as the use of a complementary media for information and communication. This suggests that the adoption of CBIS does not imply that information has to be used, but rather creates a possibility to use CBIS as an information and communication system. One CEO expressed that it is important to have support for as many information channels as possible (A13:HF:s4).

Instead of treating the use of CBIS as a complementary media for information and communication, one CEO stated:

*The use of computer systems to receive and distribute information is far superior to other methods.* (A2:WH:s7)

This implies that the perception about how information and communication systems are arranged in regards to their suitability to receive and distribute information, can influence the adoption of certain information and communication systems. Another CEO mentioned that the firm is about to enter an Asian market, which necessitates an information and communication system that can improve the firm’s information flow (A4:WH:s8).

This way of reasoning for the adoption of CBIS for certain tasks or certain situations requires a different kind of understanding than the influence on competence on CBIS adoption. This reasoning indicates that the adoption of CBIS for a certain task is based on situational decisions, and not dependant on singular traits. Media selection theories propose a possibility in understanding why CBIS is selected for certain situations. These theories, however, are several and contrasting. A number of different approaches have been proposed; the access/quality approach, media richness theories, social presence theories, as well as a number of social interaction theories.

3.3.4 Adoption based on perceived benefits with CBIS resources

Another aspect of adoption can relate to the specific CBIS resources. One CEO expressed:

*We are very interested in computerized solutions. We have just not found the right systems for our purposes yet.* (A14:WH:s5)
The CEO stated that the important feature with a CBIS was that it could connect several functions of the firm (A14:WH:s5). Another CEO made a similar remark. He stated that the firm is very positive to computer based solutions, and would like a CBIS that could link several collaborating firms with reference to information regarding what the firms have in their stock, and also regarding administrative and accounting information (A26:WH:s14).

The interest of CBIS for linking several firms has been revealed as one possible reason for CBIS adoption. One reason for linking several firms was expressed by a CEO who mentioned that this form of linking several small firms together through an Internet portal could create an illusion of a large firm (A8:CA:s1).

3.3.6 Arguments for not adopting CBIS

Some firms remarked that they had adopted CBIS, but that the use did not include business activities and processes as product development. Several others remarked that they do not have any use of CBIS because they do not need external information in the product development process. This is in line with what CBIS adoption research has proposed, which is that when CBIS is used for specific tasks it, is useful for that specific task. Several firms argued that CBIS was not suitable when it did not make information processing easier, or in other ways more preferable. One example that illustrates this comes from a firm, with three employees, that produce wood houses.

The CEO expressed that the firm makes specially constructed timber houses. The firm wants to expand their product portfolio to include different houses, but lacks the financial capital to do this. Mainly incremental changes have been made in the products so far, states the CEO, and the customers are an important part of the process. He wishes that he could afford to make more radical changes in the future. The CEO express that he does not see any advantageous with using CBIS for product development. (A20:WH:s3)

> When I’m about to make changes in products I simply ask the customers what they want and then we discuss possible solutions. (A20:WH:s3)

The firms in this group commonly express that due to the nature of the products they manufacture, they do not need CBIS. They feel that the way they currently spread information and communicate can best be handled through personal contact. The firm that produces customer adjusted timber houses can serve as
another illustration of this. This firm remarked that the customers have some influence on the new products. Further, the CEO of the firm pointed out that CBIS is not an appropriate tool to use for development processes (A25:WH:s4).

*It is other things that are important, which can’t be done through a computer.* (A25:WH:s4)

Several other firms have also remarked that they don’t have a need for external information through a CBIS, but rather prefer personal communication when it comes to information regarding product development processes (A30:WH:s5; A9:MW:s28; A4:WH:s8; A36:JO:s4; A27:JO:s7).

### 3.3.7 Product complexity, related to the need of information and communication

If the product’s characteristics aren’t complex enough to motivate the use of CBIS, it isn’t thought of as facilitating capture, reuse, maintain and transfer of knowledge (Teigland, Fey et al., 1998). Some firms remarked that they did not see any use of CBIS for collaborative product development purposes. According to one CEO, product development is much about experimenting and trying. He feels like computer systems cannot assist him when it comes to this.

> *We don’t have that kind of products that require blueprints or that can be assisted from computer systems when it’s about the development phase* (A21:HF:s15)

Similarly, another CEO commented that Internet is not suitable for blueprints or product characteristic information due to the simplicity of the firm’s products (A11:CA:s4).

> “If the products were of more complex nature it would be an interesting alternative to use computers for experimenting, scan material characteristics and to receive information from other firms. There is so much more effective to receive information through the internet compared with other alternatives” (A12:HF:s24).

The firm has not developed any new products during the last years; it is just minor changes in some products. The minor changes are, according to the CEO, mainly removal of some of the products from the production and some small adjustments to the remaining products. The CEO states that there are no external influences in the product development processes. The CEO expresses that while he is interested in computers and computer systems, he does not feel that they can assist in the
technical aspects of development. He expresses “this way of working doesn’t suite our firm” (A32:JO:s5).

When it comes to the use of internet for development purposes, the CEO express that the firm does not use the internet often. Blueprints and development projects in the firm are of a simple nature, and it is therefore CAD and the Internet are of no use in these kinds of development processes (A3:WH:s15).

Another CEO express that he does not see any advantageous with using CBIS for product development as well. “When I’m about to make changes in products I simply ask the customers what they want and then we discuss possible solutions”. The firm doesn’t use computerized systems for product development processes (A20:WH:s3).

3.4 In search of a more specified problem

Based on the material from the pre-study, it seems like the research phenomena exists. That is, some small firms’ do use CBIS for product development activities and processes. The usage of CBIS seems to be perceived as important for product development by these firms. Furthermore, several firms indicated that the usage is perceived to be more and more important with time, and will become a demand from actors in the future. The main usage of CBIS regards contact with actors in the firms’ environments, such as customers, suppliers, or competitors.

As previously mentioned, different approaches have been proposed as to the driving forces behind product development. One of these approaches to product development has focused on internal roles, resources and competences as the prerequisites for the creation of new products, see for instance Tushman (1977), Jelinek and Schoonhoven (1990), and Wheelwright and Clark (1995). According to Von Hippel (1988), “It has long been assumed that product innovations are typically developed by product manufactures. Because this assumption deals with the basic matter of who the innovator is, it has inevitably had a major impact on innovation-related research, on firms’ management of research and development”.

A more recent approach of research has given attention to the interactions with and between firms as the driver of product development, see for instance Von Hippel (1988), Rothwell (1992), Shapira, Roessner et al. (1995), Lawton-Smith (1996), Malecki and Tootle (1996), and Freel (2000b). The focus of this licentiate thesis will be on the latter as CBIS seems to be used as a medium for both gathering information and communicating with actors in the firms’ environment. The results from the pre-study also indicate that it is not unusual that small firms
use external information sources when conducting product development, which strengthens the relevancy of this approach towards product development.

The approach that proposes that the firm’s environment is the driving force to product development can be seen as beginning from a somewhat classical assumption that “Organizations are consumers, managers and distributors of information, its use being an essential element of organizational operations” (Feldman and March, 1981). This view of the organization has been criticized for reducing ideas, feelings, and symbols to a set of discrete bits pumped through a conduit from sender to receiver (Axley, 1984). The criticism is directed, rather, at traditional and early research which has had a mathematical view of the information processing organization, and often with traditional information processing models. This licentiate thesis, does not focusing on the amount of information processed, but rather at the influence and methods of assessing, transforming and using information.

Several researchers have applied the view of product development where collaboration, alliances, and product development networks have been addressed. This type of research mostly looks upon product development processes in firms as dependent on open and close connections to other firms with shared knowledge, competences or resources (Håkansson and Snehota, 1995). Several of these studies have a network perspective and focus on collaborating firms. Another approach that has received a bit of attention in the literature, is the focus on the firm as using it’s environment for assistance in the product development process.

This study assumes that small firm product development is a process that emerges over time and that the process is inherently ambiguous and can therefore not be entirely planned (Lewis, Welsh et al., 2002). This implies that management of product development processes not can be entirely planned and outlined, but rather that the task can be seen as a continued problem solving task beginning from the recognition of the need to develop new products to the product launch. Management in emergent style constructs and creates a climate that enhances and facilitates the discovery of new opportunities and challenges. This style proposes that the managerial role must be of a more active nature, searching for opportunities and solutions to specific ends throughout the product development process (Lewis, Welsh et al., 2002).
Further, it seems that several areas are of importance in the understanding of the phenomena of interest. Firstly, the pre-study indicated that small firms use CBIS for product development for unilateral and multilateral purposes. Also Soutitaris (2001) has revealed that the external-communication determinants of innovation can be categorized into a unilateral and multilateral information exchanges. The results of the pre-study also indicated that there are differences between firms using CBIS for product development and firms not using CBIS for product development, which further complicates issues. The pre-study has revealed that adoption literature might be of use in the understanding of the differences between why some firms adopt CBIS while others do not. However, adoption literature has mainly focused on why firms adopt CBIS in general, and not as much on why CBIS may be adopted only for certain tasks (such as product development). It thus seems important to question:

- Why do some small firms adopt CBIS for product development?

Secondly, regarding the usage, two different forms are present in the empirical material. One concerns unilateral use of CBIS for product development, while the other concerns multilateral use of CBIS for product development. The view of the product development process is highly ambiguous, and as the firms’ environment is the driving force, it makes the firms information system highly relevant for the outcome of the product development process. The pre-study has revealed that some small firms use CBIS in their product development. Two different ways of CBIS use have been presented, unilateral and multilateral. Although these ways of CBIS use for product development are evident, we still know little about how they are linked to the product development process and what use they are to the small firm in the product development process. This makes following questions of interest:

- How do these small firms use CBIS for product development?
- How does their use of CBIS influence product development?

Von Hippel (1988) states the importance of external sources for product development. Johnson and Kuehn (1987) express that small firms managers are regular consumers of external information regarding product development processes. Several research approaches have been directed to a relational approach towards product development, such as joint development, collaborative development, alliances for development, and inter-organizational development. These mentioned approaches all have in common a focus on what can be viewed as the traditional model of active senders of information. The research interest has
been large in these areas; focusing on the external influence on product development as important for firm performance regarding development outcomes or firm growth. Less research has focused on the medium of information, and what influence this medium has in the exchange of information in the product development process.

Information can be viewed as a resource according to the resource based view (Michael, Storey et al., 2002), and the use of CBIS for unilateral or multilateral purposes could then be viewed as the means to achieve the resource. Hence, CBIS can be viewed as a ‘tool’ for acquiring resources and for creating a unique set of resources. However, CBIS is not supposed to be the entire forum for information distribution between the firm and the environment. It is rather seen as a medium through which firms can retrieve information.

3.4.1 Presentation of new purpose

The overarching purpose of this licentiate thesis is to create an understanding for how small firms manage CBIS in product development processes. The purpose of the main study is to compare two cases which have different conditions, with regard to:

- how they use CBIS for product development,
- why they use CBIS for product development, and
- how their use of CBIS influence their product development processes

3.5 Summary

In this chapter, the research methods and results of the pre-study are presented. The empirical material is based on interviews with 36 small firm managers in the wood industry. The empirical material suggests that the use of CBIS for product development can be divided into two groups: unilateral and multilateral.

Unilateral use of CBIS refers to the gathering of information from sources located outside the firm’s boundaries. According to the empirical material, there are at least four different sources that CBIS is unilateral used for in the small firms’ product development processes: commercial, competitive, technological, and collaborative scanning. These different sources represent different areas of interest of information gathering for product development related activities and processes.
Multilateral use of CBIS, on the other hand, refers to the exchange of information (i.e. communication) with parties outside the firm’s boundaries. In the empirical material the use of CBIS for product development that could be characterized as multilateral concerned electronic mailing of text messages and attached files, concerning, for example, changes in the product development. To use CBIS multilaterally for product development increases the efficiency of collaboration and customer relations. It also increases the efficiency in relation to parties interested in the outcome of the product development process. A third reason for using CBIS concerns efficacy aspects.

Furthermore, a question concerning why CBIS is used for product development is raised. According to the empirical material, five areas are mentioned: the importance of CBIS competence for CBIS adoption, a media selection perspective on CBIS adoption, adoption based on perceived benefits with CBIS resources, arguments for not adopting CBIS, and the role of product complexity for adopting CBIS.

Finally, the chapter ends with a search for a more specified problem area. It is argued that since it can be established that the phenomena exists, it is of interest to focus on why some small firms adopt CBIS for product development, how these firms use CBIS for product development and how this use can influence these firms product development processes. We need to focus on this in order to gain knowledge about the role of CBIS for small firm product development.
4. RESEARCH METHODS

The following sections will discuss the use of research methods for the licentiate thesis. That is, the way in which the licentiate thesis has been carried out. This chapter addresses both critical path choices, descriptions about how cases have been selected, how data have been collected and analyzed for the main study. The research methods which are related to the empirical material for the pre-study are discussed in the chapter about the pre-study. This chapter will end with a discussion that deals with the strengths and the weaknesses with how the pre study and main study have been conducted.

4.1 A qualitative approach

The contributions from this licentiate thesis pre-study have been of importance in several ways for the choices made in the main study. The results indicate that the area of understanding small firm usage of CBIS for product development is complex and builds on different areas of CBIS usage. The empirical observations in the pre-study implied that the area of interest is multifaceted and that the preferable ways to address contributions is through qualitative methods. This can be motivated by the fact that there are different areas of usage for CBIS regarding product development processes in small firms, and research is needed to explore the use of CBIS specifically for these areas. Another motive for why researchers should use a qualitative approach is that many small firms do not use CBIS, and the use of CBIS seems, judging from the qualitative data, not to be dependent on the regularity of product development and the size of the changes in the products. In other terms; our knowledge about the area is insufficient for conducting quantitative studies.

It is possible to make a distinction between two types of questions concerning the research methods for a study like this, although it is a simplification of the truth. 1) What do we already know about the phenomena of interest? 2) How can we come to know what we yet do not know? The first question can be answered through the use of existing literature, while the other question points out the necessity of generating empirical material. In order to answer the second question empirical material is argued to be important, although literature in the form of theories is also of importance for understanding the empirical material. In order to describe how these two questions have been answered in this licentiate thesis, the following section will aim to answer the first question, while the second question is answered beginning with section 4.3.
4.2 The search and use of literature

As mentioned in the chapter about scientific positioning and overall research methodology, theory can be used for a number of different reasons. Theories can be used to design a study, tested, and/or used to understand empirical observations. In this licentiate thesis, literature (theory) has been used in order to:

- Design a research problem
- Understand empirical observations in the pre-study and to further contribute to the design of the study
- Create a knowledge overview for the main study
- Understand empirical observations regarding the main study

Furthermore, literature concerning research methods, methodology, scientific positioning, and philosophy has also been used, mainly for the design of this licentiate thesis.

The licentiate thesis is explorative and has proceeded stepwise. Literature searches have been a recurrent activity during the work with the licentiate thesis. In the beginning, literature was located which could help design the research problem. This type of literature was directed towards small firm product development and small firm usage of CBIS. During the analysis of the empirical material for the pre-study, literature was gathered about unilateral and multilateral use of CBIS, and unilateral and multilateral aspects of product development. Based on the findings in the pre-study, the literature overview presented in the main study is based on an expanded literature search that can assist in presenting an overview of the research area of interest. This knowledge overview has also been used for understanding the empirical observations that are part of the main study. A number of databases have been used in order to reveal relevant literature for the study:

- Academic Search Elite,
- Blackwell Synergy,
- Business Source Elite,
- EconLit,
- Elsevier Science Direct,
- Emerald Fulltext,
- ERIC,
- JSTOR,
Furthermore, in order to find relevant literature from these databases a number of different key words have been used, separately and in different search strings. Terms that are synonymous or closely related to the key words mentioned have also been used for the searches:

- product development,
- computer based information systems,
- computer,
- innovation,
- groupware,
- information systems,
- information and communication technology (ICT),
- scanning
- collaborative product development
- media selection
- small firm

Another approach to discover relevant new literature has been the use of alerts on the database Elsevier Science Direct. These alerts have consisted of the same key words as earlier mentioned and this has resulted in a number of relevant new articles that have been of use. Besides the database search for relevant literature, co-workers have made some suggestions on relevant fields of literature, resulting in some significant findings. Backwards tracking of references from the relevant findings has also been useful to some extent. Search activities have not focused on following or tracing any specific journals since no specific journal addresses both product development and CBIS in a small firm context. However, some journals have been more influential than others since they have at least one of the topics as their main focus, for instance *Journal of Product Innovation Management*.

Overall, the different search activities have suggested a number of relevant findings for each of the key words listed, but very few suited the key words in one context. This strengthens the hypothesis that there is a lack of understanding about the relationship between product development and use of CBIS in a small firm context.
4.3 Case design and selection

As Stake describes: “In the beginning, phenomena are given; the cases are opportunities to study the phenomena” (Stake, 2000). In order to understand the phenomena of interest empirical material is needed. Furthermore, the selection of cases is one of the most important choices for a case study (Miles and Huberman, 1994). In order to achieve as good an understanding as possible about the phenomenon of study, the cases must be appropriate to the study. The first distinction in the choice of a case study design is the number of cases needed to address the research question. A multiple-case design has been chosen in this licentiate thesis in order to address the research question. According to Yin (1994), the decision to undertake multiple-case studies should not be taken lightly. Every case should serve a specific purpose within the overall scope of inquiry, either by serving a literal replication (predict similar results) or to serve a theoretical replication (produce contrasting results for predictable reasons). The findings from the pre-study propose that there are two main ways of using CBIS for product development, and cases have accordingly been selected in order to represent both usage areas (unilateral and multilateral use of CBIS), and also in order to carry out a theoretical replication (see chapter 10 and the sections concerning analysis of contextual influences).

The selection of cases for this second study has been made from the sample of firms studied in the pre-study. This implies that all empirical data have been collected from the wood industry. The advantage with using the firms from the pre-study is that there is good knowledge about the firms, which makes it possible to address the phenomena of interest. The sample is not a random sample, but rather a deliberate sample, which is preferable for qualitative studies. The reason for making this kind of sample is that it would help create insight about the phenomena of interest.

Several important aspects were considered for the selection of cases. One aspect was the importance to reveal the use of CBIS for product development, which made both CBIS usage and product development activities important in deciding upon the cases selected. The main criterion for the case selection is that the firms have demonstrated a certain usage of CBIS in the product development process. The sample was combined in a way that guaranteed that all areas of usage was represented with the highest possible level of awareness of how the usage affects the process of product development. The usage is, in this context, seen as the two areas of usage that were discovered in the first study, namely the unilateral and multilateral use of CBIS. In order to receive as rich information as possible about the two forms of CBIS usage revealed in the pre-study, the informants have been
chosen through the firm which was using CBIS mainly for unilateral purposes. The other firm used CBIS mainly for multilateral purposes. Hence, the number of cases was determined through the number of areas of CBIS usage, and the specific cases chosen were based on their suitability to bring understanding to the phenomena of interest.

The second distinction in the choice of a case study design is the unit of analysis. A case study can thus consist of either a single unit of analysis or more than one unit of analysis. Possible units of analysis for research within this field of research are positioned along a continuum from personal to inter-organizational. This licentiate thesis focuses on the small firm, and its product development processes. This implies that this licentiate thesis has more of a multiple unit of analysis, since it is argued that product development cannot be isolated from the firm. The interviews started with the chief executives of the firms and further selections of respondents were based on recommendations from the chief executives. The unit of analysis ranges, in this study, from the product development process, to the firm level (mainly strategic and tactical level).

On the 16th of December 2003 both firms accepted to be a part of this study. The interviews were scheduled to start in 2004 (4th week, 19-23 January). Follow up calls was made on the 7th of January 2004, where both firms agreed upon the dates which were proposed. Interviews with informants from Shelving Systems, Inc. were booked for the 19th of January, and interviews with informants from Houses, Inc. were booked for the 21st of January 2004.

4.3.1 Case one: Shelving Systems, Inc.

When I arrived at the company, Matt (which is an assumed name for the CEO of the firm) was providing material from the supply into the production area. When he noticed that I was there, which was ten minutes before our scheduled appointment, he parked his truck immediately to welcome me. The interview took place at the firm in a room used by the chief executive for administrative purposes. We started off with a cup of coffee and a small chat which mainly consisted of an introduction of why I was visiting the firm and for what purposes I would use the information from the interviews.

After that, Matt guided me through the production area where he showed me how the firm manufactures the products and he also showed me a hall where they had a demonstration of product samples.
During the interview, I never felt that Matt was distracted or stressed. The atmosphere was good and we established a good connection. We experienced two interruptions: one phone call, and one worker who needed help. I believe the interruptions made us lose focus for approximately ten minutes. Besides the interruptions we had some discussions that were not related to the subject, and these discussions were towards the end of the interview. At the end of the interview Matt suggested that I should contact him if I had any further questions.

Matt mentioned that he made all decisions and handled all relations regarding the firm’s product development. He told me that if I wanted to make further interviews at the firm it would not be a problem, but he could not mention anyone from the firm who had been actively involved in any of the product development processes that the interviews regarded. Therefore, no further interviews were perceived as being necessary for understanding the firm’s product development processes.

4.3.2 Case two: Hones, Inc.

I booked my meeting with Sussie (new chief executive of the firm) and she welcomed me when I arrived. Three interviews were conducted, all in a private room at the firm. First I interviewed the chief executive, Sussie, together with the former chief executive, Bill. Thereafter, they recommended me to interview Calvin, who is the production manager.

We started out with the firm and its product development. Because Sussie only had had a couple of days experience as the firm’s chief executive, she had recommended that Bill, the former chief executive and Sussie’s father, would be present at the interview as well. The interview with Sussie and Bill lasted about two hours and directly thereafter I interviewed Calvin. We ended the interviews with a walk around the facilities and Calvin told me how everything from the shipment of supplies to the delivery of the products was functioning.

I used a tape recorder during all the interviews and I never felt that the informants were disturbed because of this. My perception was that the informants spoke openly and freely about all topics. In fact, the informants themselves brought up discussion topics that were severely sensitive which I took as a sign of a good relationship between the informants and myself. The informants were granted anonymity. The persons who were interviewed all worked at strategic and tactical levels of the firm. In fact, interviews were conducted with all persons on the firm’s strategic and tactical levels.
4.4 The interviews (Empirical material)

Within each case a logical selection of respondents has been made, starting with the chief executive of each firm, and then asking him or her who has been involved in product development. All persons who have been involved in the product development work have been interviewed, and everybody was asked about who else had been involved.

The main technique for generating empirical material can be resembled to what has been labelled as narratives in literature (see, for instance, Czarniawska), although the main point with the comparison to narratives is to illustrate how the data have been generated for this study. Narratives focus on stories, and similarly the main interest in this study has been to reveal processes and to gather as rich information as possible about the product development processes studied. Although, a checklist has been used during the interviews, as a way of supporting the respondents to tell the stories of the product development processes. The checklist has been used in order to at least cover the parts that have seemed to be important from the pre-study and the knowledge overview that has been put out. (See appendix D for the checklist that have been used, or appendix E for an English translation of the checklist.)

4.5 Analyzes of the empirical material

“Data analysis consists of examining, categorizing, tabulating, or otherwise recombining the evidence to address the initial propositions of a study” (Yin, 1994). According to Yin (1994), two general strategies exist for analyses: relying on theoretical propositions, or developing a case description. Ideally, reliance on theoretical propositions would be preferable, but in cases where these propositions do not exist the other alternative is necessary. The general strategies could be compared to the discussion about induction and deduction in the chapter about scientific philosophy. In this particular case the research problem calls for an inductive technique because it is neither possible to deduce from theory nor to use propositions for analysing the empirical data. Rather, empirical descriptions are needed which can form a basis for a comparison with earlier theoretical work within the fields of small firm product development and use of CBIS. The chapters of analyses have therefore a start with a within case description of the empirical material. Consequently, a result chapter will deal with analyses and comparisons of the findings to the theoretical framework presented.
According to Yin (1994), there are four dominant analytic techniques that can be used for analyzing within cases: pattern-matching, explanation-building, time-series analysis, and program logic models. The technique used in this licentiate thesis can be described as a pattern-matching technique. This has been used in order to analyze how, why, and what influences the use of CBIS has had in the product development processes studied. Based on the empirical descriptions patterns, which can illustrate how, why and what influences the use of CBIS has on the product development processes studied, have been investigated.

In the result chapter’s first sections, the findings regarding CBIS resource adoption, unilateral and multilateral use are analysed, using material from the pre study and main study together with the knowledge overview presented. The result chapter has, regarding the contextual analyses, focused on the differences between the cases (i.e. firms) as a way of analyzing how these differences (on a product, firm, and environment level) might influence the way in which CBIS is used for product development.

4.6 Reflection on the quality of the study

One of the most important parts of research material is the reflection made upon the trustworthiness or the research problems of the empirical data (see for instance Leininger, 1993; Yin, 1994). In order to reflect upon this we need to have a congruent vision about what is good research and how we can address these issues.

Qualitative studies have inherited much from the fields of positivistic and quantitative studies (see for instance Yin, 1994). Labels and reasoning used for discussing the quality of qualitative studies have focused on the same set of premises as for quantitative studies (Leininger, 1993; Stenbacka, 2001). A traditional approach has been the use of the terms validity and reliability. The basic question of validity is whether “the intended object of measurement actually is measured”. The basic issue of reliability concerns the ability of a measurement method to produce the same research result over and over again. Reliability concerns the extent to which findings can be replicated or reproduced by another enquirer. In other words reliability could be described as to which extent another researcher, following the same procedures and making the same study, would arrive at the same findings and conclusions. These evaluation criteria have been criticized for not being representative for the aims and goals of a qualitative study (Leininger, 1993; Popay, Rogers et al., 1998). The manner in which qualitative studies can be evaluated has been debated (Lincoln and Guba, 1985). Critique has been presented against the use of a terminology that has its origin in the
quantitative literature (as the terms validity and reliability), but few options have been suggested. Leininger (1993) proposes that qualitative research criteria must be used to fit with the philosophical assumptions, purposes, and goals of the qualitative paradigm. According to Leininger (1993), “a major dimension to evaluate qualitative studies has been the absence of specific criteria to determine a standard or a rule on which to make accurate assessments about qualitative research.”

Several attempts to address the issues of assessing specific labels to discuss and evaluate qualitative criteria have been made (Leininger, 1993). However, most of these attempts have not focused on the core of the issue, rather they have missed the objective to present a set of criteria that could be of use to address the evaluation of qualitative methods (see, for instance, Morse, 1991). However, some attempts have been proposed within different settings. Therefore, this study will address the contributions from Stenbacka (2001) and Leininger (1993) in order to give a response to the critics (agreed upon in this study) on how to evaluate a qualitative study.

4.6.1 Reviewing alternative terminologies

Stenbacka (2001) has in a study aimed to highlight relevant matters in the judgment of the quality of qualitative research in an organizational setting. She chose four quality concepts as a basis for the discussion. These concepts are validity, reliability, generalizability and carefulness. She also comments that these four criteria have grown to become generally accepted as having to be dealt with in order to claim a study to be part of proper research. The overall conclusions drawn from Stenbacka’s (2001) study are that reliability as it traditionally has been used has no relevance, whereas validity, generalizability and carefulness have different but distinct meanings in this context. Stenbacka (2001) emphasizes the importance of the following four criteria for evaluating the quality of qualitative research: 1) The concept of validity regards the question of whether the informants chosen are a part of the problem area, and also if the informant is given the opportunity to speak freely using the knowledge structure known by the informant. 2) Good quality concerning the use of a qualitative method regards how well and thoroughly the author makes a description of the research process 3) Statistical generalization is not the aim of a qualitative research, but rather analytical generalization is. In order to achieve an analytical generalization the researcher must make a strategic choice of informants that is relevant for the phenomenon studied. 4) Another indication of good quality is to systematically and carefully describe the process of how empirical data have been generated (i.e. the interaction between the researcher and the informant(s)).
Leininger (1993), on the other hand, proposed an alternative for evaluating qualitative research, through six criteria. The aim was to find a set of criteria that could be applicable to all research methods used in qualitative research. However, Leininger (1993) states that there may be a larger amount of qualitative data to give evidence to a specific criterion than with a different criterion, but still the six criteria have meaning and are appropriate for all qualitative methods. Leininger (1993) proposes that “the basic assumption is that some common evaluative criteria needed to be used consistently and explicitly with all qualitative paradigmatic studies and that these six criteria have congruence and are appropriate within the philosophy of the qualitative paradigm”. The six evaluation criteria and definitions developed by Leininger (1993) are presented as follows: 1) Credibility is the first criteria mentioned by Leininger (1993) and regards the value (truth, believability) of the empirical findings. This criterion refers to the truth known, felt or experienced by the informants, or the truth in reality including subjective, intersubjective and objective realities. 2) Confirmability refers to how researchers confirm the observations as seen, heard or experienced. This could either be done through what Yin (1994) mentions as triangulation of data sources, or through feedback sessions with the informants. 3) Meaning-in-context refers to how ideas and experiences within a holistic context can become comprehensible. Indicators for this criterion can be, for example, events, experiences, and situations that have a particular meaning for the phenomenon under study. 4) Recurrent patterning refers to patterns that tend to recur over time in designated ways. This criterion can be substantiated through the findings that reflect identifiable patterns through repeated experiences, events, and so forth and so on. 5) Saturation entails when the researcher can not reach any further information (explanation, interpretation, or description) from the informants of the phenomenon studied. Saturation therefore refers to when the researcher fully understands whatever has been studied. Characteristics of that this criteria have been fulfilled can be when no more information is revealed from further informants shown by, for instance, redundancy or duplications of ideas, meanings. 6) Transferability refers to how well the findings can be transferred to similar contexts while still preserving the same meaning. Although qualitative studies do not aim to produce generalizations, transferability can focus on general similarities of the findings from the study in contexts similar to the one studied. This criterion has to be answered by the researcher regarding how well the original results can be met in similar contexts.
4.6.2 Relating the criteria to the licentiate thesis

The argument that criteria borrowed from quantitative research are not appropriate qualitative methods has been addressed in this study. Evaluation criteria proposed by two different researchers (Leininger, 1993; Stenbacka, 2001) have been described in the sub-section above. The articles reviewed have discussed/proposed a set of criteria that are supposed to be suitable for the evaluation of qualitative research. In this section we will turn to discuss the pre and main study using these proposed criteria.

According to Stenbacka’s (2001) first comment, the validity of a study regards the issue of whether informants are part of the problem area. In the pre-study, the informants were predetermined and included firms which developed products, and firms that both used CBIS and not. One reason for selecting and predetermining the informants was that they would serve as a good basis for the selection of informants in the main study. Consequently, informants for the main study were selected on the basis that they were part of the problem area, which is the criteria for selecting the cases for the main study. Furthermore, another part of the comment from Stenbacka (2001) is that the informant should be able to speak freely using his or her own knowledge structure. In the pre-study, the interviews were short and the informant was asked about their opinions and their work, implying that the knowledge structure of the informant was used to give answers to these topics. In the main study, this was attempted through the use of a check list, where the informant contributed with the main part of the material during the interviews. This suggests that the role of the researcher is mainly to provide the informant with feedback such as that the information provided is of interest and also supporting that all questions get answered.

The criterion regarding creditability proposed by Leininger (1993), regarded the value of the empirical findings, and the truth as known by the informants or in reality. As also commented on, the next criterion—feedback sessions—has been made with the firms which have participated (both pre and main study) in order to make sure that the presentation of empirical generated data is coherent with the view of the informants. Furthermore, participation and presentations have been possible at seminars with firms in the same industry, as well as with actors who work with supporting activities to this industry. These presentations have confirmed the empirical material and the analyses made in this licentiate thesis.

Leininger's (1993) criterion of confirmability concerns how confirmation of observations has been carried out. The confirmability of the empirical data has been ensured via feedback sessions with the firms, where the data were presented.
All respondents had the opportunity to ask questions and have comments, but no comments indicated that there had been any misunderstandings in the empirical material. The feedback was individual, and these individual feedback sessions took place between presentations at the seminar. Not all firms participated at the seminar and therefore they have been contacted by telephone in order to have feedback sessions of the data. Feedback sessions have also been made, by telephone, with the firms from the main study.

Meaning-in-context refers to, according to Leininger (1993), how ideas and experiences within a holistic context can become understandable. This criterion was not perceived as relevant for the pre-study when the purpose more exactly was to identify usage patterns among several different firms and not to give a holistic view of the phenomenon studied.

Leininger (1993) refers to recurrent patterning as the way patterns tend to recur over time in designated ways. The aim of this study (pre and main studies) was not to find patterns over time, but rather to find patterns among different firms in their ways of using CBIS for product development. Although usage can be discussed as a pattern recurring over time it was not of interest to map the historical usage as a pattern, but rather to reveal how the usage can be described and how a possible pattern of usage among several firms might be presented.

The concept of saturation refers to, according to Leininger (1993), the fact that there is no further understanding to gain of the phenomenon of study. The pre and main study did not have saturation as the selection for the number of informants, but rather a predetermined set of informants. However, in the pre-study saturation was perceived after transcribing and analyzing the interviews with regard to the understanding of usage areas for CBIS for small firms in product development. The perceived usage of making further interviews to come to a further understanding of other areas of use of CBIS for product development was low.

The concept of transferability that Leininger (1993) proposes, is similar to the concept of generalizability (the third comment) that Stenbacka (2001) discusses. According to Stenbacka (2001), analytical generalizations are relevant for qualitative research, which can be achieved through the strategic choice of informants relevant for the study. Leininger (1993) argues that transferability refers to the extent to which results from a qualitative study can be transferred to a similar context or situation, without being transferred to statistical generalizations. It is important to point out that the goal with qualitative methods is not to
produce (statistical) generalizations. According to Leininger (1993), it is entirely the researcher’s responsibility to establish whether generalization from the findings can be made and to what extent. The aim of this study was not to generalize the findings in a statistical manner, but instead to permit comparisons between the findings from these cases with existing theory and draw conclusions that can provide extensions and modification to existent theories. Furthermore, according to Marshall and Rossman (1999), a study’s usefulness in other settings will be strengthened if multiple cases, multiple informants, and/or more than one data-gathering method are used. Therefore, the choice was made to generate empirical data with a pre-study and a main study, where one study is more ‘deep’ and the other more ‘wide’.

Stenbacka’s (2001) second and fourth comment regard the description of the research process and the description of the interaction between the researcher and the informants as conditions for achieving high quality, as is often recommended for case studies (Merriam, 1994). I have tried to provide as much information as possible on every part of the project: for example, the cases studied and the data collection procedures. Although the researcher is obliged to argue for the quality of his/her own study the final judge must still be the reader who, based on the readings, has to have an own opinion.

4.7 Summary

This chapter presents how this licentiate thesis has been carried out. The chapter contains discussions and choices regarding research methods for the main study and, to an extent, also for the pre-study. The research methods presented for both the pre-study and the main study regard the search and use of literature, and the reflection on the quality of the study. The chapter also contains discussions and choices regarding empirical questions for the main study, such as questions regarding case design and selection, the gathering of empirical material and construction of check lists for the interviews, and how the analyses of the empirical material have been carried out.
5. A LITERATURE REVIEW ON PRODUCT DEVELOPMENT AND CBIS

Based on the results from this licentiate thesis pre-study, a number of areas within the literature have been pointed out as of possible interest. This chapter will contain an introduction to research about CBIS, an overview of the literature concerning adoption of CBIS, and an exploration of why CBIS is used instead of other media. The use of CBIS in product development is thereafter described. Finally, CBIS is discussed in context.

Research about CBIS has existed since the late 50’s (Leavitt and Whisler, 1958) but is still not extensive. This section will present studies that are conducted within management research about CBIS, and especially focus on studies about CBIS in small firms. Although, these studies are mostly directed to how CBIS is connected to the firm; not so much about how CBIS is connected to product development. However, as illustrated in the section above, product development is closely linked to firm activities and processes. In this way, it is possible that the literature on CBIS in the context of the firm can also be of use for understanding it’s use in product development.

The literature on CBIS in small firms can be divided into three areas: 1) adoption literature, 2) implementation literature, and 3) impact literature. The first area, adoption literature, sets out to identify the circumstances under which firms adopt CBIS and what contextual influences make firms adopt CBIS. The second area discusses how CBIS can be successfully implemented in the firm. The third area is about the impact CBIS has on the firm, regarding the roles and functions CBIS plays in the activities and processes within the firm (Hedman and Kalling, 2002). The first area of CBIS literature, adoption literature, for understanding why CBIS is used and adopted. The following sub section will therefore deal with adoption literature. Thereafter, impact literature will be reviewed concerning the use and influences of CBIS for product development.

5.1 Why do small firms’ adopt CBIS?

Already in 1979, Neidleman asked the question, “why aren’t more small and medium sized firms utilizing computers”? Neidleman set out to identify the reasons for why some firms had adopted computers. Based on a survey, Neidleman drew the conclusion that small and medium sized firms did not use computers because of the perception that computers would not make a difference. Neidelman also concluded that many small and medium sized firm managers misinterpreted the cost-benefit factors involved, leading to firms not adopting computers.
Nickell and Seado investigated small firm managers attitudes towards computers, and how computers are used in these firms. The study, based on a survey of 236 firms, revealed that managers who have taken a computer class, or work in a firm which owns or uses computers, have a more positive attitude toward computers. Nickell and Seado (1986) differentiated between two forms of computer usage: 1) business computer applications, where accounting, mailing lists and storing information was found to be the most frequent used application and 2) personal applications, where word processing, accounting, and budgeting were the most frequently used applications (Nickell and Seado, 1986).

Montazemi (1987) examined the assessment and adoption of information technology in small firm environments. The results, based on a field study, revealed that the decision makers information requirements did not match the information systems adopted, and that this was due to lacking information requirement analyses, and policies for the selection and use of information system resources.

DeLone (1988) set out to investigate determinants that affect computer usage success in small firms. The results, based on a survey, indicate that the involvement and knowledge of the CEO of the small firm is of importance for successful computer usage.

Adams, Nelson et al (1992) replicated a study by Davis regarding perceived usefulness, ease of use, and usage of information technology. The article is based on two studies where the first study surveyed 118 respondents from 10 organizations regarding their attitudes towards messaging technologies, voice and electronic mail. The second study set out to complement the first study by letting 73 respondents rate three software applications with regard to ease of use and usefulness. The main goal was to develop and test scales for measuring these constructs. The relations between the constructs were tested, resulting in that usefulness and ease of use is important in the usage of information technology.

Cragg and King (1993) examined information system evolution in small firms. From the experiences of six small manufacturing firms, they focused on the identification of motivators and inhibitors of application growth. The results indicated that growth motivators included improved enthusiasm for the technology, while growth inhibitors included inadequate resources and limited education about information systems.
Thong and Yap (1995) examined the effects of the CEO and the organization on IT adoption, as these have been proposed to be of importance for IT adoption. CEO effects that were supposed to affect IT adoption include: CEO innovativeness, CEO attitude towards IT adoption, and CEO IT knowledge. Organizational characteristics which affect IT adoption include: business size, competitiveness of environment, and information intensity. The results, based on their survey, revealed that CEO effects are of great importance for IT adoption, that small firms are more likely to adopt IT when the CEO has a positive attitude, high IT knowledge, as well as a high level of innovativeness.

Fink (1998) set out to find the factors that are of importance for the successful adoption of information technology in small and medium sized firms. The results revealed that information technology adoption can be divided into a three stage model, where decisions have to be taken at the end of each stage about whether or not to continue with the adoption. The first stage compares and assesses the benefits of information technology against the firm’s culture, and considers which technology is suitable. The second stage determines whether sufficient resources are available, and if procedures exist for the selection and implementation of information technology. The third stage evaluates the environment for support and resources.

Sillince, Macdonald et al. (1998) examined the adoption, diffusion, use and impact of electronic mail within small firms. The results, based on a survey, revealed that the main reason for non-adoption was that the organizations with which the firms communicated had not adopted electronic mail. Other reasons for non-adoption included: implementation and maintenance costs, technical difficulties, and worries about the effects on internal communication. The study revealed that firms that have adopted electronic mail use it for sending messages about things which there are no disagreements about. It was also discovered that smaller firms use electronic mail more for communicating with other organizations, while larger firms also use electronic mail more for internal communication.

Walczuch, Van Braven et al. (2000) examined benefits and barriers of Internet adoption in Dutch small firms. The results revealed that the main barriers to adopting Internet was the perception that Internet not would lead to efficiency or lower costs, while the benefits that were perceived with Internet was the possibility of ‘border-crossing’; that is, the possibility to inform and communicate over geographical borders.
Mehrtens, Cragg et al. (2001) examined which factors influence Internet adoption in small firms. Three factors were found to affect adoption: 1) perceived benefits, 2) organizational readiness, and 3) external pressure.

5.2 How can we understand why CBIS is used for product development?

The pre-study indicated that when CBIS is adopted into the firm, the use is dependant on situational and traits reasons. Trait theories, have mostly been used regarding reasons why small firms use CBIS. They often do not focus on the use of CBIS based on situational factors. In order to make it possible to get a broader view of why CBIS is used, a perspective is needed that can illustrate why CBIS is chosen in certain situations. The possibility to extend understanding of the influences of media on small firm product development by extending the point of view to include media selection theories is of interest. Although, media selection theories proposed as a theoretical field of interest for understanding the use and effects of CBIS for product development relies on a rather debated assumption. Is there such a thing as a rational choice between different media used for information and communication?

A number of theories have tried to explain why certain media is used. Carlson and Davis (1998) reviewed media selection theories and made a distinction between two categories. According to their work, the first category, which they refer to as trait theories of media selection, can further be divided into three theories of media selection (5.2.1 Access/quality approach, 5.2.2 Media richness theories, and 5.2.3 Social presence). The second category of media selection theories consists of 5.2.4 Social interaction theories.

5.2.1 Access/quality approach

According to Carlson and Davis (1998) the access/quality approach views media selection as a function of a cost benefit analysis, where the user seeks to retrieve as good quality of information as possible with the the least effort/cost (Swanson, 1987; Carlson and Davis, 1998). This theory was researched in the beginning of the 80’s by O’Reilly (1982). Further, Carlson and Davis (1998) refer to Culnan (1984) and Swanson (1987) who revealed that the attributes of importance in the evaluation of access and quality who are comprised of convenience, easy access, and reliability.
5.2.2 Media richness theories

Carlson and Davis (1998) define media richness theories as originating from the information processing theory by Shannon and Weaver (1949), and therefore builds on the assumption that communication is distributed in order to reduce uncertainty. Since uncertainty deals with the amount of information transmitted, the choice of media is made based on which media can transmit the correct amount of information. Apart from uncertainty reduction, media richness theories also include equivocality reduction (Weick, 1979), which refers to the creation of common understandings. Regarding equivocality reduction, the choice of media is based on its ability to provide involved individuals with rich information rapidly in order to reduce equivocality. The development of media richness theory is rooted in mediums like face-to-face meetings, telephone conversations, and printed reports. Although, it has been extended to include newer mediums such as electronic mail (Markus, 1994).

Rice (1992) mentions that media richness theory\(^2\) is based on an assumption that different media channels differ in how they process information. Rice further describes that the richness of a medium is determined by the capacity it has for immediate feedback, the variety of cues it involves (i.e., face-to-face meetings include a variety of facial expressions, tone of voice, etc.), personalization, and language variety. Since the mediums differ in richness, they can be arranged. Carlson and Davis (1998) define face-to-face as having the highest richness, since this medium allows for adjustments, clarifications, multiple cues (different face expressions, tone of voice, etc.), and also makes the expression of emotions possible. The order of mediums then descends from telephone, written communication down to unaddressed documents. Carlson and Davis (1998) state that the point of media richness theory is made explicit when the richness of the medium chosen matches the message ambiguity, resulting in effective communication. This implies that communication involving routine questions does not need a high media richness level and visa versa.

Rice (1992) describes how media richness theories have been understood in studies concerning CBIS. For instance, it has been found that text messages sent through CBIS have been perceived to be less appropriate for communication concerning social and emotional tasks and for tasks that are difficult to analyze. However, other studies have found that both social and emotional content are communicated through CBIS (Rice and Love, 1987). Markus (1994) revealed that since electronic mail is both written and asynchronous, but is more rapid then

\(^2\) Also referred to as information richness theory
other written and asynchronous medias (i.e. non electronic written communication), is can be placed in between the use of the telephone and non electronic written communication on the media richness continuum.

5.2.3 Social presence theory

According to Carlson and Davis (1998), social presence is defined as “the extent to which an individual psychologically perceives other people to be physically present when interacting with them”. Similarly to the access/quality approach, social presence theory assumes that individuals base their media choice on a comparison between the cost for accessing the information to the amount of social presence needed. The media chosen is assumed to facilitate the social presence needed for the communication task. According to the theory, information and communication must be studied from a holistic perspective, where holistic refers to the theory that one media cannot be totally isolated from the others. The question is not one of which medium to use, but rather when to use the medium (Carlson and Davis, 1998). Rowe and Struck (1999) have revealed that the use of a media is not only determined by the characteristics and the cognitive aspects of the communication task, but also how the media relates to the way people interact.

5.2.4 Social interaction theories

Carlson and Davis (1998) describe the second category of media selection theories, social interaction theories, as based on the assumption that media selection is influenced by a combination of social forces. This category of media selection theories is in response to the task oriented category, which is the first category of media selection theories. This category assumes that different mediums are perceived to have different media richness and social presence. Social interaction theories argue that a combination of social forces influence the media selected. They alter, however, in their explanation about how and why social influence is conducted (Carlson and Davis, 1998).

Carlson and Davis (1998) mention three contrasting theoretical fields which explain media selection. These are: 1) symbolic interactionism theory, which considers social context an influence in media selection 2) social information processing theory, which argues that meaning is socially constructed implying that media selection is dependant on social norms of individuals within a social context, and 3) structuration theory, in which social interaction is viewed as an iterative
process, where media selection is both a medium and an outcome of a group process.

Carlson and Davis (1998) also mention that, besides these three theories, a number of models have been proposed which attempt to explain how social interaction works. They mention, for instance, a study by Markus (1994) which claims that social processes can have an impact on how rich electronic mail is perceived to be, and that electronic mail can be used as a richer media when social processes admits it to be a rich media.

5.3 The use of CBIS for product development

Rule and Attewell (1989) examined what computers do in organization by questioning whether computerization alters the nature of organizational practice. Further, if not, why is there a trend toward adopting computers? The study was based on interviews with 184 computerized private sector firms in New York. The results from the interviews with the New York firms revealed that they have continued to perform the same sort of activities as before the computers adoption, yet computers are to a large extent perceived to be of importance for efficiency improvements. The results from the pre-study indicate that the use of CBIS for product development concerns the gathering of information and communication with external parties. Daft, Lengel et al. (1987) give two different explanations for understanding information processing in organizational theories: 1) uncertainty, and 2) equivocally. Uncertainty refers to the difference between the amount of information needed for solving a task, and the information possessed (Galbraith, 1974). According to this view, firms gather information in order to reduce uncertainty. Equivocally, or ambiguity, assumes that information is processed in order to establish mutual understanding between individuals (Weick, 1979). Daft and Lengel et al. (1987) differentiate between uncertainty and equivocally through how the individual acts with regards to information processing. While uncertainty leads to the gathering of information from external sources, equivocally causes individuals to collaborate and overcome differences.

CBIS can depend on a variety of tools, both synchronous and asynchronous\(^3\), and technologies to facilitate information-processing activities; electronic mail exchange (asynchronous), teleconferencing and videoconferencing (synchronous), or web-hosted meetings (synchronous).

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\(^3\) Synchronously refers to that both sender and receiver of information are active at the same time and asynchronously refers to activity shifting over time from sender and receiver.
In the pre-study, two forms of information processing were used when utilizing CBIS for product development: unilateral, and multilateral. The main difference between these is the characteristic of information flow between actors in the environment and the firm. Unilateral use of CBIS is built upon the gathering of information, directed from the environment into the firm. Multilateral use, on the other hand, builds on communication between actors in the environment and the firm.

5.3.1 A unilateral approach to product development

From the literature on product development, the unilateral approach could be compared to environmental scanning. Environmental scanning is the activity or the process through which information is retrieved. Several related terms have been proposed for describing different modes of information retrieval, such as monitoring, focused search, and noticing (Huber, 1991). The differences in terms have been used to illustrate the differences in how the theory of information retrieval is explored. Huber (1991) defines scanning as the behaviour people exhibit when they browse through information without a particular problem to solve or question to answer, while focused search occurs when people are looking for something specific.

Huber (1991) makes a distinction between scanning the external environment and scanning internal operations for information. In this study, the use of scanning will address the way in which information is retrieved by a firm. The focus is upon the retrieval of information from the external environment. As stated in Huber’s (1991) theory, scanning can be divided into separate modes of information retrieval, and Aguilar (1967) proposed four categories through which we can understand scanning: undirected viewing, defined as general exposure when the viewer has no specific purpose in mind; conditioned viewing, or directed exposure not involving active search; informal search, which is an unstructured effort to obtain specific information; and formal search, which refers to a deliberate effort to find a piece of information. Although these modes can be viewed as activities, it has also been proposed that these modes are actually a process for decision making beginning with undirected viewing of information. It is also assumed that this process can be viewed as relevant for product development at two different levels of abstraction. The product development process has been argued to be highly uncertain in the beginning, certainly developing as the process develops. This is similar to the process of scanning, which starts with undirected viewing as something highly uncertain, almost a random activity, developing towards the formal and explicit search. On the other hand, the connection between scanning
and product development activities, for instance in decision making, can trigger scanning processes that focus on specific tasks.

Raymond, Julien et al. (2001) have also proposed three categories of scanning: commercial scanning, which refers to markets and customers; competitive scanning, which refers to competitors and industries; and technological scanning, which refers to production and information technologies and providers.

Further, Souitaris (2001) makes a distinction between information that is firm-specific and information that is more general. According to this classification, firm-specific information refers to information that can be directly related to the products and processes of a firm, while more general information refers to market and technological trends. Both types of information have been found to be positively associated with product development. According to Souitaris (2001), firm specific information can be obtained from customers, suppliers, and/or competitors. General information can be obtained from a large number of different sources, such as from public agencies and private consultants.

According to Katila and Ahuja (2002), a firm’s scanning efforts can be separated with respect to the depth and the scope of the search. Similarly, Pfeffer and Salancik (1978) propose that managers scan according to their perceptions of the necessity for information. This implies that managers differ with respect to the amount of information used and the sources of information used. Further, Aguilar (1967) has proposed a category, or search scope, which is referred to as undirected viewing, a general exposure to information without a specific purpose.

There is strong support for the proposition that scanning a broad range of information sources leads to improvements in performance (Huber, 1991; Thomas, Clark et al., 1993). Chief executives in high performing companies scan more frequently and more broadly in response to strategic uncertainty than those in low-performing companies (Daft, Sormunen et al., 1988). Ahituv, Zif et al. (1998) point out that information from written sources complement information from personal sources in order to deliver a better understanding of an uncertain environment.

Ahituv, Zif et al. (1998) discussed the benefits of a ‘multi-media approach’ for information gathering. The main argument was that a weak signal detected from a personal source may be supplemented by objective data. Scanning can, thereby, trigger the use of a complementary medium for information retrieval.
CBIS has been proposed as an information system which can be used for scanning activities. Huber (1990) questions how critical characteristics of advanced information technologies effect organizational design, intelligence and decision making. Huber divided these characteristics between basic characteristics and properties of advanced information technologies. Basic characteristics refer to data storage capacity, transmission capacity, and processing capacity. Properties of advanced information technology refers to facilitators of information and communication within and outside of the firm’s boundaries. The propositions developed state that the use of CBIS for scanning enhances information retrieval from sources within the firm, as well as outside the firm’s boundaries, making information more accessible. Further, the use of CBIS for scanning can enhance organizational intelligence and memory through making information gathering more efficient.

Unilateral use of CBIS is based on the theory that it can be useful for gathering of information about the market, disseminating this information, and using it to promote and launch a new product. Internet is also argued to facilitate widespread marketing activities, not dependant on geographical location (Ozer, 2004).

The use of CBIS in facilitating decision making has also been indicated in the literature. Vlahos, Ferratt et al. (2003) investigated how managers in large firms used information technology. The results revealed that CBIS was used mainly for resource allocation, evaluating alternatives, identifying problems, and in short-term decision-making. The study also indicated that the surveyed managers were using CBIS for more then ten hours a week, and that the amount of use and the perceived value of the use were positively correlated. Further, Ozer (2003a) states that since the use of CBIS for unilateral activities can render more information, it is also possible that the use of CBIS for screening activities improves the objectivity of decisions.

Besides decision making, analysis has also been argued to be facilitated by the unilateral use of CBIS. Ozer (2004) argues that financial and business analysis is linked to the performance of new products, and that the Internet can make analysis more effective and efficient through its capability to collect information from a wide set of sources. Further, CBIS has been viewed as a facilitator for the analyses of a firm’s product portfolio due to the ability to collect, categorize and use information. Ozer (2003a) refers to a study by Teo and Choo (2001) which revealed that the use of the Internet is positively related to the quality of the information regarding the collection of market information, and that the quality of the information collected positively impacted the quality of the decisions made by
managers. Ozer (2003a) concluded that information has a higher quality and allow, managers to get an aggregated view of the firm’s product portfolio, which also allows them to more effectively launch and market new products.

Ozer has proposed that CBIS can be used for the collection of market intelligence and for the identification of market trends. In other words, CBIS can be unilaterally used for product development related activities. A number of sources with useful information are of possible use, such as market or governmental data. CBIS can offer fast connections to data, which can facilitate effective analysis. Ozer further proposes, since the use of the Internet is positively related to the quality of information decisions, it can be assumed that Internet is positively related to the speed and quality of analysis.

5.3.2 A multilateral approach to product development

In the literature on product development, a multilateral approach can be compared to the work on collaborative product development. Several different theoretical understandings for collaborative product development have developed. According to Ozer (2000), Internet tools can offer multiple options for communication needs; electronic mailing of information and files, discussion tools, videoconferencing. Ozer (2000) argues that the success of Internet usage depends on both the compatibility it has to other systems, and it’s supply of software and hardware necessary for new product development activities.

Littler, Leverick and Bruce studied factors affecting the process of collaborative product development. The purpose of their study was to identify risks and benefits with product development collaboration. An implicit assumption is that collaboration takes place in product development in order to reduce or share risk. The results cited benefits of collaboration in product development as satisfying customer needs, accessing expertise necessary to take advantage of market opportunities, reducing costs and risk for product development, decreasing the time to market, and accessing new markets. Among the risks of collaboration in product development the study revealed factors concerning knowledge spillover effects, less control of the product, and difficulties of coordinating management and budgeting (Littler, Leverick et al. 1995).

Regarding multilateral use of CBIS for product development, it has been argued that CBIS can be used for issues directed towards the market. Poon and Swatman (1999) set out to examine why small firms are spending time online and with Internet commerce. The results, based on a qualitative study, indicate that small
firms are using electronic mail for business communication and file transfers, but that Internet commerce is in its infancy. Poon and Swatman found that the perception of long-term benefits and potential opportunities are influential for adoption of Internet commerce. Furthermore, it is pointed out that Internet commerce is likely to expand if small firms perceive tangible benefits.

Also, Ozer (2003a) remarked that CBIS can play a role in marketing issues. He argues that CBIS can be used for commercialization of new products, since CBIS has highly efficient documentation and database capabilities. For commercialization, CBIS can be used to present information about new products to customers. Another argument that Ozer uses for addressing the use of the Internet in the commercialization of new products is the increasing demands for real-time information from customers and retailers. He states that the use of Internet can lead to firms to commercializing new products more effectively and efficiently.

Furthermore, Ozer (2000) argues that the involvement from customers and business partners is important for new product success, and that Internet is an efficient tool for incorporating the views from these partners. Empirical descriptions illustrate that firms use information technology to “facilitate strategic listening with customers” and business partners during the design of new products.

CBIS has also been proposed to facilitate the external relations of a firm in several ways, making it suitable for collaborative product development activities. Bauer, Grether et al. (2002) have proposed that the connectivity, the interactivity, and the constant availability of information on the Internet can lead to higher commitment, satisfaction, and trust among parties, can enhancing the quality of relationships. Another aspect of improvements for collaborative product development through the use of CBIS addressed states that Internet removes the geographic barriers among collaborators, which is supposed to facilitate collaborative efforts(Mascarenhas, Baveja et al., 1998). Ozer (2004) argues that internal and external relations are of importance for new product development performance, and that Internet can facilitate these relations in several ways.

Ozer (2000) argues, based on empirical evidence from the business consulting industry, that firms extensively use Internet for knowledge management in new product development, as well as for storage and retrieval of information in databases. These databases are used in new projects in order to retrieve information in an efficient and rapid way. The use of Internet also makes it
possible to share information and knowledge with other parties during product development processes.

5.4 An introduction to a contextual perspective

This section aims to present a contextual view of product development. Since the operations conducted by the hardware of a CBIS includes the capturing, transmissions, storage, retrieval, manipulation and display of data, it can be assumed that CBIS connection to product development regards information and communication. The literature reviewed in this section will hence present a contextual view of product development to enhance the understanding of possible connections between the use of CBIS and product development.

This discussion is dependent on three contextual areas (see Figure V) the context of the product, 2) the context of the firm where product development is conducted, and 3) the environment of potential markets for the product, suppliers, and other actors supporting or dependant upon the product development process and activities.

![Figure V: An illustration of product development contexts](image)

5.5 The context of product development

In order to understand the connections between CBIS usage and small firm product development, there is a need to disentangle the dynamics of small firm product development. This implies that the concepts, activities and processes of small firm product development needs to be presented in order to later incorporate the use and impact of CBIS in these concepts, activities and processes. The following sub-sections will therefore aim to present the concepts, activities and processes of small firm product development. There are no general principles for handling small firm product development, therefore the following sub-sections
Product development has been argued as one of the firm’s most complex activities and processes. The product development process can be divided into several activities. The research literature has regarded product development as both an activity and a process. The product development literature has, however, divided product development into a series of activities that, if put together, is possible to construct a process. Product development has also been seen as a ‘mean’ to achieve an ‘end’. This type of research is often interested in how differences in product development/innovation/R&D together with organizational differences, contingency variables etcetera relates to firm performance. For instance, Georgellis, Joyce et al. (2000) examined how entrepreneurial competence variables (competencies to innovate, plan ahead, and willingness to take risks) affect business performance. Also, Gray (2002), Herbig, Golden et al. (1994) focus on the entrepreneurial field where innovation is seen as one of the main variables that affect firm growth/performance. Another illustration of this kind of research is a study by Meyer and Roberts (1986) that examines how different patterns of sequential product development leads to different corporate successes. A further, different approach within this type of research can be illustrated using the study of Young, Francis et al. (1993) which tried to assess marketing variables in innovation in order to reveal which of the variables are associated with firm growth.

Product development has often been regarded as the ‘end’. Studies that have focused on aspects of the development processes, however, are regarded as the ‘means’. For instance, Hadjimanolis (2000) used a resource based view in order to reveal innovation performance of the small firm. That is, he focuses on the roles of resources, capabilities, and their interactions as determinants of the innovativeness of the small firm. Similarly, Hartung and MacPherson (2001) are also interested in the in-house research and development as a prerequisite for achieving innovation performance. They also focus on firm size and location as factors influencing innovation performance. Several researchers have also focused on the specific roles people within the organization play as an important issue for product development/innovation/R&D output. Variables including learning, skills, intelligence, and management have been examined as innovation output (Capello, 1999; Dou and Dou Jr, 1999; Freel, 1999; Ledwith, 2000; Freel, 2003). Another approach in comparison to the resource based view, examines the importance of external influence during the product development/innovation/R&D-process. Hanna and Walsh (2002) addressed the
question of how networking affects innovation in small firms. Lipparini and Sobrero (1994) focused on the role of the suppliers, as well as explored the importance of managing many innovative ties. Also, MacPherson (1997; 1998) and Freel (2003) have been interested in the external cooperation within small firm product development/innovation/R&D. Other contributions to the question of how small firms can be successful in product development/innovation/R&D are Herbig, Golden and Dunphy (1994), who examined the relationship of structure and innovative success. Kickul and Gundry (2002) examined the relationship between a small firm owner’s personality, strategic orientation, and innovation. Koeller (1996) examined the role of union membership, industry concentration, with innovation output. Roper, Love et al. (2000) addressed industry concentration, technological opportunity, and locational factors as determinants of innovation propensity. Sonfield, Lussier et al. (2001) made a gender comparison with the interest to find differences in levels of venture innovation. Swink (2002) examined different tactics for improving the speed (referred to as performance) of the development process. Yet another approach towards revealing factors that influence innovation outcome has been made by Khan and Manopichetwattana (1989), who compared similarities and differences among innovators and non-innovators. This reasoning implies that we can look upon product development as activities at different levels of abstraction. Further, aspects of product development as a process and as an activity imply that there are different abstract levels of product development. The figure below illustrates this, exemplifying separation between the 1st level, 2nd level and 3rd level. The ‘boxes’ at each level can be viewed as an activity and that the ‘arrows’ at the second and third level can be understood as processes.

Figure VI: Product development as process and activity
Breaking down the product development activity at the first level of abstraction has been made in numerous ways in the literature. Different types of processes consisting of different activities have been proposed. The second level of the illustration is based on Rogers (1983) description of what constitutes product development activities (i.e. a model of innovation) at a highly abstract level. Rogers (1983) has proposed one of the most widely known models of the product development process. This model consists of three basic stages illustrating the process of product development. The first phase, described as idea generation in the illustration, in his model is the invention of a novel idea. This idea comes from the recognition of either the need of a market or a user need and advances in basic or applied research. The second phase, described as development in the illustration, consists of the development, or the sequence of events, in which the new idea is transformed from an abstract concept into an operational reality. The third and final phase, described as launch in the illustration, is the implementation, or the diffusion and adoption, of the innovation by users. Henceforth, the activities of the product development process will be labelled as either phase one, phase two, phase three, or as idea generation, development, launch, illustrating the process view of this licentiate thesis.

Other studies have proposed additional activities to the process of the product development at this level. Crawford (1997) divides product development into; new product planning, idea generation, screening and evaluation, technical development, market appraisal, and launch. Cooper and Kleinschmidt (1986) separate the sequences in the product development process into thirteen sub-sequences, initial screening, preliminary market assessment, preliminary technical assessment, detailed market study/market research, business/financial analysis, product development, in-house product testing, customer tests of product, test market/trial sell, trial production, precommercialization business analysis, production startup, market launch. The view of this licentiate thesis is that the proposed activities from the previously mentioned studies can be divided into processes at the lower stages of the abstraction level of product development. Henceforth, when the process of product development is addressed, it is regarding the process on the second level of abstraction. Discussions of product development in this thesis will be based the on the activities mentioned at the second level of the abstraction.
5.5.1 Product development performance

Regardless whether or not product development is viewed as an activity or a process it is assumed that all product development aims to achieve high performance with regards to the new product. What makes this complex is the number of different definitions of product development performance, as well as the large number of ways in which performance can be divided. A number of studies use several performance measures when researching product development. For instance, Hertenstein and Platt (2000) distinguished between several types of performance measures, financial measures, timing measures, design effectiveness measures, design efficiency measures, customer satisfaction measures, employee-rated measures, strategic measures, innovation measures, and volume measures. Further, Montoya-Weiss and Calantone (1994) argued in a literature review on new product performance that product development performance can be arranged into three categories; financial objectives, market share objectives, and technical objectives.

Furthermore, Montoya-Weiss and Calantone argue that financial and market share objectives can be viewed as one category, labelled as commercial performance. Their literature review also indicates that technical objectives are a rather rarely used category for studying product development performance. Di Benedetto (1999) focused especially on launch activities that determine the performance of the product development process. Another alternative comes from Brown and Eisenhardt (1995), who regard a structure of factors affecting each other in a series, such as process performance and product concept effectiveness, as affecting financial performance.

A strategic perspective on product development performance would consider the fulfilment of intentions of the product development process, a view that would allow for different goals within the product development processes. Furthermore, according to Tidd, Bessant et al. (2001), there are several different mechanisms behind product development processes (i.e. innovation processes) which lead to different strategic advantages. This implies that there are several different rationales for the management of product development, and product development performance.
<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Strategic advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty in product</td>
<td>“Offering something no one else can”</td>
</tr>
<tr>
<td>Complexity</td>
<td>“Offering something which others find it difficult to master”</td>
</tr>
<tr>
<td>Legal protection or intellectual property</td>
<td>“Offering something which others cannot do unless they pay a licence or other fee”</td>
</tr>
<tr>
<td>Add/extend competitive factors</td>
<td>“Move basis of competition – e.g. from price of product to price and quality, or price, quality, choice, etc.”</td>
</tr>
<tr>
<td>Timing</td>
<td>“First-mover advantage – being first can be worth significant market share in new product fields”</td>
</tr>
<tr>
<td></td>
<td>“Fast follower advantage – sometimes being first means you encounter many unexpected teething problems, and it makes better sense to watch someone else make the early mistakes and move fast into a follow-up product”</td>
</tr>
<tr>
<td>Robust design</td>
<td>“Offering something which provides the platform on which other variations and generations can be built”</td>
</tr>
<tr>
<td>Rewriting the rules</td>
<td>“Offering something which represents a completely new product or process concept – a different way of doing things – and makes the old ones redundant”</td>
</tr>
<tr>
<td>Reconfiguring the parts</td>
<td>“Rethinking the way in which bits of the system work together – e.g. building more effective networks, outsourcing and co-ordination of a virtual company, etc.”</td>
</tr>
<tr>
<td>Others?</td>
<td>“Innovation is all about finding new ways to do things and to obtain strategic advantage – so there will be room for new ways of gaining and retaining advantage”</td>
</tr>
</tbody>
</table>

Table V: Strategic advantages through product development  
(Excerpt from Tidd, Bessant et al., 2001)

In comparison, Ozer (2004) proposed that product success depends on the value added for the customer, defined as the product advantage. Internet is supposed to facilitate the collection of high quality market information, and facilitate communication both internally and in the value chain. Thus, Internet would be important for making informed decisions and help firms achieve product advantage. The argument for the use of Internet is based on the fact that Internet is easy to use, has wide availability, low cost, and builds on common standards.

Another proposed dimension for product development performance, one that has been cited more and more during the last years, concerns the developed products speed to market. Ozer (2000) argues that faster product development processes are of importance due to increased competition and reduced product life cycles. CBIS (cited as Internet in the work of Ozer) is supposed to enhance product development speed through the possibility of increasing the efficiency and effectiveness of cross-functional activities, the collection and use of market.
information, dissemination of information, and by allowing for the usage of computerized design and manufacturing software. The later have been mentioned as important factors in improving the speed of the new product development process (Ozer, 2004).

Regarding financial performance, Ozer (2004) argues that Internet can reduce the costs for new product development, and through this increase the financial performance of new products. Ozer (2004) argues that Internet can offer cost advantages throughout the new product development process, by providing an infrastructure for information and communication with which firms can market their new products at lower costs.

5.5.2 The nature of the product

Product development processes can range from honing existing products to novel innovations. They can also range from new to the firm or new to the market, to new for the world. Balachandra and Friar (1999) define an incremental innovation as “one where the basic technology and product configuration remain essentially the same, and only minor modifications are made to the performance, flexibility, appearance and other characteristics”, while a radical innovation is defined as “one where the principle of operation of the product is considerably different from the earlier product, or it may be the first of its type in the market”.

Several studies have indicated that management of product development differs with regard to where a product development process can be positioned on a continuum of incremental and radical changes in the product (Balachandra and Friar, 1999). Ozer (2003a; 2004) proposes that the role of the Internet is more pronounced for innovative products than for less-innovative products during the earlier stages of the new product development process, but will be more pronounced for new product success because more innovative products involve greater uncertainties and the early stages of the product development process is about reducing uncertainties.

The second difference in products discussed in the literature is transactional versus relational products. Ozer (2003a) proposes that the use of Internet will be greater in the business analysis stage for transactional products, while Internet will have a more pronounced role during the development, testing and validation, manufacturing development, and commercialization stages for relational products. Regarding the use of the Internet for transactional products, Ozer argues that Internet can assist in identifying suitable vendors more efficiently for the new
products during the business analysis stage. For relational products, Ozer argues that Internet is advantageous for communication and collaboration with others, and can assist in making communication and collaboration more efficient and effective, which is of importance for the development of relational products. Furthermore, Ozer argues that communication and collaboration is more important during the activities of development, testing and validation, manufacturing development and commercialization of new products. Hence, Internet usage will be more pronounced for activities regarding relational products. In his other article, Ozer (2004) argues that the use of Internet will be more important for product development success of relational products since these products require collaboration during the product development process, unlike transactional products that can be managed without outside influence. Since Internet can facilitate involvement from others, its influence will be more important for the success of relational products.

The third difference in products discussed in the literature is industrial versus consumer products. Ozer (2003a) proposes that the role of the Internet will be greater for industrial products during the concept generation and screening, business analysis, development, testing and validation, manufacturing development, and commercialization stages. Ozer (2003a) argues that the differences between industrial and consumer products are such that new industrial products require more careful concept generation and screening, more detailed business analysis, as well as more collaboration with potential buyers in the development, testing and validation, manufacturing development, and commercialization stages. It is argued that Internet can facilitate these activities and thus is of more importance for industrial products than for consumer products. In his attempt to align Internet usage to new product performance, Ozer (2004) argues that industrial and consumer products differ in mentioned ways, that industrial products require more resources, market understanding, commitment, and relationships. The use of Internet will be of greater importance since Internet can facilitate these activities. Hence, Internet will be more important for the success of new industrial products.

5.6 The context of the firm

According to Dougherty and Hardy (1996), it is important to understand both the product development project, as well as the context of the firm. They state that there are two levels of problems associated with innovation, one concerns the product development project and the other the context of the firm. Dougherty and Hardy (1996) claim that the firm has to solve a number of problems related to the level of the product development project, such as the positioning of the
product in the market, managing external relations, and developing production. The main idea by Dougherty and Hardy (1996) is that when these problems are solved, sustained innovation can occur. The other level mentioned is the context of the firm. Dougherty and Hardy (1996) refer to problems at this level as a difficulty connecting the innovation with routine operations. Although this discussion is based on large mature organizations, it indicates that product development processes and activities are not only affected by factors related to product development processes and activities, but also affected by the context of the firm. Hence, in order to understand the influence of CBIS on product development, we also need to know how CBIS is connected to the organizational context.

It is argued that favorable organizational conditions are related to new product development success. Ozer (2004) argues that Internet can enhance these conditions by increasing collaboration and communication within the organization, and improving coordination of new product development related activities. These enhanced conditions are supposed to increase innovation capacity and knowledge sharing within the organization. Resources are one organizational aspect where the use of CBIS is supposed to facilitate product development. Ozer (2004) argues that the amount of resources available for the firm is of importance for product development performance. Internet is supposed to make additional resources possible available for firms, which can facilitate technological synergy. Furthermore, productivity is an important aspect for product development performance. Ozer (2000) argues that there are several possible ways in which Internet can increase a firm’s productivity. Ozer (2000) claims that Internet can lead to information sharing among individuals and groups involved in new product development, and thereby reduce the risk of ineffective communication. He also presents empirical descriptions illustrating that Internet can be used in order to reduce costs for communication and travel during new product development (Ozer, 2000).

5.6.1 How does the use of CBIS affect the firm?

Powell and Dent-Micallef (1997) investigated possible connection between information technology and firm performance. They reviewed the literature on information technology and developed a resource-based framework. Their empirical study in the retail industry indicated that IT in itself does not produce a sustainable competitive advantage, but that advantages can be gained through using IT when it exploits pre-existing, complementary human and business resources.
Sillince, Macdonald et al. (1998) examined among other things, the impact of electronic mail in small firms. The results revealed that electronic mail reduced the use of fax, post and telephone usage, and were used in order to create and keep connections with external contacts. Perceived impacts of the use of electronic mail were efficiency gains, the possibility of performing new tasks such as sending computer files, and being able to use electronic mail for distance working.

Dewett and Jones (2001) set out to conceptually review how information technology impacts organizational characteristics and outcomes. Based on a literature review, they described two performance-enhancing benefits of information technology: 1) information efficiencies, defined as “the performance gains that result when IT allows two or more individuals or subunits to pool their resources and cooperate and collaborate across role or subunit boundaries, a between-person or between-group effect”, and 2) information synergies, defined as “the cost and time savings that result when IT allows individual employees to perform their current tasks at a higher level, assume additional tasks, and expand their roles in the organization due to advances in the ability to gather and analyze data … a within-person or within-group effect”. Based on these two performance-enhancing benefits, Dewett and Jones identified five organizational outcomes affected by these benefits. They also discuss the role of moderation IT plays on the relationship between organizational characteristics and organizational outcomes. Dewett and Jones suggest that IT affects organizational outcomes because 1) links and enables employees, 2) codifies the knowledge base, 3) increases boundary spanning, 4) promotes efficiency, and 5) promotes innovation. Regarding the role IT plays in the moderation between organizational characteristics and organizational outcomes (in this discussion efficiency and innovation), Dewett and Jones discusses several contingency factors: 1) structure, 2) size, 3) learning, 4) culture, and 5) inter-organizational relations.

Cragg, King et al. (2002) set out to study whether there is a link between IT usage and firm performance in small firms. As has been indicated, the mere use of IT is not supposed to lead to performance, but rather the way IT is used. Cragg, King et al., therefore, measured the fit between business and IT strategy. Empirical data was collected through a survey from manufacturing firms in UK. It was revealed that firms with high a fit between IT and strategy also achieved better firm performance than those which had a low fit between IT and strategy. These results strengthens the assumption that IT usage, if organized and linked correct, is linked to firm performance and might create a competitive advantage.
5.6.2 The nature of the technology

Similar to the nature of the product, Balachandra and Friar (1999) have also proposed that the nature of the technology can influence the management of product development. Technology is, according to their view, “how familiar a company is with the underlying technology of the new product”. Furthermore, Balachandra and Friar claim that the level of familiarity with the technology affects a number of issues concerning the product developed.

Ozer (2004) argues that technological synergy is of importance for product development performance. Technological synergy refers to the fit between technical requirements and technical capabilities needed in new product development. The arguments for how Internet can facilitate technological synergy are three-fold. 1) The possibilities of documentation over the Internet theoretically form a basis for comparing technical requirements and capabilities making it possible to solve problems early in the process. 2) Utilizing software such as CAD, facilitates the fit between technical requirements and capabilities. 3) The use of software, in virtual prototype testing can facilitate technological synergy through making actual prototype building unnecessary, allowing firms to test prototypes even though the technical capabilities are lacking.

5.6.3 Firm and product strategy

This section presents firm strategy as one influential aspect of product development. An underlying assumption to strategic management is that all firms have a strategy, whether it is explicit or implicit, and that it is a part of a decision making process. Porter (1979) proposes that strategies can be planned according to certain criteria; for instance, cost leadership, focus, or differentiation strategies. Although several researchers have argued that strategic planning is not present in small firms, it is argued here that strategy at least can be interpreted from the thought process of the CEO of the small firm.

Strategy itself implies a deliberate action or reaction to events. This planned strategy, that according to Mintzberg and Waters (1985), consists of a statement of “clear and articulated intentions, backed up by formal controls”. However, the opposite can be viewed as emergent strategies, which may simply be an indication of the flexibility of the management and the ability to react to circumstances. In fact, several attempts have been made to value the importance of the planned (i.e. deliberate) and the emergent strategy. For instance, Inkpen and Choudhury (1995) argue that the absence of a strategy may make the firm more flexible and better able to respond to external changes.
Fuller-Love and Cooper (2000) describe planned strategy as a management formulated plan, of great detail, which is then implemented. They state that a problem with planned strategy is that it is found in an environment, which is highly volatile, and that a common assumption behind the planned strategy is that the environment is stable. Also Garud and Van de Ven (2002) propose that the orderly decision process underlying the planned strategy is not often observed in practice.

Cohen, March et al. (1972) recognized that organizational action can result from a process more similar to organized anarchy than deliberate action (the garbage can model). This view has come to focus on the strategy process as emergent. However, within this perspective there are differences among scholars as to the degree of randomness in the process. The emergent strategy can be viewed as one extreme, opposite to the planned style, where the randomness of the process differs from none in the latter case to complete randomness.

The connection between firm strategy and the development of products has been a topic for several studies. Deszca, Munro et al. (1999) addressed the importance of the match between firm strategy and product development strategy. According to their argument, it is the match between the strategies of importance which make certain that necessary resources and support to the development and launch of the product exist, or can be acquired. According to Pratali (2003) a product development strategy arises from the need to establish a link between customer needs and the needs satisfied by a firm’s product. This study views small firm product development as a process that emerges over time, that the process is ambiguous and can therefore not be entirely planned (Lewis, Welsh et al., 2002). This implies that management of product development processes not can be entirely planned and outlined; but rather that the task can be seen as a continued problem solving task, arising from the recognition of the need to develop new products.

Management of emergent style is thus about constructing and creating a climate that enhances and facilitates the discovery of new opportunities and challenges. This style proposes that the managerial role must be of a more active nature, searching for opportunities and solutions to specific ends throughout the product development process (Lewis, Welsh et al., 2002).
Ozer (2003a) argues, that it is of importance to align new product development processes and activities to the overall firm strategy, since this 1) ensures that the firm can align necessary resources to the new product development process and activities. 2) makes synergies possible between the firm’s products, and 3) reduces the risk for introducing products that compete with already existing products. The connection between the use of the Internet and strategy development regarding new product development, is based on the argument that Internet is a preferable medium for interactivity and customization. Ozer argues that Internet can be used in order to identify market trends and customer needs through its ability to collect and gather information from individuals into databases. He refers to a study by Avlonitis and Karayanni, (2000) which illustrate that Internet had a positive impact on activities such as faster discovery of customer needs and greater product customization. Furthermore, Ozer (2004) argues that the degree of the fit between product and firm strategy has been shown to be of importance for product success. The role of the Internet can be two-fold: 1) Internet can facilitate the gathering of information necessary for making strategic decisions, and 2) Internet can facilitate the diffusion of strategic information in the organization.

5.6.4 Firm culture

Firm culture can, according to Hofstede (1984) definition, be viewed as “the way things are done in the business”. More specifically, culture has been defined by six properties: “(1) shared basic assumptions that are (2) invented, discovered, or developed by a given group as it (3) learns to cope with its problem of external adaptation and internal integration in ways that (4) have worked well enough to be considered valid, and, therefore, (5) can be taught to new members of the group as the (6) correct way to perceive, think, and feel in relation to those problems” (Schein, 1985). The firm’s culture affects the organizational members’ expectations of each other as well as their expectations of interactions with others outside the firm (Ireland, Hitt et al., 2003).

Ireland, Hitt et al. (2003) proposes that an effective culture for product development fosters risk taking, tolerates failure, promotes learning, expects new ideas and creativity, champions innovation, processes and administrative form, and especially focuses on continuous change as a window of opportunity. Firm culture can thus be viewed as the firm’s potential, and as an important aspect influencing product development (Curry and Moore, 2003).
5.6.5 Management and leadership

The CEO of a small firm has been described as “occupying a position of unique influence, serving as the locus of control and decision-making” (Daily, McDougall et al., 2002). The importance of the CEO to the firm has been described by Westerberg, Singh et al. (1997) as strongly influential on firm performance and firm orientation. The small firm CEO is responsible for strategic direction. The action of the CEO has, according to Curry and Morgan (2003), a strong influence on the overall organizational culture. Further, Arvonen and Pettersson (2002) found that leadership behaviour influenced internal effectiveness and the capacity for change, making leadership an important aspect of product development. A broad definition of leadership is provided by Ackoff (1999), who refers to leadership as “guiding, encouraging and facilitating others in the pursuit of ends by the use of means, both of which they have either selected or approved”. According to Mintzberg (1973), one of the main roles of the CEO is to scan information from a large number of sources both within and outside the firms boundaries. Rowe and Struck (1999) argue that individual characteristics determine if the CEO would use CBIS to conduct this form of scanning.

Ozer (2004) argues that the involvement and support from top management is related to product development success, and that the Internet can facilitate this involvement and support through Internet based communication and networking. It is argued that these usage areas can support and enhance an integrated view of the new product development process, and hence lead to shared understandings among team members and top management. This, in turn, is supposed to facilitate communication and coordination, and also to reduce problems and enhance performance.

5.7 The context of the environment

It is also supposed that the firm’s environment can affect the product development processes and activities. Ozer (2004) argues that the collection and use of environmental information is of importance for product development performance, and that the Internet can facilitate in the understanding of the environment through both making information collection possible, and by creating a structure for the information acquired.

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4 The term ‘external’ will be used in this thesis with the notion that it refers to parts of the firm’s environment.
Ozer (2004) further argues that the Internet can enhance market potential in three ways: 1) through the collection and use of information, which leads to a better understanding of markets and enhanced decision making. 2) facilitating activities aimed at expanding and reaching markets which otherwise would be impossible due to geographical or financial factors. 3) facilitating word-of-mouth communication.

5.7.1 The nature of the market

As held true for the nature of the product and the nature of the technology, the nature of market can also be categorized into a dimension of newness. Balachandra and Friar (1999) argue that this dimension is correlated to market uncertainty for new products. This also implies that information about the market will vary depending on the newness dimension, and that the firm’s activities towards the market varies depending on the newness of the market. Hence, management of product development differs with regard to the nature of the market. On the other hand, marketing synergy refers to the degree of correlation between marketing resources and marketing requirements, which is supposed to be positively correlated to foster new product success. Internet is argued to enhance this synergy through facilitating market research and assist in “reaching hard to reach markets” (Ozer, 2004).

5.8 Summary

This chapter sets out to capture various connections between CBIS and product development in small firms, and starts by describing the currents in CBIS literature. Three currents are revealed, and two of them are important for this licentiate thesis: adoption and influences of CBIS on the firm and the firm’s activities. Because of this, this chapter includes a short introductory review of the literature about why small firms adopt CBIS. However, this type of literature discusses CBIS adoption as a phenomenon where adoption is based on characteristics that are stable and are not depending on situational factors. Another approach for understanding why CBIS is used (adopted for a task) concerns the selections of the media based on situational aspects. As a response to this, media selection theories are reviewed. Thereafter, literature concerning the described usage areas of CBIS for product development is discussed. The unilateral usage of CBIS for product development is compared to fields of literature such as scanning, and the multilateral use of CBIS for product development is compared to collaborative product development. Examples of literature that could be of use for understanding contextual perspectives (product development, the firm, and the environment) on CBIS usage for product development end the chapter.
In this chapter the empirical material from Shelving Systems, Inc. will be presented. First, an introduction to the firm and the firm’s strategy will take place. Thereafter, selected product development processes will be presented. Information regarding the case is located in the chapter about research methods.

6.1 A background to Shelving Systems, Inc.

Before 1989, Shelving Systems, Inc. produced shelves mainly by hand, which were exported to Norway. The firm went bankrupt but the municipality funded a restart. Matt was asked to take over the firm when it was getting close to a second bankruptcy. Despite municipality aide through both financial support and machinery, long production times caused Matt, after a month as a CEO, to declare bankruptcy. The firm, in its present form, started in 1989, when Matt came up with a solution to the long production times and bought the remains from the bankruptcy administrator. He and one employee, while figuring out how to start up the firm again, worked with serving ships. Meanwhile, they started to construct a machine that made it possible to automatically glue shelves. This new machine made it possible to produce more shelving systems with two and a half employees then was possible with fifteen employees earlier. Matt regarded this necessary in order to keep production running. The products did not change, except for some small necessary adjustments, and in order to be cost efficient.

We tried to adjust the products to the most common lengths of plank in order to eliminate waste material, and we also made investments in packaging machines that the firm didn’t have before, ordinary plastic bags were used.

Thereafter, the production has steadily increased. During the first year the firm produced 15,000 to 20,000 shelves in two different appearances. At the moment the firm produces about 300,000 shelves in twenty different appearances, and has seven employees. The two shelves that were initially produced are still available, as well as an additional eighteen new sorts. The first couple of years were devoted to constructing the production, where no new products were developed. From 1995 to 1996, new products been developed in order to increase the range of products. The firm has also begun to import some products that cannot be produced within the firm, due to the high costs of production, in order to have a larger supply of products. According to Matt, it is all about keeping costs down as much as
possible. He mentions that the firm has chosen to use a certain wood dimension during the entire process due to the perception that the firm can not compete with firms’ from countries such as Estonia or Latvia. He also mentions that the firm aims to produce products that require as little work as possible, and products which firms from the afore mentioned countries are unable to compete. Shelving Systems, Inc. buys products that are not affordable to produce from a firm in Romania. Matt gives some types of consoles as an example of the products imported:

_The costs for labor in Romania are between seven and ten SEK per hour, which we cannot compete with. It does not Matter how much we want to produce it by ourselves, they are nor worse than we are when it comes to work. It is just impossible. Then it is better that we buy those products, or else we have to manage without them._

The firm provides products to the _do-it-yourself_ markets in Sweden, Norway and Great Britain. The main customers of the firm’s products are nation wide retailers within the countries served, but the firm also serves some small furniture stores within Sweden. Most of the firm’s products go to three big customers, from which two are Swedish and one is English. These three customers are all low price retailers. The firm also sales to smaller furniture stores. According to Matt, the sales to the smaller furniture stores do not generate enough revenue to survive. Matt perceives that the variety in products is necessary due to the different customers; he states that selling one product to all types of customers would be like cannibalism, due to the differences between the types of consumers. He mentions that when the firm sells products to retailers, the price is low. The firm, therefore, has to adjust the quality of the products in order to profit on low-price levels. The firm also serves small furniture stores, and thus can not have higher prices on the same products, or the small furniture stores will turn to the retailers to buy their products. As a consequence, Matt explains, the firm sells one type of shelving system to small furniture stores which can not be compared to the shelving systems that are sold to the retailers.

_I believe that it has to be like this. When we sell a pallet for nearly 5.000 SEK to a retailer for a worth of 100.000 SEK per delivery, then we have to have a difference in the price. And we cannot have a more expensive shelving system either, the competition is so tough that it would not be possible, it is a balancing act._

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5 The meaning with do-it-yourself market is that the product is delivered in modules and put together by the customer. One well-known example of retailer on this market is IKEA, although it is not an actor in this segment.
The firm’s main production is a variety of shelving systems that are produced for a wide range of storage needs. Examples of these systems include, stock shelves and bookshelves in a number of sizes, as well as special shelving for wine storage. In addition to shelving systems, the firm also produces products as flowerboxes and shoe shelves. These latter products are, according to Matt, mainly produced in order to get rid of waste material in the most profitable way possible.

It is the shelving systems that are the main line of production. We do the other in order to make use of the waste material. We can make some flowerboxes in order to get rid of the waste material, instead of selling it as firewood. We should not be doing this but we have to in order to keep the costs down. We try to keep the production of these products down; it should not be too much of this.

6.2 A background to CBIS in Shelving Systems, Inc.

The firm has always used computers. The first computer, according to Matt had a small monitor with green text. The computers used by the firm have improved over time. According to Matt, his sons are responsible for the computerization of the firm. One son is currently working as a computer consultant and the other recently graduated as a computer engineer.

I get a lot of help from my sons. They do always bring parts to the computers with them when they come home. And then they use those parts to build something new of the computers here. I’m never quite sure about what I have.

At present Matt reveals that he is not quite sure about how many computers the firm has. He mentions that the firm has one server in a server room, and one laptop which is used by him and which he brings with home, one stand-alone computer that is mainly used by a person that helps Matt with the bookkeeping. Aside from those, there are computers that serve as spare part machines, which his sons use when they modify the firm’s computers.

Matt uses the laptop to control the server, and he mentions that the laptop is connected to a docking station at the office. At the office the firm has an ADSL connection to the Internet. When Matt brings the laptop with him, he can connect to the firm’s computers from home or with the use of a cell phone. He perceives that this makes it possible to connect to the firm whenever he wants and wherever he is. Matt’s sons can also connect to the server and the computers at the office, which makes it possible for them to assist with matters regarding the firm’s computers.
My sons can from where they live connect to the computers and work on things that need to be done with the computers, so they do not need to come here in order to fix things. And that is incredible good.

The software installed upon the computers works on windows operations system and the firm uses SPCS as the bookkeeping software; they also have software for image editing, electronic mail, and web browsers. Matt explains that he is not quite sure about the other software installed on the computers.

I’m not sure what we have in our computers; we have the ordinary mail and Internet explorer and some stuff like that. We use SPCS everyday with bookkeeping, and for invoices and that kind of things. We also make advertising material and stuff like that, we do a lot of those things ourselves and then we print it on a laser printer.

Besides the internal use of computers, as for book keeping, Matt also mentions that the computers are used for sending and retrieving information and also for communication purposes outside the firm’s boundaries. Matt’s sons also help out for these purposes, by searching for information and assisting the spread of information over the Internet.

We download a lot from Internet, about potential customers and in my opinion it’s vital. We constantly scan for new possibilities for customers and products. I get good help from one of my sons to scan for information. He is phenomenal at searching information about what exist in the world. I feel that it is a good way to get an understanding and a secure feeling. We use computers in order to monitor competitors and customers.

Regarding the use of telephone and electronic mail for communicating with customers, Matt mentions that one of the Swedish customers often calls him over the phone and talks about all kinds of things. He states that this is quite nice and especially considering what large customers they are. However, he states, it is usually preferable to communicate with the use of electronic mail.

The firm also has a website that is accessible in both Swedish and English. The website contains information about the firm, the firm’s products, and also some links to related websites. Matt believes that the website needs to be reworked, and a friend to one of his sons who has just finished a course at the university in web design, has agreed to help the firm improve the website. The firm encourages website visitors to submit ideas for product development projects. Some visitors to the site have contacted the firm because of this. One person contacted the firm
and recommended that they start producing pedestals for flowers. Another person sent pictures from Wales regarding a shelving system that he had bought from the firm. The person from Wales had made a shelving system just like the one he had bought, but in oak, and put it in the living room where all of his furniture is oak. He then sent pictures of the shelving system by electronic mail to the firm. Matt admits that he enjoys this end-customer contact, and that he believes that it both supports the firm’s products, as well as it leads to new ideas on what can be done. He also mentions that he has a lot of contact with end-customers, mainly because many customers call the firm and ask questions about possible products, or modifications to existing products.

The firm also has a private section to the website, which can only be accessed from the firm’s computers. This part contains information on the website’s visitors. Shelving Systems, Inc. registers the IP-addresses of the visitors which can be used to calculate the amount of visitors and from which countries the customers have accessed the website. Matt mentions that this function of the website is especially useful when the firm conducts tests or promotes products. Furthermore, the firm also uses this function of the website in order to reveal if visited trade fairs renders any results in form of increased interest for the firm’s products.

*We have right now sent a shipment to USA and the number of visitors on the website from USA directly increased. It is quite good to use.*

Regarding the use of computers, Matt believes that it is a question about the age of the user. He also believes that the use of computers will increase in the future and be a demand from the customers.

*I believe that it has much to do with the age of the purchaser. If they are over 40 then they want paper brochures that they can feel, but all younger just uses computers. I would rather be without computers, I really want that but we have to use computers.*

Matt has several things he would like to do to improve the firm’s computerization. Besides the website update, he also would like to make use of computers for accounting purposes. The firm also has plans to develop software and hardware that can be used to automatically count the amount and type of products packaged. This is important in order to accurately calculate profitability, and also in order to reveal real time information about profit. The system the firm has today is manual and perceived to be both insufficient and lacking in quality. Matt believes that the computerization of the production, which can reveal real time information about single products, combined with his knowledge about the fixed cost will
result in good material for making decisions about the firm. He also mentions that the profit margin is small enough that it is a necessity to keep track of the firm’s economy.

It is real small differences that make losses or profit, and because of the volumes it happens quite fast.

Regarding how to make use of computers, Matt responds that it is too expensive to hire consultants for all solutions. He perceives that it is important to have access to people the can assist with everything that has to be done.

This requires that you have kids or contacts that can do this. It would not be possible to hire persons to do this. That would be entirely impossible.

6.3 Product development within Shelving Systems, Inc.

The product development activities and processes within the firm is connected to the activities and the production line that the firm has built up. The production that the firm has built up is planned to be as cost efficient as possible, with one type and dimension of wood, and no changes in the production. Matt denotes that cost efficiency is a prerequisite for being competitive. He describes the main idea of this business is that one dimension of one sort of wood is bought and used for production. This means that the products produced by the firm are all to be made of the same type of wood. The competition is perceived to be so tough that the firm cannot use different types of wood and further, the dimensions of the wood used are determined by the available supply of the sawmills. The dimension bought is an output that sawmills cannot easily resale, which makes it possible to buy it at a reasonable price. Furthermore, another advantage of using one type and dimension of wood makes it possible to avoid changes in the production.

We adjust our products, or at least try to, in order to have the same cut lengths because we cannot afford to make any changes in the production. You are gone today if you would have to make changes in the production, at least in our industry.

Matt states the logic behind the firm’s product development stems from the connection between product development activities, the operations, and idea of the firm. The firm’s strategy affects the product development activities and processes within the firm in the sense that the product development activities and processes, as well as the resulting product should fit the thoughts of the business logic, which sometimes conflicts with the needs of the customers.
When I develop products it is mostly that it should be fast to produce, take little raw material and you should be able to take a reasonable price. And this is not always consistent with what the customers want. We have developed some products, which were not possible to sale.

Regarding how product development activities and processes are distributed within the firm, Matt describes the close connections within the firm and between the hierarchical levels. He also mentions that everything is conducted together at the firm, and that there is a helpful spirit among the workers.

Everyone realizes that this is of importance to stay in business.

Among the employees, there are possibilities to find competence areas suitable for solving technical problems, and for the production of the firm’s products. For example, one of the employees can weld, and Matt is educated as a sea-engineer. The firm’s employees are described as a close-knit group where everyone helps if there are any problems. The workgroup has been the same since the start of the firm, with a few extra workers as needed. The firm does not even have a list for absence. Furthermore, everyone is involved in discussions and planning. Matt express that he feels like one of the group since he works a lot in production. Regarding his role in product development activities and processes, Matt states that he handles contact with the customers, and that he makes the final decisions.

One of the strengths of being a small firm is the constant contact with the production. Because I’m working most of my time in the production, there should not be any troubles with people making wrong. ... We are all involved in the development of new products. However, I have all contacts with the customers. And I have the last word regarding decisions about the development projects.

Regarding product development activities and processes, Matt mentions that the firm produced two sorts of shelving systems when they started and are now producing about twenty different shelving systems. The reason for extending the supply of products is that the customers have asked for shelving systems with other requirements than those produced as well as the threat of cannibalism described earlier. From the start, the shelving systems all had a depth of 35 centimetres. Retailers demanded less depth in the shelving systems in order to decrease the price. Another customer group wanted deeper shelving systems that could be used, for instance, in basement storage. All development projects conducted were based on the shelving systems that the firm originally produced.
Some adjustments, mainly in depth and height, were performed on the original products. Although some of the development projects started due to customers contacts, and others started on initiative of the firm, one product is, however, separated from this reasoning. The shelving system to an English retailer was something entirely new.

*The product to the English retailer is the last that we have developed. The shelving system for the English retailer is something entirely new, a totally different construction. The others are quite similar.*

The firm has not had any construction problems with new products. The reason for this is believed to be due to the production not changing with the products. Product development processes within Shelving Systems, Inc. are based on the production technology, and adjustments are made in order to be able to produce the final product with the existing technology. Since the firm only produces products in one type and dimension of raw material it creates only small differences for what the firm produces. This is a requirement believed necessary in order for the firm to be competitive. Matt believes that this makes it possible to keep waste material at a minimum. Furthermore, to use two or more types of wood is perceived to only create complexity and confusion.

*It ends up in very little waste because we do everything in the same dimensions and of the same raw material. There are a lot of products to develop from this dimension. If we would extend our production to two sorts of wood it would create confusion. We will continue like this and that was the main idea from the beginning. Design issues don’t have to be that tricky either when we just use one material, pine.*

As to the protection of the products developed; no products have been patented. The reason for this is the perception that not even a patent could assure that no one else starts to produce the product. Matt mentions that the firm could not afford to hire a lawyer and go to court. Furthermore, the firm’s competitors are so large that the firm cannot afford to start a war because of a product. The risk of losing a product does not scare Matt that much. He mentions that it is quite difficult to start up a production of their products and that possible new competitors will face the same problems that Shelving Systems, Inc. have already gone through, leaving Shelving Systems, Inc. one step ahead. Instead, the products have to be produced as efficiently as possible, so that no one else can produce them more efficiently. Matt remarks:
We have not tried to patent any of our products. For us it is about to produce the products in a so efficient way that no one else can do it. If any one else starts to produce the same products we cannot do anything about it. ... It is better to produce as long as it is possible. If the products were more advanced then it would perhaps be a different thing, but this kind of products it is no sense. It is just to keep producing as long as it is working.

6.4 An illustration of a product development process of a shelving system

The product development process of a shelving system to an English retailer is the only product that the firm has developed together with another firm, in this case together with the customer. The background to the product development process is a troublesome customer relation, where the customer was late with payments. The firm produced enormous amounts of products to a retailer, two trailers a week were sent, and the customer was constantly late with the payments. Matt was starting to feel worried when payments were delayed for 90 days, and he spoke to the retailer and mentioned that he was worried to end up in bankruptcy. Contact with the retailer was troublesome. Matt had a hard time trying to reach the people that he wanted to speak to, and those responsible maintained that the payments would be taken care of. The problem, however, remained and he finally had to end the cooperation with the retailer.

Every shipment is about 200,000 SEK, which is 400,000 SEK a week. After 90 days you are not left in the game. It is just to realize that, and then it is better to quit. It ended with that we told them that we wouldn’t deliver anymore.

In order to replace the troublesome customer Matt began to look for alternative customers for the product. He says that he always is “on the hunt for new customers”. About four years ago, contact was made with another large English retailer. Matt visited the retailer in 1999 in order to present Shelving Systems, Inc. and their products. The meeting took about half an hour to forty-five minutes and the meeting did not render in anything for Shelving System, Inc. Later, Matt met with the retailer at a trade fair. After several exchanges, the English retailer turned to Shelving Systems, Inc. and asked whether the firm could develop a shelving system.

This product development project happened because I have chased them, called them and sent brochures and stuff like that. Most commonly, I spook to purchasers, and then two years ago they came to us with a proposition. We have delivered to them for one year now and it probably took about a
year before we arrived to an agreement that we should produce this shelving system to them. There were a lot of turns during the development of this product.

The product development process of the shelving system to the English retailer was initiated by the customer who had an idea for the product. Representatives for the English retailer visited Shelving Systems, Inc. and presented an idea for a product and clarified the demands that the product had to fulfil.

They visited us and had an idea about the product, but they had not thought about a design or something like that. Because we have that much experience with these kinds of products we saw what we could do of this.

The English retailer, beyond the functional demands, had no thoughts about how the product could be designed. The demands from the English retailer suited production technology for Shelving Systems, Inc. The dimensions of the raw material were the same as for the other products. Based on the experience within Shelving System, Inc. a prototype of the product was constructed by hand during the visit. The representatives from the English retailer consented to the design solution.

They arrived from England and we made this shelving system. We have never done anything like that earlier. But the dimensions and everything was correct for us. They arrived with an idea that they wanted a shelving system that they had some demands on ... We arrived to the idea how to produce the product at once and then we made a prototype by hand and the person that visited us from the English retailer was satisfied with that one.

The demands that the English retailer had on the product regarded environmental consideration, product quality, and functionality. The most important demand was that the firm had to use FSC wood (FSC is a standard for environmental consideration). Regarding product quality demands, the English retailer demanded that the product should have the highest quality among the low price products, which forced the firm to increase the quality of raw material and to develop routines for quality checks. Functionality demands with regard to the loading weight that the shelving system could withstand was also a consideration.

That meant that we had to increase the quality of our raw material in order to meet that demand and we also had to develop routines for checking for holes from twigs. No twigs can be larger than 20 millimetres and black twig has to be less than 15 millimetres. We have never had anything like
this before. Another demand was that the shelving system could be loaded with at least 50 kg per shelf. We tested it with a total of 450 kg and then we didn’t have place to put anything else on the shelving system, because it was fully loaded. The shelving system met all demands and the tests we made.

When the prototype of the product was developed, the firm had to make sure that the product could be delivered to the customer. A number of products were loaded onto pallets in order to see if they fit the pallets, and that they would fit in the English retailers stock. All steps in packaging were tested and documented with a digital camera. Pictures were sent to the English retailer in order to show the customer how Shelving Systems, Inc. were about to solve the problem of packaging and delivery of the product. The pictures included images of how the loading was conducted, and what types of pallets were used, as the pallets normally used by the firm, europallets, are not accepted in England. The digital camera was considered to be very useful, according to Matt. Pictures were sent step by step in order to show the customer how the project was to be carried through. The customer approved the plans through electronic mail, which was archived. Matt clarifies that it is good to have these correspondences stored since they could be used in order to document the customer what has been agreed upon. He also mentioned that he photographs the content and the loading of the trailer in order to have evidence that Shelving Systems, Inc. has fulfilled their duties.

It is lucky that the digital camera has been invented because now we could send pictures all the time. Otherwise we have had to try to send the products, but it had ended in that they had been returned with comments that we have to remake them. We solved most of the issues together with the customer, from layout to deliverance, but even brochures we made together. That is not common for us.

The digital camera is considered necessity that the firm not could do without. When the firm is about to order spare parts, they usually take a photo if there is any uncertainty about the spare part to send with the order. If the firm had to do this without the aide of the digital camera, Matt express that he would have to make sketches instead, which is more time consuming. Furthermore, the use of the digital camera also has implications for the receiver of the photo, according to Matt. He states that if the receiver can see a picture instead of a sketch, it would result in less uncertainty. Therefore, everything is photographed and a copy of all documents and pictures are kept in a folder on the machine, in order to secure against miscommunication.
The digital camera is a necessity; we cannot make it without the camera.

When the development of the prototype was finished, a price indication was calculated and discussed with the customer. The customer did agree to both the price and the prototype, although the customer stated that they would renegotiate the price once a year.

Matt signed a contract with the English retailer that implied that the retailer is not required to buy anything from Shelving Systems, Inc., but that Shelving Systems, Inc. has to deliver to the English retailer. The contract is based on the retailers conditions, and Matt mentioned that he had to fill out a fifty-page contract, with demands from the retailer. It was tremendous work to handle the administrative part of the collaboration in the product development process, according to Matt. He further mentions that even though he fulfilled these routines, it was not certain that the retailer would buy anything. The completion of this procedure was necessary in order to present the product for the customer.

It is a lot of routines with this, and it was not even sure that they would buy anything. This procedure has to be done just in order to present the product for them.

There are both advantages and disadvantages with using mail, Matt mentions. He states that when using electronic mail everything is put in black and white, and it is not possible to wriggle out of what has been communicated. When using the telephone, on the other hand, it is always possible to modify what has been communicated earlier. This, of course, goes both ways. It could be an advantage if Shelving Systems, Inc. receives all information through electronic mail, but it can also be a disadvantage to send all information through electronic mail. Some of the personal contact is perceived to be lost when using electronic mail, but at the same time it is impossible to reach people all the time by telephone.

Mail is unbeatable because then they at least answers. You know, it is impossible to keep calling a person just in order to speak with them.

When all demands were fulfilled the English retailer bought the product. At this time the production technology had to be updated in Shelving Systems, Inc. Due to the production demands, a new machine needed to be constructed. This constituted the big problem during the product development process. Matt explains that the old machine worked with chains that feed the boards forward, which was not an alternative with the new machine, since the boards had to be kept together. A quite different solution was needed. There were several ideas
about how the machine could be designed. Most of the design and building concerns were solved within the firm, since the machine does not exist anywhere else, and one of the employees was heavily involved in the construction of the machine. The firm did not want to make the production technique that is used for gluing and producing shelves public. Matt remembers making that mistake once by showing one large Swedish firm how Shelving Systems, Inc. was packaging their products. After six months Shelving Systems, Inc. started to lose customers in England. It was then realized that the large Swedish firm was producing and selling a shelving system that was exactly the same as the one from Shelving Systems, Inc., and with the exception of the altered logotype, even their brochure were the same. Shelving Systems, Inc. was not able to compete with this firm, as they had 30% lower prices. Due to this, a customer was lost; a loss that took long time to work in.

The English retailer made an oral commitment that they would not look for the product anywhere else, as long as Shelving Systems, Inc. handles their production and deliverers in a satisfactory manner. Furthermore, the process of changing a supplier is costly for the customer, This is viewed as an advantage by Matt, and he has been told that the exchange approximates costs of one million SEK, with all the work.

*It is an advantage that things are a bit complicated. And they acquired credit reports and, well they checked for most things.*

The customer required a large amount of information about the product. They requested measures of the weight of the plastics for the packaging per shelving system, and also the weight of the one page product brochure. According to Matt, this information is easy to forget to include as it easy not to realize that the customer may need such detailed information about the product.

Matt further explains the reasons for the comprehensive routines. He states that there are a lot of things that have to be considered in the development of the product, besides the product. He also remarks that it is especially complicated when dealing with large firms, because they buy products from around the world. Their background check of the firm for example, was more thorough than Matt could ever have imagined. He had to prove that there were no child workers, that the personal had the right to drink water, and that the personal had the right to a room for drinking coffee and resting. Matt states that he is not used to these kinds of problems since they are not common for Swedish firms’, and that it was a tremendous amount of work to fill in all the paper work; although he acknowledges the point and the importance of the questions.
The documents that we had to fill out are about 50 pages with demands from the retailer and it is a lot of job to work through this.

A representative for the English retailer made a second visit to Shelving Systems, Inc. in order to make an environmental inspection of the firm. Approval at this inspection, was another prerequisite in order for the firm to be allowed to deliver the products. A thorough check of the firm resulted in that Shelving Systems, Inc. was approved as a supplier. The inspection included a check that the firm could deliver, that the work environment was acceptable, and that routines were functioning. The personal aspect was considered very important. Besides the visit, a number of forms had to be filled out, regarding environmental issues.

The contact with the English retailer is mentioned to be very good. Shelving Systems, Inc. has certain personnel that they can contact for transports, and purchasers. Matt mentions that contact people are necessary. His experience from the previous retailer proved that if it is impossible to reach people, then it was impossible to discuss topics related to the business conducted between the firms.

*Our experience from the retailer before, the one we stopped our deliveries to, was that it was similar to give them a call as what it is to call the county administration, you don’t get anywhere. The English retailer we are producing for right now is probably one of the best retailers we have had; because they really want that our cooperation should work and this is not always the case. We have a lot of experience from retailers that just focuses on the price, and only buy from the cheapest supplier.*

With the exception of a few meetings with representatives from the customer, all communication has been handled through electronic mail. When Matt grew more familiar with the customer, and the contact people, he has begun to use the telephone to some extent. However, from the beginning he felt like he should only provide the information that was expected, and for this electronic mail was perceived to be preferable.

*As we have been more familiar with the firm and our contact person we have started to use the phone to some extant, it happens sometimes that we call them. But from the beginning it was more of that we felt that we just should send the information that they expected, and for that electronic mail was more preferable.*

Shelving Systems, Inc. has admitted to only producing the shelving system for one customer. And during the product development they did not have any contacts with other firms besides those with the customer. Matt believes that it took a
couple of months between the time that the firm had delivered the prototype for the product to the English retailer until the production of the product started.

Regarding the production of these products, it has been expressed as important that the products are not mixed up, and the wrong products are shipped to England. It would be a disaster if wrong pallet would be shipped, Matt expresses. The customer has demanded that the products should be kept separated from the rest of the products and that the firm should have warning signs in both English and Swedish. The firm has not done anything about this yet, although they plan to as it is a customer demand. In order to separate the different types of wood the firm levels four round edges on the FSC wood, and has also altered the dimensions of the wood used for the production. According to Matt, this makes it almost impossible to mix up the different wood types, and hence products.

Furthermore, the English retailer has been promised the right to visit the firm and control the production of their product, almost anytime during the year, only four days of the year are excepted from the customers right to visit.

There were some discussions within the firm about how the quality checks should be conducted. The discussions resulted in that everyone check in on each other, and that everyone must be aware of the next step in production. The raw material is checked at delivery for moisture, dimensions and that it is correct for the shelving system to be produced.

Matt uses his laptop in order to search for product specific information on the retailers’ websites. He states that most retailers present their products on the Internet along with prices and most product information, which is perceived to be highly important and useful. Matt perceives the price information to be the most important, but that also product quality and similar information is of value. He mentions that this has to be known in order to be able to keep up with market standards. Matt mentions that what he knows about the English retailer’s product is that competing firms have lower prices, but that they don’t have the same quality, which he perceives to be right for the product.

That’s the good thing about this, that the shelving system is not comparable with the low price shelves, the customer does not buy the same thing.

The costs for the product development process has been calculated to about one hundred thousand SEK. This does, however, include the costs for tests, shipments and travel, but not the costs for work. Matt states that he is surprised about the high costs, as a lot was given early in the product development process. Although, he mentions that he has kept track and that the figure is correct.
Today the firm ships its products once a week to the English retailer, about 1,500 to 1,800 units of the shelving systems. The production of shelving systems to the English retailer is about 30-40% of the firm’s production, and is planned to be increased to about 50% in the future, which approximates four million SEK in turnover.

And now they are buying this product and it works really good, we haven’t had a single complain on any of the set of shelves that we have delivered, and we have probably sent more than 100,000 of them, that are probably not enough I am certain that we have sent more than that.

The firm is connected to the customer through a computer system. Through this, Matt can view when the customer sells a shelving system, and in which store it has been sold. Matt had the choice to get this information from his cell phone via SMS whenever a shelving system is sold, which he has difficulties viewing as useful. The connection with the customer’s computer system is described as a cash register. There are specific codes for each store and product, which makes it possible to follow every single product as it goes through the retailer’s system. Matt can view all this information from home, and he believes that this will be of importance in the future. According to Matt, the relationship becomes simpler through this connection and he believes that in the long run there will not be a need to talk with the customer anymore, which is assumed to be what the customer strives for. The customer regards all of their suppliers like they were a part of their group, and they put the same demands on their suppliers as they put on their own stores. Matt mentions that if the English retailer did not have this computer system, they would need a person that travels around between the suppliers inspecting new customers and negotiating prices on products.

Matt can see directly how his sales are and, according to a conversation he recently had, it is probable that the customer will extend their work with the computer system. The plan is that the customer should be able to demand a quantity of products that should be in stock in stores, and thereafter it is the suppliers’ responsibility to make sure that this quantity always is intact, the customer will no longer send orders for products.

We have to take care of their routines as well, and damn you if you don’t have the right number of shelves in England, they can monitor every single store and also the main stock. This solution is made in order for them to not have to do this.
The English retailer will change their routines for payments in the future; they will pay continuously after the deliveries. This will lead to the suppliers getting the costs and work rather than the retailer. Matt states that he also sees advantages with this, since it means that the customer affiliates with their suppliers. He mentions that it makes it harder for the customer to change suppliers, and that it requires that the retailers’ suppliers are connected to the Internet. According to Matt, a lot of small firms do not have computer hardware that is required to be connected in this way.

*But it is quite interesting; I believe that this will be the reality for many firms in the future. For instance, if I had to have five hundred to one thousand shelves in England and then it is my problem to make sure that everything is functioning, they don’t give a damn. Then they have some automatic routines that signal to me when I get below five hundred. I believe that this is our future. This is quite advanced.*

### 6.5 An illustration of product development processes from waste material

In addition to the product development activities and processes directed towards shelving systems, Shelving Systems, Inc. also develops products based on the waste material from the production. The shelving systems constitute the main production for the firm, but the firm also has other products that mainly are produced in order to make use of the waste material. The firm produces, among other things, a number of flower boxes in order to get rid of waste material, rather than throwing it away or selling it as wood. Matt mentions that the products based on waste material should not be produced by the firm, but that the firm is almost forced to produce these products in order to not have unnecessary costs. It is viewed rather, that the waste material forces the firm to develop new products, in order to increase profitability.

Product development processes based on refining waste material were started when the firm had customers and production running. Matt felt that he had the time and the resources necessary to focus on matters like these at that time.

*We started the development projects that are based on waste material when we had our customers and production up and running, at that time we got some time and resources to focus on these matters.*

The machines available limited the possibilities for what could be developed. The decision to start a product development process with waste material must consider what can be produced, along with how the production can fit the firm’s existing production.
It is the machines that have limited the development, I have had my thoughts on what we can produce but I always have to consider how we can produce it.

Matt reveals that the Internet has been a tool of inspiration that can be used in order to find ideas for products that can be created from waste material. In order to find potential products that can be produced from the waste material, the firm uses the big warehouses websites. If a product is found that is possible to produce, it is adjusted to fit the production of the firm. According to Matt, this is a good way to get ideas for potential products.

Internet has been an inspiration tool, you can find almost anything if you know where to look. I do often look at the big warehouses websites but there are some other places as well. If I find something of interest I make some adjustments in order to make it fit our production. I believe that this is a good way to get ideas for what to produce.

The alternative to using the Internet for gathering ideas about potential products would be to hire a designer. Although, Matt mentions that the firm is too small to afford such investments. Furthermore, the firm does not have the time necessary to work with a designer in these projects.

An alternative to this would be if we used a designer, but we are too small to afford that. And we do not have the time to have a designer on these kinds of projects, because it is quite expensive.

6.6 An illustration of a product development process of a wall shelf

The firm has recently conducted a product development process that was less successful. The product development process regards the development of a wall shelf, which was conducted as a part of the firm’s products that are developed from production waste. Matt had high beliefs in the product, which was constructed based on functionality. The product included two consoles and one shelf. The two consoles were large enough that they also served as bookends. Besides the functionality Matt also believed in the product for its ease of assembly. All that was needed was to attach the two consoles into the wall, with one screw in each, and then slide the shelf into the consoles.

We developed wall shelves and I thought that they were damn clever. You have two consoles that you attach to the wall with one screw in each, and then you just slide the shelf into the consoles.
Matt believed that the idea for the wall shelf, and the functionality that could be incorporated into the product, would add value to the product. He felt that the product could be produced using the existing technology and that it could support the firm’s profitability. He felt confident in producing the product and in testing a launch of the product.

*I thought that a shelf like this should have some bookend and this construction would give the customer bookend for free because of the consoles that has that function.*

The firm has earlier experience from launching products similar to this one. When a product is to be launched, it is sent to a customer asking for an opinion whether the product could be sold or not. If the customer response is that the product is possible to sell, the answer also includes a price indication. Normally, the product is sent to one of the Swedish retailers that is a customer to the firm and has a store not far from the firm. In the case of the wall shelf, the product was not launched as usual. Instead of sending it to one customer for a test, a series of one hundred exemplars of the product was produced.

*We made, I have to insure you that I am very surprised because we probably made one hundred exemplars, but they were not possible to sell, completely ridicules. No one of our customers wanted to buy the product.*

Shelving Systems, Inc. tried to launch the product through packaging it on pallets when the customers ordered other products. In this way, the product was launched to several of the firm’s customers. No one was interested in buying the product

*We tried to market these products through packaging on the pallets when our customers ordered set of shelves, and it went perfect to package these on the pallets. But no one wanted the product.*

The response to the low interest for the product was a price dump, but it was still not possible to sell the product. The product development process ended with the test series of the exemplars being burnt. However, Matt has been trying to figure out whether the product can be improved with stronger and bigger consoles, in order to try a new launch the product. He believes that if one of the big retailers had had a fare on the wall shelf, the product would have been possible to sell.

*This constitutes a set of shelves, but it did not work. I ended in that we had to burn them. I do not believe that there is anything wrong with this. We tried to sell them for 20 SEK, but it did not work. We made a lot of these*
and thought that there would not be a problem to sell them. It did not work at all. We are thinking about to try again but with stronger and bigger consoles.

The reflections of the results of the product development process are directed towards the market connection. The connection with the market is considered one of the most important parts of product development processes and, as Matt expresses it, a common mistake is to not control for the market during product development.

Marketing is an important part of product development for us. It is almost the most important part. I believe that a common mistake is to look on to what you believe in without controlling that there is a market for the product. It is not that certain that others believe in or believe that it is a good product and that is the hard part. We have great use of all our contacts, we often send out small series to our customers in order to try to sell a new product.

6.7 Summary

In the beginning of this chapter, the history of Shelving Systems, Inc is presented, concerning products, technology and market. Thereafter the CBIS resources and history of CBIS usage and resources are described. This is followed by a general discussion about product development processes in Shelving Systems, Inc., which aims to describe the firm’s product portfolio and also to position the product development processes to the firm’s supply of products.

The first product development process reviewed concerns the development of a shelving system together with the customer, an English retailer. This product development process was realized due to an inquiry from a potential customer. The product development process was largely customer-based and included the use of CBIS for communication, and for gathering and exchanging information.

The second product development process reviewed deals with developmental activities concerning refining waste material. In order to increase the total profitability of the firm, the choice was made to develop products using the waste material as input in the product development process. The case indicates that the conditions for product development activities and ideas regarding refinement of waste material do not admit for changing technologies. In fact, prerequisites for the development of these products are that they should be able to produce, using the existing technology. The ideas for products are clearly defined and the CEO mentions that he unilaterally uses CBIS for information gathering about potential product ideas from retailer’s (i.e. customer’s) websites.
The final product development process reviewed concerns the development of a wall shelf. The origin for this product was a product idea that the CEO of the firm had, and based on functionality advantages, the product was perceived to be able to introduce. However, the market reaction to the product was unexpected. Not a single entity of the shipped products was sold, and large parts of the stock were burned. The reflection from the CEO was that the connection to the market was insufficient during the product development process.
7. WITHIN-CASE ANALYSIS OF SHELVING SYSTEMS, INC.

The empirical description of Shelving Systems, Inc. contains information about the firm background (history, firm and product strategies, and CBIS resources and experiences) as well as information regarding the three product development processes that have been conducted. One product development process focuses on the main products sold by the firm (shelving systems) and the other two focuses on products that are developed from waste material, as a way of increasing the firm’s profitability. In this chapter, analyses of the use of CBIS for the product development process described will be presented, especially with focus on how and why Shelving Systems, Inc. has used CBIS for product development activities and processes. Furthermore, the influence of the use of CBIS in the product development activities and processes will be analyzed.

7.1 CBIS on a firm level

In order to understand why some small firms use CBIS for product development, how this usage is exercised, and the influences it might have for product development, a good point of departure is to ask why small firms adopt CBIS and what resources the adoption generates. CBIS adoption and CBIS resources seem to be a platform for the use of CBIS, admitting the use of CBIS for product development, and hence to influence product development activities within the firm. The following sections will analyze and describe the reasons for CBIS adoption and possessed CBIS resources in Shelving Systems, Inc.

7.1.1 Adoption of CBIS

The reasons for Shelving Systems, Inc. adopting CBIS seem to influence the use of CBIS, and hence the influence CBIS has on product development activities and processes. There are mainly three reasons that constitute the base for Shelving Systems, Inc. adopting CBIS

1) Adoption is based on a perceived necessity of CBIS, which is evident when the firm has to use computers and Matt would rather do without them. Even though Matt mentions that he would like to work without computers, he states that he nevertheless believes that the use of computers will increase in the future and that it will also be a demand from customers. This belief has ensured Matt that the use of CBIS is important for the firm.
2) Adoption is based on perceived firm benefits. Matt mentions that he plans to improve the firm’s computerization, and that the usage of computers will increase. He mentions that the firm plans to develop software and assemble hardware that can be used for accounting purposes through automatic count of amounts and types of products packaged. This is done since it is perceived to improve the business processes of accounting within the firm. Furthermore, Matt mentions that many small firms do not utilize CBIS, which he perceives to be increasingly important, constituting a competitive advantage for the firm in the future. The adoption of CBIS hardware and software seems therefore to be influenced by the perception about possible advantages that CBIS can entail for business processes.

3) Adoption is based on accessed CBIS competence. According to Matt, the use of CBIS within Shelving Systems, Inc. is largely due to the influence from his two sons, who have schooling and work experience in computer science. Regarding the adoption of hardware resources, Matt mentions that his sons are responsible for the computers the firm use and that they have spare part machines that they use together with parts that they bring with them in order to extend the hardware resources of the firm. Matt’s sons are also responsible for the adoption of software resources to a large extent, they can access and modify the firm’s software from their homes and one of them has also introduced Matt to a friend that can help with the reworking of the firm’s website. The accessed experience is not only necessary for the adoption of hardware and software resources, but also for the maintenance of them. Matt’s sons can connect to the firm’s server in order to maintain and further develop the software resources, and on their visits they maintain and further develop the hardware resources, which leads to a higher adoption rate. Hence, the access to CBIS experience seems to be of great importance for understanding the adoption of CBIS within Shelving Systems, Inc. The accessed experience could be retrieved from computer consultants as well. However, Matt remarks that it would not be possible to hire consultants for all solutions since it is too costly. According to Matt, this is not even an option for a small firm, thus illustrating that the accessed CBIS competence is evaluated based on a cost benefit analysis.

Moreover, the adoption of CBIS is not to be viewed as a dichotomous phenomenon, but rather as a continuous process of CBIS hardware and software resource acquisition. Shelving Systems, Inc. has had computers since the start, which have been updated and are planned to be further updated in the future. Matt mentions that the first computer had a small monitor with green text. Although CBIS existed in the firm at the start, the adoption processes have increased the CBIS resources amount in terms of both hardware and software resources. It is thus possible to view adoption as a continuous process.
7.1.2 CBIS Resources

The outcome of CBIS adoption is the CBIS resources possessed by the firm. These resources can further be divided into hardware resources and software resources. Hardware resources constitute a base for the operations which can be conducted with CBIS, and which CBIS software resources that can be used. The firm has one server, one laptop, and one stationary computer. Furthermore, the firm has computers that serve as spare part machines. Finally, the firm has also equipment that supports the I/O functions of the computers, as, for instance, a laser printer. In the office, the firm has an ADSL connection to the Internet, which makes it possible for Matt and his sons to connect to the firm’s server and computers. The software resources possessed by the firm are working on Windows operating system and include bookkeeping software, image editing, mail, and web browsers.

Matt mentions that the firm has highly developed CBIS resources in relation to other equally sized firms in the same industry. In the empirical description of the product development process of a shelving system, Matt mentions that many small firms need to have CBIS in the future because it is a demand from customers. Matt also mentions that the connection to the customer’s computer system strengthens the relation between the firms and makes it harder for the customer to change supplier. The CBIS resources and competence can thus be viewed as a part of the firm’s competitive advantage.

7.2 Use of CBIS

How does Shelving Systems, Inc. use its possessed CBIS resources? First, the CBIS hardware and software resources possessed are used for a number of activities and processes within the firm. The firm uses CBIS resources to capture, transmit, store, retrieve, manipulate, and display information, and for communication with parties outside firm boundaries. In order to understand the connections between CBIS usage and product development in the small firm, this section will describe the use of CBIS in the product development activities of Shelving Systems, Inc. Furthermore, this section will compare the usage of CBIS in the different product development processes.
7.2.1 The product development process of a shelving system

There are four areas of CBIS usage in the product development process of a shelving system to an English retailer.

First of all, communication with the customer has mostly been handled through electronic mail. In the contact with the customer—the English retailer—electronic mail was preferred as the means of communicating. Besides from a few meetings, almost all communication has been made via this medium. One reason for this was that electronic mail was more preferable in the beginning of the relation since it admitted for the information that was expected to be provided. When Matt grew more familiar with the customer and their contact persons the telephone was used to some extent. Therefore, it seems as if a socialization process influenced the choice of media in the business relation. Another reason why CBIS is preferred as a communication medium is that it renders possibilities for synchronous communication. The use of the telephone requires the simultaneous presence of the person communicated with. It was then perceived as impossible to reach people when needed, and therefore electronic mail was perceived to be the superior form of communication. A further reason for the selection of electronic mail in the relation with the customer is that this medium has the possibility to store information without distortion. This, because it is impossible to ignore or dismiss what has been communicated when using electronic mail, compared to a telephone conversation. This is considered to be both an advantage and a disadvantage depending on the direction of the communication. It seems that the media selection for communication with the customer depends on the socialization process, where a form of communication is used that suits the level of familiarity with the customer. Furthermore, the media selection seems also to depend on the accessibility of the contact person. Finally, it depends on the perception of whether information can be allowed to be stored.

Secondly, a digital camera has been used in order to communicate visualizations of problem solving activities in the product development process. The digital camera is perceived as a necessity the firm cannot do without. There are two empirical examples of how Shelving Systems, Inc. has used the digital camera for the product development of a shelving system. One concerns the communication with the customer; after the prototype was developed routines for packaging and shipments had to be worked out. In order to make sure that the products could be delivered to the customer, all steps of the packaging process were photographed with a digital camera. The pictures were sent to the customer, illustrating step by step the planned solutions for the packaging and shipment. The customer gave
their approval via electronic mail, which were all archived since they could be used in order to show the customer later what had been agreed upon. Photographs were also taken of the content and loading on the trailer that freighted the products in order to prove that Shelving Systems, Inc. had fulfilled their obligations. The other empirical example of the use of a digital camera for visualization concerns suppliers of machine parts. The firm takes a digital photo of spare parts when there are uncertainties, and sends this together with an order. The perceived alternative to this would be to make and send a sketch of the part. The use of the digital camera creates less uncertainty about what has been ordered, and through keeping the order and digital photo the communication has been documented, which, in turn, ensures that misunderstandings and conflicts can be avoided.

Thirdly, there are scanning activities with the use of Internet to meet customer demands. During the product development process Shelving Systems, Inc. gathered market information with the use of CBIS in order to make certain that customer demands were met regarding the positioning of the product on the market. Scanning activities were directed to the retailers’ websites gave information about competing products, and reassured Matt that the firm would market the product as having the highest quality among the low price products. The information Matt revealed from the scanning activities reassured him that the product was correctly positioned and that there were no products that could be regarded as directly competing.

Finally, the firm is connected to the customer’s computer system, which enables the firm to trace the status and the location of the products in the customer’s stores, including when and where products are sold. The connection enables Shelving Systems, Inc. to view information from the firm’s computers, and it is also possible to retrieve this information in the form of SMS messages to a cell phone, but this was not considered useful. The influence of the connection to the customer’s computer system was perceived to make the relation simpler, and in the end it might exclude the need to communicate in person altogether. It was assumed that the customer strives for this, and that it is possible since the customer regards their suppliers as part of their group. From the customer’s perspective this computer system can rationalize the need of administrative personnel, through handling issues through the computer system instead of through personal contact. The customer plans to expand their computer system to include order procedures. Based on information from the computer system, suppliers can keep a specified amount of products in the stock. This solution forces the suppliers to take care of the administrative routines. Similarly, the routines for payment will also be changed as a cause of this, which will imply that
the suppliers will end up with the work costs. A perceived advantage is that the customer through this computer system affiliates to their suppliers, making it harder and more costly to change suppliers. Moreover, this will force the suppliers to be connected to the Internet, and a lot of small firms do not have CBIS resources necessary for this.

7.2.2 The product development process of waste material

In the product development process of waste material the use of CBIS was foremost unilateral, directed towards scanning activities with the aim to recognize opportunities for the development of new products from the raw material used. This is evident in the empirical material that this type of scanning activity renders information about products that have market acceptance, and that the firm only modifies the products to fit the production. If the firm could not use CBIS scanning activities for opportunity recognition, the alternative would be to hire a designer. However, the firm is too small to have the time or finances to hire a person for the development of waste material. Hence, the choice to use CBIS for performing scanning activities seems to be based on a cost benefit analysis.

7.2.3 The product development process of a wall shelf

In the product development process of a wall shelf the firm did not use CBIS. In fact, the first contact with outside parties during the product development process occurred when launching the product. External information was not perceived as necessary due to the strong belief in the product.

7.2.4 A comparison of CBIS usage in the product development processes

In the product development process of a shelving system, CBIS was used for communication with the customer through electronic mail and with digital camera. It was furthermore used for the connection to the customer’s computer system, and for scanning for market information. Regarding the product development process of waste material, CBIS was used in order to scan for information regarding opportunity recognition. Finally, in the case of the product development of a wall shelf CBIS was not used. Hence, the use of CBIS differs to a large extent between the various product development processes within Shelving Systems, Inc. In order to receive an answer to why the use and influence of CBIS differ between the different product development activities and processes we need to disentangle the differences in the nature of the usage of CBIS for product development. In the three product development processes described, there are at least two different
groups of CBIS usage: one can be labeled unilateral usage of CBIS, while the other can be labeled multilateral, or relational use of CBIS. Unilateral use of CBIS refers to the use of CBIS for unilateral purposes, which regards the gathering of information or for publishing information. Multilateral or relational use of CBIS refers to the use of CBIS for relational purposes, which concerns communication through the use of CBIS. These two forms of CBIS usage are consistent with the findings of the first study in this licentiate thesis, and the following sections will discuss how and why these uses are carried out and how they might influence the product development.

7.3 How and why CBIS is used for unilateral purposes

This section aims to analyze how the unilateral use of CBIS is exercised in connection to product development activities within Shelving Systems, Inc., and why CBIS is used for unilateral purposes. The unilateral use of CBIS in the development process of a shelving system was a consequence of the fact that the customer had a number of demands on the shelving system developed, and the firm had to gather information in order to meet these demands. Similarly, in the development process of waste material information was perceived as necessary for generating ideas. In contrast, in the development process of a wall shelf all information needed for developing the product was perceived to be possessed in the firm, although market information turned out to be lacking. Furthermore, the website is used as a link between the firm and the market, which makes it possible for the firm to retrieve information about market needs. The website is designed for opportunity recognition through that it encourages visitors to submit ideas for new products. In addition, the website is designed for market tests because it stores information about visitors. Matt mentions that any information provided from this website is regarded as aiding in decision making activities regarding the need to develop new products, or when it comes to determining whether or not to continue with a product promotion.

Accessed CBIS competence is considered to be important also for the unilateral use of CBIS, and Matt indicated that one of his sons has such competence. This assisting unilateral use of CBIS is perceived to be important and helps Matt to feel secure.

In order to understand the influences of CBIS for product development related activities, we need to establish why CBIS is used for unilateral purposes. In sum, the need to acquire information for various types of product development is assumed to influence the use of CBIS. Regarding the issues of product development, Matt maintains that the alternative to use CBIS for opportunity
recognition would be to consult a designer, which would be more costly and time consuming. Regarding the use of CBIS for acquiring market information and competition, Matt reveals that he could find all information that was needed in one place and that this information was updated and that accuracy was important. Regarding the product development process of wall shelf, any outside information was not perceived to be important, wherefore the firm developed the product without any external communication during the process. It is evident that there seems to be some form of choice behind the use of media, and it seems as the attributed value of using a certain medium reveals why the medium is used. Hence, CBIS is used for unilateral purposes in the product development processes when information is perceived to be needed and when there is a perceived value of using CBIS for gathering the information.

7.4 Influence of unilateral use of CBIS on product development

Shelving Systems, Inc. has used CBIS for unilateral purposes for the main scanning activities during the product development of waste material, and also in the product development process of a shelving system. The unilateral usage in these product development processes can be analyzed as having an impact on product development efficiency and effectiveness.

7.4.1 Unilateral use of CBIS to support efficiency in product development

Shelving Systems, Inc. scans with the use of CBIS in order to support the efficiency (to do things right) of the product development process when they develop products from waste material. The product development strategy for developing products from waste material means that the products should be simple and not expensive to develop. In order to achieve these goals the firm uses scanning to support efficiency in the product development process. Through scanning for information about products that can be developed from the waste material the firm perceived that they did not need to spend money on a designer or spend time on generating ideas. Furthermore, the firm thinks that developing products based on the information retrieved from scanning activities makes the product launching more secure. The firm has tried to develop products without market information (see, for instance, the empirical description about the development of a wall shelf), which did not have a positive outcome. The information that the firm considers gained from the scanning is not only design information but also the price of the product and other business related information, which signals to the firm how to launch the product (at what price and quality).
7.4.2 Unilateral use of CBIS to support effectiveness in product development

Scanning with the use of CBIS in order to support the effectiveness (to do the right things) of the product development process are conducted by Shelving Systems, Inc. when they develop products from waste material and in the product development process of a shelving system. Regarding the product development of waste material, the firm mentioned that they use search engines and websites on the Internet in order to discover products that are sold by their competitors or by the retailers, which are the firm’s customers. The reason for scanning is that the information can trigger ideas for new products which, because they are sold, have been proved to function on the market. For instance, Shelving Systems, Inc. also conducted scanning during the development of the shelf. According to the firm, the scanning activities rendered in that the CEO was reassured that the product was correctly positioned in connection to the market. Regarding the product development process of a shelving system, the scanning activities were carried out to reassure the firm that the product could be correctly positioned on the market, which was a customer requirement. In this, the firm gathered information from websites in order to compare the product developed to the existing competition.

7.5 How and why CBIS is used for multilateral purposes

Analysis of how the multilateral use of CBIS is carried out, why CBIS is used for multilateral purposes and what influences the use of CBIS has on product development related activities in Shelving Systems, Inc. are described in this section.

In order for a multilateral use of CBIS for product development a close collaboration with the customer is necessary during the entire product development process. This is made clear in the case of the product development of the shelving system for the English retailer. Regarding the relational use of CBIS in the product development process, there are three types of relational use: 1) electronic mail for communication, 2) the use of a digital camera for visualization, and 3) the connection to the customer’s computer system.

In order to understand why CBIS is used for relational purposes, we have to understand both the media selection activities within the firm and the relation to the firm in communication with. In sum, it can be assumed that the perception of the necessity to communicate with external parties during the product development process influences the use of CBIS. The use of CBIS seems also to be determined through a social process involving influence and power.
Regarding the media selection for communication with external parties the CEO stated that the firm prefers to use electronic mail. Matt mentioned that he likes the more personal contact which is possible when using the telephone, but that he prefers to communicate with the use of electronic mail.

The use of electronic mail was in Shelving Systems, Inc. described as a complementary medium for communication during the product development process, and it seems also to be influenced by the idea of the amount of information needed. Shelving Systems, Inc. is connected to the English retailer’s computer system, and was offered to receive information to the cell phone every time a single product was sold, a service that the CEO of Shelving Systems, Inc. had a hard time to understand the use of.

Furthermore, the CEO regarded electronic mail to be of importance when the exchange of information and communication was considered to be necessary to store. In the Shelving Systems, Inc. product development process of a shelf comments were made pointing to the fact that the use of electronic mail was the preferred means of communication due to the possibilities to store communication. According to Shelving Systems, Inc., the stored communication could be used if the customer changed his or her mind on previously agreed upon steps in the product development process. Following this line of reasoning, the use of CBIS (through electronic mail) for communication in collaborative product development can be viewed as a documentation of agreements in the product development process.

Besides from the above mentioned reasons for using electronic mail, Shelving Systems, Inc. used electronic mail to a high extent in their product development process of a shelf even though Matt perceived that the personal contact is lost when using electronic mail. Matt also mentioned that electronic mail was used more in the beginning of the relation with the customer when he perceived that only the absolute essentials should be communicated. The advantages mentioned with electronic mail (for instance, easiness of reaching people) determined the use of the media for exchanging communication during the product development process.

7.6 The influence of multilateral use of CBIS on product development

Shelving Systems, Inc. has used CBIS for collaborative product development in the product development process of a shelving system to an English retailer. In this case, the retailer was influential in the decisions to use CBIS for communication.
7.6.1 Multilateral use of CBIS to support efficiency in product development

When it comes to using CBIS for efficiency purposes, one positive effect from the use of CBIS for collaborative product development regarded the possibilities to decrease the time for marketing. Several comments on the use of electronic mail for communication in the collaborative product development processes were regarded the fact that it was time saving, and that it made the communication faster. Another similar reasoning was that certain situations, where communication was to be too complex with the use of other media, necessitated the use of CBIS for communication. The alternative was to not communicate these issues but rather use a trial and error method. For example, in the product development process of the shelf in Shelving Systems, Inc. the alternative to sending digital pictures with the use of electronic mail was sending the products directly to the customer, and the customer would then have to send the products back with descriptions about how to change them.

In addition to the use of CBIS as communication medium that can increase the efficiency of the product development process; the CEO remarked that CBIS could facilitate the administrative work to increase the efficiency of the product development process. Shelving Systems, Inc. is connected to the English customer regarding the produced shelf. This connection via CBIS made manual work with orders unnecessary for the English customer and it also makes it possible for Shelving Systems, Inc. to access real-time information about the sales and the demand for products.

7.6.2 Multilateral use of CBIS to support effectiveness in product development

Regarding the use of CBIS to support effectiveness in collaborative product development the CEO of Shelving Systems, Inc. observed several areas of usage for increasing the efficiency.

In Shelving Systems, Inc., CBIS was used to visualize products or solutions to the customer during the product development process as a way of assuring the effectiveness of the process. The visualization concerned both the product and the technology to produce and ship the product. Visualization was made through pictures taken with a digital camera that were sent through electronic mail. According to the firm, there were several issues that had to be solved regarding the product, the production technology and shipment of the product. The use of
digital camera and electronic mail was important for informing the customer about solutions made and also as a way to reach agreements about solutions.

The possibility to store communicated information assured Shelving Systems, Inc. that the right things were done and that the customer could not dismiss solutions already agreed upon. The documentation of agreements can hence be viewed as a positive and effective effect of the use of CBIS for product development.

7.7 Summary

This chapter presents analyses of the empirical material from Shelving Systems, Inc. First, CBIS on a firm level is analyzed. The adoption of CBIS resources seems to be influenced by a perceived necessity, perceived benefits and accessed CBIS competence. It is also likely that the adoption of CBIS leads to a certain amount of CBIS resources that is the outcome of the CBIS adoption activities.

Thereafter, descriptions of the links between CBIS and product development are described in connection to the product development process of a shelving system to an English retailer, and the product development of waste material. For the product development process of a wall shelf, CBIS was not used. These connections are then compared in order to find a way of discussing how and why CBIS is used for product development.

Based on the fact that both unilateral and multilateral use is present in the empirical material, two sections deal with how and why CBIS is used. The influence these ways of CBIS usage has for product development is discussed as aiming to support efficiency and effectiveness in product development.
8. HOUSES, INC.

In this chapter the empirical data from Houses, Inc. will be presented. First, an introduction to the firm and the firm’s strategy will take place. Thereafter, selected product development processes will be presented. Information regarding the case is located in the chapter about research methods.

8.1 A background to Houses, Inc.

The firm started in 1999, as a response to an article published by their present sales organization in the local newspaper which claimed that the production was insufficient and that it was hard to find suppliers. The municipality asked a number of people if they could start a factory in the region. The people asked found the offer interesting, so they attended a course that was specially designed for them at the upper secondary school. At the same time, they attracted some investors creating a firm that was up and running by the end of 1999. During this time Bill, the former CEO and founder of the present firm, was asked to work for the firm due to the fact that one of the managers had a stroke. When Bill started as the new CEO, he changed the production, went through the firm’s economy, and realized that it was not good at all. The first task he performed was placing the firm into bankruptcy. He mentions that he did not like to start this way at all. Together, with two more people, Bill bought the firm back. According to Bill, the development of the firm has not been easy due to the fact that it has been necessary to use his own money as capital as it is almost impossible acquire elsewhere.

The firm’s main production is block delivery of house elements, which refers to outside walls, supporting inside walls, and joists. These products are delivered to large building constructors through a sales organization. Apart from building constructors, the firm also has some private consumers. The firm is made up of about 20 employees. The sales differ some from year to year but mostly stays between 20-22 million SEK a year.

The business idea was, from the beginning, to be a supplier of building material for the large building constructors. However, this business plan has changed, which has led to the need to rework their existing business plan.

We have not yet decided, we rather stand with one leg on each side right now when it comes to building constructors and private consumers. It’s about finding a balance between these and we have not yet put our feet down, we are not quite sure. (Susie)
The different customer groups are mentioned to have different pros and cons; and no decision has been made as to which customer group to primarily serve. Susie argues that the selection of private consumers leads to how the organization is adjusted to support this work. This is not possible at the moment since Bill, who normally keeps contact with the customer, calculates prices, and communicates with the customer, is sick. Susie also expresses that private consumers, on the one hand, requires more times, take a lot of energy, requires a different type of organization, and requires that one person works full time with matters regarding private houses. On the other hand, a higher profitability on the private houses is possible. If the firm were to serve private consumers, it would not be preferable to make a house model, but rather make different block constructions that can be assembled differently in order to be able to offer different kinds of houses. Furthermore, it takes longer time to make a private house because it is always “the first time”; routine is never achieved expresses Susie.

Regarding competition, several house producers exist who already have a series production of houses. Houses, Inc. has no plans on taking shares in this market, since the firm can not compete with these series producers. According to Susie, Houses, Inc. needs to produce more specially constructed houses, as this market does not have as high competition. Susie explains how representatives from the firm sit down with the customer when ordering a single house. It is in this way sketches, and agreements about how the customer wants the house, can be agreed upon. When an agreement has been arrived at, the house sketch is broken down into sections and then produced. Susie mentions that it is not possible to go to a series producer or a firm that only constructs houses from its own models to get a specially constructed house.

*This is not possible if you go to the firms’ that produces series of houses or have own models of the houses, there you have to choose a house from a catalogue. We can make a little bit more of special models of houses.*

(Susie)

The production in Houses, Inc. is adjusted to fit single production of houses, not towards series production of houses. This means that the production is flexible to a high extent, and that it can be altered fast. The firm has no lines, robots or automatic production at all.

*The production is very specific for each product. We are not comparable to firms’ that produces series. The production is adjusted to the type of house we are producing, it is very flexible and we can alter our production fast. We have no lines, robots or automatic production at all.*

(Susie)
8.2 A background to CBIS in Houses, Inc.

Houses, Inc. has three workstations in their office, and none in production. At the office, one machine is used for administrative work tasks. The second computer is used by Calvin who uses it to calculate and create CAD drawings, among other things. The third computer is used for simpler things such as writing orders.

The firm has two different CAD software applications. One application is house CAD, which Bill considers rather easy to use. He mentions that this software can be used in the beginning of the development of a new house, where it is possible to start by drawing the size of a concrete foundation and then add walls, outer and inner. According to Bill, this software is advantageous in the beginning stages because decisions can be made together with the customer until a solution is found. This software makes it easier for the customer to understand the product. The other CAD software that the firm has is more advanced where block elevations can be made. These block elevations produce the functions, cultists and everything needed for the production. According to Bill, the program generates these figures automatically, which is preferable as it saves a lot of time in comparison to manually calculating.

Regarding the firm’s connection to the Internet, Houses, Inc. is connected to the Internet through a modem. Broadband is installed but is not connected at the time. Susie mentions that this is because the office will be moved to another location in the building. The firm will wait to connect the broadband until the new office is ready.

According to Susie, the use of the Internet is perceived to be advantageous for broadening perspectives, acquiring information, and communicating with parties that would otherwise not have been communicated with. It is easy to just focus on the region when not using Internet. Regarding the use of Internet for communication, both Bill and Susie respond that electronic communication is a complement to personal communication, and should not be viewed as the only medium for communication.

One is not forced to just use the Internet, you still have your old network.
(Bill)
8.3 Product development within Houses, Inc.

Susie remarked that the firm’s largest share of production is contract manufacturing to the larger building constructors. When the firm has the capacity, it engages in production to private consumers. The firm’s product development, however, is concentrated on the houses sold to private customers. The production sold to the larger building constructors is geared more towards order procedures. The firm cannot affect anything in the orders from the building constructors. The only possibility for the firm to make changes in the products to the building constructors is if they notice that something is wrong, Susie adds.

The firm’s main product development activities and processes are directed toward private end consumers. The firm has no models for houses, but rather produces what the consumer wants. This implies that the production is specific for each house produced.

*There are not two products that are the same, except for the production to the building constructors. Regarding the production to the building constructors we can in a project produce up to forty to fifty houses, in perhaps three different models and in three different colours. That is the closest we get to long run production. Normally a project like that takes about a year and a half.* (Susie)

Houses, Inc. has a number of firms that assist in the firm’s product development activities and processes. Two different firms assist with the blueprints, which are also made by Calvin through the use of CAD software. The relationship to the firms assisting with blueprints is perceived to be of high importance; Susie explains that it is important to speak the same language when communicating about the blueprints. This is because there are not any given templates. Houses, Inc. has worked with one of the firms since the start, while the other assisting firm is a new contact. Regarding the latter, Susie describes that there are some small problems in communication since the firms have not yet gotten to know each other well. The complexity in knowing what the customer is finally going to settle for, and that it is hard to know what information is required for making the blueprints. Susie believes that it is about learning to read people, and that personal contact is enormously important.

*The personal contact is enormously important, it is more important than one can believe. A relation is important in long-term business.* (Susie)
Furthermore, the firm does not engage in finding craftsmen. That is entirely a task for the customer. This creates a situation for the firm with no fixed work costs. After the house blocks are produced, they are shipped to the customer, who then has to employ craftsmen that can build, install electricity, assemble heating, ventilation and sanitation.

Regarding the internal work at the firm during product development processes; Bill is responsible for product development projects and makes cost estimations, and Calvin makes the blueprints. Bill describes that the work during the product development process begins with blueprints. When the customer agrees to the blueprint and price indications, an offer for both parts is signed. Due to the fact that the firm cannot afford customer losses a bank warrant is demanded from the customer.

8.4 An illustration of a product development process of a single house

Product development processes of single houses to private consumers are the main product development activities and processes conducted by Houses, Inc. After a discussion with Bill and Susie, one particular product development process was chosen. This product development process was mentioned to be typical for these kinds of houses. The product development of the process was finished a year ago.

*We worked a lot with the development of this house and it was delivered a year ago. It was Bill and Calvin that were involved in that product development process, from the first time the customer called, and during the dialogue. Projects like these take a great deal of Bills time; he works with these while I run the rest of the business. It takes a lot of time to run the firm and it is almost necessary to have a person that can engage in the development activities. (Susie)*

In this case, the customer did not have any idea about what he wanted when he came to the firm. The customer arrived and presented the idea that he wanted a house and had some thoughts about the size and the exterior of the house. Thereafter all parts of the house were solved through discussions. Bill and the customer started to draw some sketches on a paper napkin and exchanged some ideas. The product idea was developed through communication between the firm and the customer during the entire development process.
According to Bill, there are no real limitations about what can be done. He states that the picture about what the customer wants grows and shapes during the product development process. Furthermore, the experience within the firm is argued to facilitate some issues. The firm will be informed about whether the house will be assembled in the city or in the countryside, which in this case was the countryside. From this, the customer was asked whether he was looking for a house similar to the beginning of the century, which was common and suited to the location where the house would be assembled. The customer agreed to this which made it possible to start to make building drawings. The type of house chosen has some typical details that were proposed to the customer, as for instance a bay.

*I have almost forty years of experience of the build industry and this gives me a hunch about what can be done, and also Calvin has many years experience. (Bill)*

Based on the ideas discussed and sketched on the napkin, the drawings were created with CAD. One of the versions of CAD, house CAD, was mentioned to be easy to use, as it is possible to start by drawing the size of a concrete foundation and add outer and inner walls. The sketching of these aspects was perceived to made it easier to sketch what the customer wants at a stage when the customer can view and discuss the solutions proposed.

An initial CAD drawing contains a design and facades. When the customer starts to agree to the emerging plans, more detailed discussions and drawings are created. Calvin breaks down the original drawing, discusses inner ceiling and wall thickness, and then arrives at a suggestion for the customer. According to Calvin, there were a lot of modifications done to the drawings and the customer altered his mind on several occasions.

*I believe that the customer in this case had some thoughts on thicker walls and so we added plywood or a particleboard behind the plaster. And this was the drill for the project; we added, modified and subtracted parts all the time. In extreme cases this can continue until delivery. (Calvin)*

Calvin describes that it was quite difficult for the customer to use the blueprint in order to understand what the final product was going to be like. He explains that it is quite a common problem for customers to understand the blueprints. According to Calvin, the CAD software can only produce blueprints, not visualize the product. He mentions that the CAD software used for initial illustrations provides quite a schematic picture. In order to make the product more understandable,
Calvin exports the drawings to another CAD application that better illustrates the product. According to Calvin, the visualization retrieved is not that good, but it makes it easier for the customer. He further adds, that in this project AutoCAD was also used, which presented four facades that illustrated how the house would look like from the outside.

*It was still quite difficult for the customer to understand everything, but I noticed that the visualizations helped the customer in creating an opinion about the exterior of the house.* (Calvin)

Based on the different CAD blueprints, the customer has to decide upon the product. When the customer has agreed to this, the customer must then solve the financial parts and in order to employ craftsmen. When the customer has solved these issues, Calvin continues to work with the blueprints. When these are turned into a draft, they are sent to one of the firms which assist Houses, Inc. with work on blueprints. This assisting firm solve issues such as whether double windows are necessary, if there should be extra walls, whether or not a window is to large, and other construction issues.

The exchange of blueprints with the assisting firm was conducted through electronic mail. According to Bill, the firm previously would have sent paper copies, but now this is perceived to take to much time. He explains that before he had to make copies of the blueprints to be sent, and that it takes time to send by ordinary mail before it reaches the person that should have it. Furthermore, if something is wrong in the blueprints sent, then the entire process has to be repeated. The exchange of files instead of paper copies is therefore perceived as time saving; Bill also believes that CAD software have other advantages. He mentions that with the CAD software, a house can be drawn and block elevations can be made which render functions and production lists automatically that the firm needs for producing the house. The automatic calculations are also mentioned to decrease the risk of anything going wrong during the process when the blueprint is translated to production lists, and that it is also time-saving, as everything is automatic.

The firm strives to send blueprints electronically, as it makes the exchange easier. Bill declares that he does not perceive are any greater risks with sending CAD files with electronic mail. The only possible threat with exchanging information electronically is the risk of retrieving computer viruses; Bill explains that he is not worried that anyone would take the blueprint or in any way misuse the materials that that are sent. This has, according to Bill, to do with that the firm’s trust in their co-operators, and in the fact that the files exchanged do not contain any technical secrets.
It depends on that we trust our co-operators and it is no technical secrets when building houses, it is not like we were developing an aeroplane to the military, it has been known for hundred of years in Sweden how to produce houses and there are no secrets about that. (Bill)

The firm also exchanged information with one of their suppliers, which is located nearby and delivers roof trusses to the firm during the product development process. According to Bill, this firm is contacted because Houses, Inc. needed assistance with calculations for the roof trusses.

The firm is used to the fact that private consumers change their minds at the last minute. Therefore, product development projects are not forced, but rather the customer is told that the project will take several months. According to Bill, this is done in order to make the customer really think everything over. He further mentions that this is the largest business deal that many private persons make in their lifetime.

Although suggestions are given about, for instance, what a bathroom could look like, respondents at the firm perceived it as important that the craftsmen are involved in the project and are a part of the decisions made. It is the customer that ultimately decides how the bathroom will appear, which makes it important that the customer creates the discussions in the development of the project.

The firm has to receive information from the electricians that will do the installations in the house, for instance, where electric sockets will be placed. This information is then added to the blueprints. Calvin remarks that it depends whether electronic mail or paper copies are exchanged with the craftsmen. He states that this has to do with whether the receiver has the hardware and software necessary for making adjustments in the blueprints. According to Calvin, many craftsmen does not use CAD software, and in this particular case the firm had to send paper copies, which were returned with some sketches that Calvin had to import into the CAD file. The sketches consisted of a number at different places in the blueprint which corresponded to notes on a different paper that contained electric keys, the height in which the electric socket would be assembled, and at which socket it would be with cross dimensions. According to Calvin, it does not effect his job whether CAD drawings are sent electronically or by ordinary mail, he still has to update the CAD file. Although, he perceives that the use of electronic mail is time-saving.

*It really does not matter if we receive it as a CAD drawing or as a paper copy for my work; I have to insert the changes anyway. The adjustments*
made in the CAD file are only text notations and I have to insert them for our production. Although it saves some time if I could send it through electronic mail instead of by ordinary mail. (Calvin)

After the electricians have made their adjustments, it is time for the other craftsmen to make changes. In the particular case, it was a house with two floors where the bedroom was upstairs. Calvin mentions that the only thing that was done at that time was to leave the floor downstairs open, which made it possible for the craftsmen to plan for floor drains etcetera.

The production starts when the customer has signed the contract and when the firm has received a warranty from the bank. When the contract is signed and the warranty is received, the production lists are printed from the CAD drawing and then the product is more or less finished, Bill explains. The CAD drawing is modularized to suitable lengths for production, and how the house will be assembled is taken into consideration. The blocks are produced in the order that they will be assembled, blocks are positioned on the truck in an order that facilitates the assembly of the house.

8.5 An illustration of a product development process of a house concept

Bill mentioned during the interview that the firm is involved in a project where they are assisting in developing a house concept for Thailand. The project is directed towards the slum area in Bangkok where the firm has developed a concept to teach the people of Thailand to use wood for construction. The use of wood for constructing houses in Thailand is rather rare since there, according to Bill, is no culture of using wood in Thailand.

They do not have a culture of wood in Thailand; they spent their forest approximately a generation ago. (Bill)

The project includes building 100,000 apartments a year during ten years time. The usual methods for constructing houses in Thailand could not be used, since they build their houses with bricks and the bricks are about half the size than those used in Sweden. Rather, Bill noticed that the building process must be radical changed in order to be able to build that number of houses a year.

Bill believes that the reason for that the firm gets as many questions about projects like this is due to the experience he has in working outside Sweden. Both Bill and Susie have spent six years working in tropical climates.
We have spent a great deal of time in other countries, I have been living in different countries in tropical climate for six years through work, and my family have always been with me. (Bill)

According to Bill, the interest for the wood construction comes from a presentation about Swedish prefabricated construction functions, and the time it takes to construct and assemble houses. It takes three to four men to build the top floor of the house in one day, due to prefabrication. This building technique would hence be a prerequisite for conducting the planned program.

The project is described as a kind of know-how project where Houses, Inc. develops a product that is supposed to be functional for the slum area of Bangkok. Regarding contacts during the product development process, Bill has visited Thailand three times and he awaits a visit from Thailand in the near future. The first time Bill visited Thailand concerned a presentation of Swedish wood, the second time was about production technique, and the last time was a continuation of production technique.

The blueprints of the houses already existed. The first trip, Bill went together with the Swedish forest industry in order to market Swedish wood and to introduce Swedish construction. Interest for Swedish construction techniques was quickly generated. Bill expresses that a great interest was showed and the firm has had some contact with an entrepreneur who has been visiting in order to learn Houses, Inc. construction techniques. The firm is now about to show a model describing the construction of the house.

Houses, Inc. has finished a three-dimensional computer animation illustrating the house and how it should be assembled. The reason for this animation is that the house is very special from a Swedish point of view. According to Bill, the houses could be compared to a double-floored garden shed. He perceives it to be of importance to discuss the model at an impending visit from his contacts in Thailand.

Regarding the work to develop the product, the original idea for the product was to build the house with bricks. Although, since the top floor is larger than the bottom floor there was an interest to build the bottom floor with bricks and the top floor with wood. Bill states that Houses, Inc. is interested in building the entire house of wood, which, he indicates, could be possible. Furthermore, much will

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6 Susie is Bills daughter
depend on the customer which will be represented at the minister level when visiting the firm in order to look at the proposed house concept.

It is very special to work in these kinds of countries for the first time, expresses Bill. He mentions that it is very difficult to understand the way of thinking as influenced by the culture. Bill explains the importance of accepting and learning from the culture, and remarks that it does not matter how good one is if one does not adjust to the culture.

In order to visualize the product for the customers, Houses, Inc. has developed a three dimensional model of these houses with two PhD’s from a university. One has a PhD in wood technique and the other has a PhD in architecture. Houses, Inc. has also had help from two professors of architecture. These contacts have been established through the Swedish-Thailand chamber of trade. The university has helped the firm with developing a three-dimensional model, based on the requirements provided by Bill, and the firm had contact with these academics before this project.

The blueprints for this project already existed. Bill clarifies that it was just to transform the blueprints into wood, and that the blueprints were modularized and adjusted to the type of production that Houses, Inc. already has. All measures were supplied in the original drawings provided by the customers, which implies that it was just to change the material, which was not perceived to be a big procedure. What could constitute a problem, according to Bill, is that the norms for construction differ from what he is used to, and he exemplifies this with the fact that these houses do not have any isolation.

*I have had complete drawings that illustrate everything. A lot of the questions have been answered through these. And I have also knowledge from my travels. (Bill)*

Regarding the gathering of information and communication within the product development process, the responsibility of providing information on the building norms was on the customer. Bill clarifies that Houses, Inc. teaches the technique but that the customer has to bring demands for the buildings. Bill mentions that he has been told that there is a thick book representing the building norms in Thailand, but it is not translated. He also states that the interest of following the building norms seems to be low.

Houses, Inc. has an agent in Bangkok, a person that has earlier lived in Sweden and speaks Swedish, which makes the communication rather easy. Otherwise,
business English is used for communicating with the customers, explains Bill. He also states that the media for communication is chosen based upon the situation. Everything that is supposed to be decided upon, or has been decided upon is preferred to be exchanged through electronic mail, since this media makes it possible to store the information exchanged.

> _Everything that should be handled is preferred to be exchanged through electronic mail. This ensures us to have it black on white. Otherwise, we use the telephone sometimes in order to call and have a conversation. It is very easy to use the Internet and then we always have documentation along with what we discuss._ (Bill)

The firm’s agent is also the Swedish chamber of trade’s affiliate Thailand. However, the main reason for having an agent is that the law prohibits conducting business with foreigners in Thailand without local help. The agent handles the contacts with potential customers in Thailand for Houses, Inc.

Houses, Inc. will receive a visit in a month where a demonstration of the assembling of the top floor will take place. In the future, Bill hopes that Houses, Inc. will be head of the product development process. He also comments that the firm would not have been interested in the project if it were not possible to be profitable.

Regarding the market, prefabricated houses are new in Thailand, and entering this market would raise new possibilities for the firm. The possibilities to develop special houses for singular consumers are perceived to be large. Bangkok contains approximately eleven million people, and about two million of them own more than one million in Swedish kronor, which is of interest for the firm’s product development processes towards singular consumers. A lot of exclusive houses are built in Thailand, where exclusive is something entirely different from what we have in Sweden, Bill explains. He states that the firm hopes to catch more projects through the development of the house concepts.

**8.6 Summary**

In this chapter the empirical material generated at Houses, Inc. is presented. The main production in the firm concerns block delivery of house elements to large building constructors. However, a part of the firm’s production is focused on special development of houses to private consumers. First, the chapter describes the background (i.e. history) of Houses, Inc.. Thereafter, the CBIS resources and usage were described, followed by a description about the product development
processes and activities in the firm. Based on these descriptions two product development processes are described further.

The first product development process concerns the development process of a customer-based house to a private consumer. This was depicted to be a typical product development process at the firm. CBIS was used in the process for collaboration purposes, for three different types of co-operating partners. The first type is the private consumer, for which CBIS was used through CAD applications with the purpose to communicate the product with the customer. The second type of co-operating partners regards the hired craftsmen that use the CAD drawings for inserting information about their separate areas. The third and final type is Architects, who use CAD drawings for assisting with blueprint work that are of such special nature that it is not perceived to be possible to solve within the firm.

The second product development process described concerns the development process of a house concept. This product development process was mentioned to be different from the firm’s usual product development processes. The origin for the product development process was a seminar series where the Swedish forest industry presented Swedish wood, and as a cause of this, the firm became involved in the work in the slum areas of Bangkok. Since the building techniques normally used in Bangkok could not meet the demands for the quantity of new houses, a new way of producing houses was needed. Houses, Inc. was engaged in the activities to develop a product and a concept to meet the construction demands. CBIS was used for collaborating purposes, where a three-dimensional model of the house concept and its assembling was created in order to be presented to the customer. Finally, electronic mail was used for market communication and for storing communication exchanged in the product development process.
9. WITHIN-CASE ANALYSIS OF HOUSES, INC.

This chapter regards analyzes of the empirical description of Houses, Inc. and will focus on the two questions from the problem discussion. Namely, what affects the way in which CBIS is used for product development, and how does the use of CBIS influence product development in small firms? The empirical description of Houses, Inc. contains information about the firm background and about two product development processes that has been conducted. One product development process focuses on customer based houses sold to private consumers, and the other focuses on the development of houses in Thailand.

9.1 CBIS on firm level

First, the adoption of CBIS and the CBIS resources are analyzed. These are supposed to form the basis for the CBIS usage within the firm, and can therefore shed light on how and why the firm uses CBIS for product development activities and processes.

9.1.1 Adoption

Houses Inc. had computers from the beginning, although the adoption of CBIS resources within Houses, Inc. is largely due to the perceived necessity and benefits with having CBIS as an option to other media.

1) The perceived necessity is illustrated when Bill expressed that it is not possible to run a business without computers. He stated that a number of business activities have to be conducted through the Internet, as, for instance, banking. Bill also stated that it is not necessary to use the Internet just because it is possible; it is rather to be viewed as an option.

2) The use of CBIS as a cause of perceived benefits is illustrated by Susie, who mentioned that the use of the Internet is important for expanding the horizon and gaining more knowledge, since information is accessible on the Internet.
9.1.2 CBIS resources

As a consequence of the adoption, and the reasons behind the adoption, the firm has CBIS hardware constituted by three workstations that are used for administrative purposes. Regarding the connection to the Internet, the firm has broadband installed but is not connected. Because of the fact that the office is about to be moved, the firm has decided to postpone the connection of broadband until the new office is ready. In the meantime, the firm uses a modem to connect to the Internet. Software resources within Houses, Inc. are based on windows operating system with ordinary software packages, and the firm also has software for book keeping and two different versions of CAD software. The members of the administrative personnel are the only ones using the computers and there are no computers in the production.

9.2 Use of CBIS

There are two product development processes that have been described in the empirical chapter. The use of CBIS in these two product development processes are described in the following sections.

9.2.1 The product development process of a house

The product development process of a house was directed towards a private consumer and the process was customer based and hence also a form of collaborative product development. The use of CBIS in this product development process was directed towards collaborative product development, and the influence of the use of CBIS on the product development process comes from the communication with co-operating firms. The use of CAD and electronic mail are some of the reasons for why the firm prefers to use CBIS for collaboration. There are three different types of co-operating partners in the product development process of a single house to a private consumer; 1) the private consumer, 2) craftsmen who are hired to assemble the house and make installations, and 3) architects.

The collaboration with the private consumer includes influences from CBIS on the product development process. The firm has two different versions of CAD which are used for the development process. One is used because of its easiness to illustrate the consequences of the discussions with the customer (visualization), and the other is used in order to convert the agreements into technical solutions that serve the final production of the product. The use of CAD can therefore be seen as two folded: 1) The use of CAD makes it possible to visualize the product
to the customer, and 2) the use of CAD can serve the production with technical solutions on how to construct the house. The use of CAD can hence be viewed as a link between the customer’s need and the production, with the aim to increase the efficiency of the product development process. The influence of the CBIS usage on the product development process was directed towards the production of the final product. When the final agreements have been delivered, Calvin makes block elevations with the use of CAD, and through the software production lists are automatic generated and printed out for the production. The firm modularizes the house in CAD before writing it out in order to retrieve suitable lengths for the production. The assembling order is also a parameter that is planned when sending the production lists to the production office, because this ensures that the production can be made in an order that suits the final assembling of the blocks to the house. The printings from CAD renders in lists that are delivered to the production office through which the employees know what should be done. The use of CAD makes the transformation from the developed product to the produced product faster and decreases the risk of miscalculations when all functions for the production are calculated automatically.

Another influence that the use of CBIS had on the product development process was the possibility of listening and admitting to changing customer requirements it rendered. The use of CAD thus made it easy to change customer requirements during the whole product development process. This is considered important since the customer mostly makes only one investment of this size in his or her entire life. This makes the firm both flexible and efficient.

Regarding the use of CBIS to visualize the product, this was perceived as important for revealing the customer needs. The customer’s idea about the product was not developed in the beginning. The product idea was rather gradually generated during the product development process through communication between the firm and the customer. The initial discussion took place at the firm and was complemented with sketches on a paper napkin. During the product development process the understanding of what the customer wants is forming and agreements are made. The ideas of what the customer wants become more detailed, which leads to a switch from the initial napkin sketches to the use of CAD in order to visualize the product to the customer. The ordinary, private consumer could have a hard time understanding the final product through the discussions only and sometimes also through blueprints. In order to make sure that the customer demands are met and properly understood, Calvin uses a number of different CAD solutions to illustrate the final product. The customer has to make his final decision based on the CAD blueprint.
The second group of co-operating partners during the product development process is craftsmen, which are hired by the private consumer. The craftsmen are involved in the customer's decision of the product, and it is their role to assemble and make installations in the house. The craftsmen also have to be involved in some of the decisions regarding the development of the house. Even though it is the customer who makes the final decision, he has to be involved in the discussion with both the firm and the craftsmen. For communication with cooperating firms, the firm prefers to use electronic mail when sending and retrieving CAD-files. It is faster and easier to use electronic mail (a component of CBIS) for these purposes than ordinary mail, which would be the alternative. The risks combined with sending CAD files are low because they trust their co-operators and do not believe that there is much secrecy concerning the blueprints within the industry. Although, one perceived risk with sending files with the use of electronic mail is computer viruses, but this risk is perceived to be minimized by updated virus definitions and software. The reason for sending CAD-files was to a large extent determined by whether the co-operating firms had access to the same software and could work from the electronic drawings. Many of the craftsmen did not have access to CAD and therefore it was not unusual that the firm had to send paper copies through mail, which was returned with notes and sketches. Calvin had to update the CAD drawing with these changes regardless of whether the co-operating firm has access to CAD or not. Because the CAD drawing is used for rendering production lists, every notation must be a part of the final calculation and therefore Calvin had to insert all notations made by the craftsmen. However, Calvin prefers to send the CAD drawing by electronic mail because it saves time for the product development process.

A third group of cooperating firms is architects with which the firm has ongoing co-operation. The medium chosen for dialogue with co-operating architects is mostly electronic mail since these firms have access to the software needed for working on these files. These types of co-operators are hired for technical solutions with the use of CAD and for making sure that the work is correct.

9.2.2 The product development process of a house concept

The product development process of a house concept started out in a marketing project of Swedish wood. As a result, Bill was asked to put together a model illustrating the use of wood for building houses in Thailand. The product development process can be described as a collaborative product development process where a number of actors are involved. The use of CBIS is thus for collaborative product development with different influences for the product development process.
The first influence is the visualization that is made of the product through the use of three-dimensional modeling. The firm has developed a three-dimensional model of the house and the assembling of the house, because the project is different from what the firm is used to and different from what the market is used to. Bill plans to show the three-dimensional model for a delegation from Thailand on a visit in Sweden. In order to put together the three-dimensional model, Bill has received help from two PhD’s within the fields of wood technique and architecture and a professor in architecture, contacts that have been ensured from when the organization planned the first visit to Thailand. These persons have worked on the computer solution which is the base for the next presentation in the product development process.

Another influence regards the market communication in the product development process where CBIS is used, through electronic mail, to retrieve and archive discussions and agreements from the product development process. Bill mentioned that the communication media was chosen based on the specific situation. According to Bill, everything that is supposed to be handled is preferred to be handled through electronic mail. The motive for communicating through electronic mail is that they can be saved, and thus properly documented. Bill mentions that the electronic mails are also complemented with telephone calls sometimes.

9.3 How and why CBIS is used for multilateral purposes

To understand the way in which Houses, Inc. use CBIS for product development is we need to look at their CBIS experience and CBIS resources. Although, this gives us less information about how CBIS is used for product development, and more about how CBIS is used for multilateral purposes in the product development processes. In order to achieve more knowledge we need to understand why CBIS is used for multilateral purposes. Although, the usage differs to some extent between the various products and therefore the next section will continue by analyzing the reasons why CBIS is used for product development, and how this might influence the product development processes.

The main use of CBIS in Houses, Inc. product development processes regards the use of CAD applications, and communication applications like electronic mail for distribution of information and communication with cooperating partners (including the customer) during the product development processes. In the contact with customers CBIS is used for visualization of products to be able to meet customer requirements and make changes in the product as efficiently as possible.
In the collaboration with craftsmen and architects the use of CBIS is, when possible, foremost directed towards the exchange of blueprints.

Electronic mail was in Houses, Inc. used during the product development process of a house concept in Thailand to communicate with the potential market. According to the firm, electronic mail was used when the communication concerned agreements which were preferred to be stored.

According to the respondents, electronic mail is used because it is: 1) faster 2) easier 3) possible to store communication 4) safe due to mutual trust. Finally, although there is a risk for computer viruses, to use updated virus definitions make this risk low. However, the firm stated that the use of electronic mail during product development processes, especially for distribution of blueprints, depends on CBIS resource similarities, since certain applications are needed in order to be able to make use of the information distributed.

9.4 Influence of CBIS on product development

In Houses, Inc., the use of CBIS has been for multilateral purposes. Respondents of the firm mentioned that collaboration partners determined the use of media for communication, and if the collaborators had the hardware and software necessary for conducting communication through CBIS.

9.4.2 Multilateral use of CBIS to support efficiency in product development

Regarding the use of CBIS to support efficiency in the product development process respondents for Houses, Inc. mentioned several influences.

One issue of efficiency concerning the use of CBIS for collaborative product development regarded the speed of the communication. Respondents of Houses, Inc. commented that the use of electronic mail was more preferable for sending blueprints since the distribution of the information was faster through this media. Furthermore, the firm stated that even though time to market is not important to the firm, the possibility to communicate efficiently was important in the product development processes.

Furthermore, respondents from Houses, Inc. remarked that CBIS could solve any administrative work areas that were directed to increase the efficiency of the product development process. The use of CAD can be seen as a way of increasing the efficiency during the product development process, and the use of CAD made it possible, in a reasonable way, to admit to meeting customer requirements during the process. Furthermore, the use of CAD makes it also possible to automatically
generate production lists when the product is agreed upon. Compared to manual calculations, this software solution is a time saving solution.

9.4.3 Multilateral use of CBIS to support effectiveness in product development

Regarding the use of CBIS to support effectiveness in collaborative product development, respondents from Houses, Inc. mentioned several areas of usage as ways to increase the effectiveness. In Houses, Inc., CBIS was used for visualizing products or solutions to the customer during the product development process, as a way of assuring the effectiveness of the product development process. Respondents from Houses, Inc. argued that product development processes were entirely customer run (single houses to private customers). The product sold was based completely on customer requirements. According to the firm, the understanding of what the customer wants grows during the product development process. As the agreements become more detailed and contains more and more information the usage of the CBIS component CAD grows as well, in order to illustrate the consequences of the discussions with the customer. According to Calvin, the ordinary private consumer can have a hard time understanding the final product just from the discussions and sometimes also through blueprints. In order to make sure that the customer demands are met and properly understood Calvin uses a number of different CAD solutions to illustrate the final product. Similarly, the firm also used three-dimensional models during the product development process regarding the house concept in Thailand in order to make the product and its assembling viable for the customer early in the product development process.

9.5 Summary

Adoption of CBIS resources within Houses, Inc. is discussed to be influenced by the perceived necessity and benefits of adopting these resources. This makes it possible to view the firm’s CBIS resources as the outcome of CBIS adoption. However, the use of CBIS is described for the product development process of a house where CBIS was multilaterally used for collaboration with the customer, craftsmen, and architects through sending electronic mail with attached CAD files. The use of CBIS is also described for the product development process of a house concept, where CBIS was used for communication with the market through electronic mail, where electronic mail also were stored due to the fact that it included some form of document of agreements. Furthermore, CBIS was used for visualizing a three-dimensional model of the house concept, and the way in which it would be assembled. For Houses, Inc., CBIS was used for multilateral purposes, and therefore the aspects of the CBIS usage was analyzed as multilateral and the impact it has on product development is discussed using concepts as efficiency in product development.
This chapter contains the results of this thesis. Empirical material from the pre- and main-study is analyzed in the context of the literature review. It is possible to divide these results into four parts: 1) Analysis of prerequisites and reasons for CBIS adoption. 2) Analysis of how and why CBIS is unilateral used for product development, and what influences these reasons have on product development. 3) Analysis of how and why CBIS is multilateral used for product development, and what influences these reasons have on product development. 4) A discussion about possible contextual influences on the use of CBIS for product development, along the dimensions of product, firm and environment.

10.1 CBIS adoption

CBIS adoption can be viewed as the foundation for understanding the usage and influences of CBIS for product development. Adoption of CBIS is a complex phenomenon, and can be viewed from different perspectives. One perspective on CBIS adoption is the possibility to view adoption of CBIS hardware and software as a process. This was evident in the main study where both cases used computers since their beginning, and where CBIS resources had been updated and extended over time. Due to this, it is possible to distinguish between the adoption of the first CBIS resources from the adoption of further CBIS resources.

One distinction could be described as adoption of CBIS into the firm for a certain purpose such as product development. In this, it seems possible to divide adoption in two different aspects, 1) the adoption of CBIS resources into the firm, and 2) the adoption of CBIS resources for a specific task.

The empirical material, pre- and main study, indicates that there are three different aspects that are influential for the adoption of CBIS resources into the firm for a specific task. These aspects concern 1) the perceived necessity to use CBIS, 2) the perceived benefits from using CBIS, and 3) the competence necessary to use CBIS. This is similar to Mehrtens, Cragg et al. (2001) findings, which argue that perceived benefits, organizational readiness, and external pressure influence Internet adoption in small firms.
10.1.1 Perceived necessity to adopt CBIS

Regarding the perceived necessity, the empirical material from the main study indicated that the firms perceived CBIS a necessity due to influences from the firms environment; for example, communication with customers or for instant banking. It was also indicated, both in the pre- and main study, that the need to use CBIS would increase in the future, with higher demands from the environment. The latter reason for adopting CBIS could be viewed as driven by influences from the environment. It was also indicated that this perceived necessity could affect adoption reasons negatively. Several firms remarked that the adoption of CBIS for multilateral use was negatively influenced by the number of collaborating firms that are negative towards the use of CBIS. This was also found by Sillince, Macdonald et al. (1998), who revealed that firms who collaborated with organizations which had not adopted electronic mail were less likely to adopt electronic mail themselves.

Task specific reasons also seem to be influential in the adoption of CBIS. In the main study, it was evident that Shelving Systems was forced to use CBIS during the collaboration with the English retailer. The use of CBIS was a demand from the retailer and hence to be viewed as a perceived necessity to adopt, due to task specific reasons rather than firm specific reasons.

10.1.2 Perceived firm benefits of CBIS adoption

Perceived firm benefits seem to be another influential determinant for the adoption of CBIS. The main study revealed that adoption of hardware and software resources was a consequence of perceptions about how these resources could improve the business activities and processes. The pre-study indicated that the adoption of CBIS software resources for perceived firm benefits is dependent on the correlation between perceived firm benefits and the possible CBIS software resources. Several firms indicated that they would adopt CBIS if they could find CBIS software resources that match the prerequisites for achieving perceived firm benefits. The task of aligning certain prerequisites to a set of resources has earlier been shown to be a barrier for CBIS adoption. Montazemi (1987) found that adopted computer systems did not match the information requirements.

Furthermore, the pre-study indicated that a number of task specific reasons existed that influence the possibilities of adopting CBIS resources for a given task. The first, and perhaps most obvious, reason for CBIS adoption could be linked to the need for external information and communication in the product development process. Several firms indicated that they had a good knowledge of their
environment and that collaboration was not preferable in the product development process, indicating that they did not see any need of firm external information and communication. This also implies that there would be no benefit of using CBIS for gathering information or communicating during the product development process. A similar perspective is based on firms that did have external relations during the product development process, but indicated that there was not any use of CBIS due to that the simple nature of the information and communication it was preferable to handle information and communication through personal contact. Walczuch, Van Braven et al. (2000) concur, CBIS will not be used for a task if it is not perceived to create benefits.

10.1.3 CBIS Competence in relation to CBIS adoption

Besides perceived necessities and benefits, the adoption of CBIS also seems to be influenced by CBIS competence. In the empirical material, one important aspect of CBIS adoption seems to be the competence necessary to handle CBIS resources (Cragg and King, 1993). Several firms in the pre-study indicated that they had not adopted CBIS due to insufficient competence in handling CBIS resources. These firms mentioned that they had low trust or low confidence towards CBIS, and also perceived CBIS as difficult to learn. Some managers also argued that they were too old to use CBIS, indicating that the competence to use CBIS is higher among younger people. These comments are in line with the study by Thong and Yap (1995), which found CEO knowledge to be important for CBIS adoption in small firms. Furthermore, the involvement and knowledge of the CEO has also been indicated to be of importance for the successful usage of CBIS resources in the small firm (DeLone, 1988). So far, it has been argued that CBIS competence is of importance for adoption. Insufficient competence has been indicated as problematic for the use of CBIS. However, the main study illustrated that accessed CBIS competence can be sufficient if it is long term and focuses on the maintenance of the CBIS resources. Furthermore, the results also illustrated that the accessed competence cannot be too costly.

The influence of CBIS competence on the adoption of resources seems not to be a direct effect, but rather an influence of adoption from the perception of the benefits and the perception about the necessity of using CBIS. Furthermore, it is also possible to divide the adoption of CBIS resources between the adoption into the firm and for a specific task. These distinctions make four influences of CBIS competence possible for the adoption of CBIS resources.
One possible relation between CBIS competence and the adoption of CBIS into the firm is the perceived benefits of the CBIS resources. It is likely that the benefits perceived with CBIS resources are influenced by the CBIS competence possessed or accessed. For instance, the outcome of insufficient competence to handle CBIS seems to stem from the same perception that CBIS is not useful. An argument for this, is stated in the empirical material in the pre-study. The importance for support and resources for CBIS adoption has also been confirmed by Fink (1998). As a consequence, CBIS resources are not perceived as necessary as they are perceived to not contribute to business activities and processes. This is similar to the results of Neidleman (1979), who found that small and medium sized firm managers perceived that computers would not make any difference, and therefore did not adopt CBIS resources into the firm. It is possible to assume that insufficient competence influences attitudes about CBIS usage, as has also been previously indicated (Nickell and Seado, 1986; Thong and Yap, 1995). Also, Cragg and King (1993) found that limited education about information systems was an application growth inhibitor.

Another possible relation between CBIS competence and the adoption of CBIS into the firm regards the perceived necessity to adopt CBIS resources. The perception that CBIS resources are necessary for the firm has been argued in both the pre- and the main study. Several comments suggest that the perception that CBIS resources will be more important in the future. Due to this perceived necessity, these firms are more likely to adopt CBIS resources and acquire CBIS competence.

Furthermore, a possible relation between CBIS competence and the adoption of CBIS for a specific task, regards the perceived benefit of adopting CBIS resources. Given that CBIS resources have been adopted into the firm, the adoption of the resources for a specific task seems to be dependent on the perceived benefits of using the CBIS resources in relation to other media options. One view of the importance of competence in the adoption of CBIS for a task, can be exemplified from an empirical example based on the pre-study. Several firms remarked that they perceived no benefits of adopting CBIS for product development collaborations since their collaborating parties refused to use CBIS due to insufficient competence. Similarly, Sillince, Macdonald et al. (1998) found that the main reason for non-adoption was that organizations with which the firm communicated had not adopted electronic mail. CBIS competence is not to be treated as dichotomous, but rather as a continuum ranging from CBIS expertise to CBIS novelty. If adoption is based on insufficient competence, there is a risk that the CBIS resources gathered into the firm are not optimal for use. Further, if
competence to handle these resources is insufficient, it is likely that the maintenance of CBIS resources would be problematic. This was indicated by one of the firms in the pre-study. The CEO argued that the CBIS competence was insufficient which obstructed the possibility to maintain the firm’s CBIS resources. As this illustrates, it seems that CBIS competence can not only obstruct the adoption by obstructing perceived benefits, but it is also connected to the adoption and use of CBIS for specific tasks. This is strengthened by the results of DeLones (1988) which indicates the importance of the involvement and knowledge of the CEO in a small firm in order for CBIS usage to be successful. Also Walczuch, Van Braven et al. (2000) found that main barrier to Internet adoption is that the perception that the Internet would not be beneficial in the tasks conducted.

Another possible relation between CBIS competence and the adoption of CBIS for a specific task regards the perceived necessity to adopt CBIS resources. It is possible to illustrate this through a case from the main-study where Shelving Systems, Inc. developed a shelving system for an English retailer. In this case, the relationship between the developing firm and the customer was influenced by power exercised by the customer. Due to administrative routines of the large retailer, CBIS was forced upon all suppliers. For Shelving System, Inc. this meant that the choice was to either use CBIS and deliver to this customer, or turn down the possible agreement with the English retailer.

10.2 Unilateral use of CBIS for product development

This section aims to analyse how and why CBIS is unilateral used for product development related activities and processes. The theories presented are based on the results of the empirical material from the pre-study and the main study. Unilateral use of CBIS for product development was present in the pre-study and in the case of Shelving Systems, Inc., in the main study.

Unilateral use of CBIS refers to the use of CBIS for information gathering, similar to environmental scanning, which is the searching and gathering of information from websites. The results of the pre-study indicated that several firms used CBIS through Internet for information gathering from websites. During the product development processes, information sources were used: 1) Commercial scanning, where CBIS was used for information gathering about: a) the effects and market reactions to changes in products and advertising, b) customer groups early in the product development process, and c) the market, as a complement to other medias in order to retrieve as much information as possible about the market. 2) Competitive scanning, where CBIS was used in order to gather information about
competitors’ products. 3) Technological scanning, for which CBIS was used to scan for information with the aim of accessing knowledge about production techniques (Raymond, Julien et al., 2001). A fourth source of scanning was labelled as 4) Collaboration scanning, where CBIS was used for gathering information about potential collaborating firms’ resources and competences. Based on the literature, the sources of scanning are not of particular importance. Rather, performance has been indicated to be influenced by the number and the frequency of information sources used for scanning (Daft, Sormunen et al., 1988; Huber, 1991; Thomas, Clark et al., 1993).

The main study, i.e. the empirical descriptions from Shelving Systems, Inc., indicate that descriptions about how CBIS is used could be described using other dimensions. Besides the sources of information, it is also possible to distinguish between how information is actively gathered. In the main study, it was revealed that information gathering ranged from encouragements stated on a website, to active searches for opportunities on customer websites. As proposed by Aguilar (1967), it is possible to distinguish between activities of scanning based on how active the search effort is. In the main study, the firm’s website was partly used for encouraging visitors to submit ideas for new products or modifications to existing products. This information was used as a signal for the need to develop the firm’s products further, and according to the terminology of Aguilar, could be described as conditioned viewing since information was gathered for a purpose but without a certain effort. Another example from the same study could be used to illustrate how active scanning was performed during the product development process. During the development process of a shelving system, the customer demanded that the product should have the highest quality among the existing low price products on the market. In order to meet this demand information was required about existing products. CBIS was used through Internet in order to identify these products. This search effort, which according to the terminology of Aguilar (1967), could be labelled as a formal search since there was a deliberate effort to find certain information. Furthermore, it is also possible to assume that the information gathered through less active effort can trigger more active scanning efforts, implying that these activities also can be viewed as a process. However, it is also likely that the media selected will differ among different scanning efforts.

It is possible to break down the use of CBIS based on the functions used when searching, gathering, and making use of information. In this, data-processing activities (Hedman and Kalling, 2002) can form a foundation for the discussion.
10.2.1 Information retrieval as an aspect of unilateral use of CBIS

One reason for unilateral use of CBIS for product development instead of other media can be described as the data processing function, retrieve (Hedman and Kalling, 2002). This function refers to information retrieval. The empirical material from the pre- and main-study indicates that unilateral use of CBIS for product development is possible to understand using media selection theories such as access/quality approach and social presence theory.

One reason for why CBIS is preferred for information retrieval rather than other media could be described by cost-benefit analysis. This theory compares unilateral use of CBIS to the alternatives for gathering information. This was evident in the main study, where the alternative would be to hire a designer, which was perceived as more costly. This could be compared to the access/quality approach, which proposes that the media chosen for information retrieval is based on the theory that information should require the least effort/cost to access and have the best quality possible (Swanson, 1987; Carlson and Davis, 1998). Similar findings exist in the pre-study, where reasons for unilateral use of CBIS were aligned to rationality in information gathering. Several firms indicated that CBIS was a rational choice to use, where attributes such as convenience and easy access are part of the motivation. Also, Huber (1990) proposed that the use of CBIS could enhance information retrieval, making information more accessible. Further, a study by Teo and Choo (2001) revealed that the use of the Internet is positively related to the quality of the information. They went on to say that the quality of the information collected positively impacted the quality of the decisions made by managers.

The influence of CBIS usage on product development activities seems to partly be related to the costs for product development. As media selection is based on a cost benefit analysis, the quality of the information is less important than the cost for information. The gathering of information for the product development processes will be cheaper than the cost of gathering information with other media. It is also likely that the costs for the entire product development process will be lower than what would be possible without the use of CBIS. The use of CBIS in the product development of waste material in Shelving Systems, Inc. can be used as an empirical example of this. Through scanning for information about products that can be developed from the waste material, the firm felt that they did not need to spend money on a designer or time on idea generation. This use of CBIS did not only lower the costs of the product development process, but also made the product development process possible for the firm.
Another possible influence the use of CBIS can have on product development is related to the amount of information gathered. Since CBIS is chosen due to that it is less costly in comparison with other medias, it is possible that the use of CBIS would lead to more information gathering. Shelving Systems, Inc.’s website can be used as illustrates the unilateral use of CBIS for information retrieval. The website is used as a link between the firm and the market, which makes it possible for the firm to retrieve information about market needs. The site is designed for opportunity recognition in that it encourages visitors to submit ideas for new products. From this example, the area of influence from the unilateral use of CBIS could be discussed as having increased the amount of information gathered for product development related activities, facilitated decisions regarding opportunity recognition, as well as having facilitated product launch through increasing market knowledge. Ozer (2003) argues that the Internet makes the launching and marketing of new products more effective since Internet can be useful for information gathering, and also because it can assist with the dissemination of the information.

Another reason for why CBIS is preferred for unilateral purposes, in comparison with other media, could be discussed in terms of the perceived social presence needed for retrieving information. In the pre-study, several comments indicated that CBIS is a medium which requires low social presence. Comments like “It is an information channel that can be used freely”, indicates this. Furthermore, these comments also included accessibility of issues, where only certain information is accessible by using CBIS. These reasons seem understandable set against social presence theory, which assumes that media selection is a function of the cost for accessing information and the amount of social presence needed (Carlson and Davis, 1998). However, social presence theory has been used in order to understand that the task is demands a certain amount of social presence. It seems that the theory could also be used in order to understand how it is possible to avoid social presence to gather information unknowingly.

10.2.2 Storage and manipulation of information as aspects of unilateral use of CBIS

Other data-processing activities that seem to be influential as to why CBIS is unilaterally used compared to other media for product development, regard the possibility of storing and manipulating information that has been retrieved. In the empirical material these activities are connected, where storage of information seems to be a prerequisite for the manipulation of the information.
The main study revealed that Shelving Systems, Inc. has a website which is designed for market tests through that it captures and stores information about its visitors. This information is then manipulated into statistics about the visitors, as from where they have accessed the website, and how many visitors that have accessed the website for a given period of time. The use of CBIS seems to be influenced by that this alternative is perceived to be most efficient for gathering, and manipulation of information, in similar to what has been proposed in the literature (Huber, 1990).

It was mentioned in the empirical material that this use supports decision making activities, such as the need to develop new products, whether or not to continue with a product launch. Furthermore, the unilateral use of CBIS for storage and manipulation of information was also increases knowledge about the environment. This was especially the case in Shelving Systems, Inc. Ozer (2000) argues that the storage and manipulation of information gathered can increase efficiency and the rapidness in which information needed can be retrieved.

10.3 Multilateral use of CBIS for product development

Multilateral use of CBIS has been defined as the use of CBIS for distribution of information and communication between collaborating firms in product development processes. In the pre-study, several firms remarked that the multilateral use of CBIS for product development could be described as communication via electronic mail. Furthermore, a common remark was that the multilateral use of CBIS included the creation of blueprints with assistance of CAD applications and electronically mailing these CAD-files for comments and changes. The use of CBIS for multilateral purposes is also evident in the empirical material in the main study. Both Houses, Inc. and Shelving Systems, Inc. indicated usage of CBIS for multilateral purposes in their product development processes.

The main use of CBIS in Houses, Inc.’s product development processes included the use of CAD applications and communication applications, like electronic mail, for distribution of information and communication with cooperating partners. In contact with customers, CBIS is used for the visualization of products in order to meet customer requirements, as well as to make changes in the product as efficient as possible. In collaboration with craftsmen and architects, the use of CBIS mainly concerns the exchange of blueprints. The use of electronic mail was, in Houses, Inc, described as a complementary media for communication during the product development process.
As mentioned earlier, the multilateral use of CBIS for product development is evident in Shelving Systems, Inc. during the product development of the shelving system to the English retailer. Three types of relational use were defined regarding the multilateral use of CBIS in the product development process: 1) electronic mail for communication, 2) the use of a digital camera for visualization, and 3) the connection to the customer’s computer system. It could be assumed that the perception of the necessity to communicate with external parties during the product development process influences the use of CBIS. The use of CBIS also seems to be determined through a social process involving influence and power. The use of electronic mail was, in Shelving Systems, Inc, described as a complementary media for communication during the product development process.

Comparing the empirical material from the studies, it seems possible to extract four different features of CBIS usage: 1) electronic mail, 2) CAD, 3) digital camera, and 4) the connection to a customer’s computer system. These results are similar to Poon and Swatman (1999) that found that small firms mainly use electronic mail for business communication and for transferring files. The arguments for why these are used for multilateral purposes in product development instead of other media seem to relate to the data-processing activities that can be achieved through a CBIS (transmit, display, store, retrieve, capture, and manipulate). Based on this, the following sub-sections will present the reasons for why CBIS is used for multilateral purposes in product development instead of other media.

10.3.1 Transmission of information as an aspect of multilateral use of CBIS

One of the main data-processing activities which seems to influence the selection of CBIS instead of other media for multilateral use in the empirical material concerns the transmission of information and communication (e.g. the use of electronic mail for sending and receiving information). It seems possible to define several different dimensions of why CBIS is used instead of other media and also the different areas of influence the dimensions have on product development activities. Overall, it is possible to describe the reasons, given in the empirical material, as characteristics on communication influencing the selection to use a certain media. One reason for using CBIS instead of other media regards the perception that CBIS can facilitate the transmission of communication in product development collaboration compared to other media, which has also been described by Sillince, Macdonald et al. (1998).
The empirical material indicates that the use of CBIS can facilitate the transmission of information and communication, especially over geographical distances. In Houses, Inc., it was mentioned that CBIS could facilitate understanding and knowledge about what happens outside regional boundaries. Similar statements exist in the pre-study and in the case of Shelving Systems, Inc.

Another reason for why CBIS is chosen instead of other media regards the accessibility of asynchronous communication where the sender is not dependent on the receiver of being active at the same time as the information is transmitted. Comments concerning the selection of CBIS due to asynchronous possibilities are present both in the pre- and the main-study.

Another dimension concerning transmission concerns the speed of communication. In the main study, both firms argued that electronic mail was preferable in relation to other media for transmitting information between collaborating partners due to electronic mail being perceived as faster. In Shelving Systems, Inc. the perceived effect from the use of CBIS was a decrease in the time to market. However, time to market was not perceived as important in Houses, Inc., where instead the possibility to communicate efficiently was perceived to be important. The notion of speed-to-market has been increasingly cited as important for product development performance in the literature, however (Ozer, 2000). In the cases studied here, the difference between Shelving Systems, Inc. and Houses, Inc. were production and customer involvement. Shelving Systems, Inc. produces large series, while Houses, Inc. produces customer based singular products. In this, Houses, Inc. does not compete based on speed-to-market, the market for the singular product is already considered when the product is ordered, not delivered to the market.

Another argument for multilateral use of CBIS through transmitting electronic mail is based upon arguments concerning the cost of communication. In the pre-study, one firm mentioned that they used CBIS in the beginning of customer relations due to that the cost for communication is low, while the uncertainty about customer interest is large. This firm also mentioned that when the uncertainty about the customer interest decreases, communication turns to personal relation. This could be compared to the access/quality approach, indicating that the use of CBIS is based upon a cost benefit analysis (Swanson, 1987; Carlson and Davis, 1998).
Furthermore, the transmission of information and communication seems to be influenced by the different ways of communicating. The possibility to use several different applications and features of CBIS makes it possible to communicate in text, illustrations, etcetera. In the pre-study, firms argued that the use of CBIS for communication regarding the work with blueprints increased the efficiency of the collaboration, since all collaborating firms could work directly on the blueprint.

10.3.2 Displayed information as an aspect of multilateral use of CBIS

Another data-processing activity, display, was revealed in the empirical material, as influencing the choice to use CBIS for multilateral purposes in reference to other media. This data-processing activity has been pointed out as important in both cases in the main-study. Houses, Inc. used CAD applications while Shelving Systems, Inc. used a digital camera to display product related information to their customers.

In both cases, the use of CBIS for the function display regarded the need to communicate with the customer. In Houses, Inc. the product development process was entirely customer driven, where the understanding for what the customer wants forms during the product development process. In order to communicate complex product development information, where the product consists of a high number of details, the firm uses CBIS in order to present illustrations for the customer of what has been agreed upon and suggestions for how to solve certain customer demands. In this, CBIS is used to facilitate the display of large amounts of information, while it also brings on the possibility to make changes to the information relatively easily. The display function of CBIS usage is chosen in comparison to other media when communication is perceived to be too complex for other medias. From the studies, it is possible to propose that CBIS was chosen due to that it was perceived to support communication and increase the possibility to create shared meaning between the communicating parties.

It has been commented that using CBIS to display data depends on resource similarities among collaborating firms. In the pre-study, one CEO argued that the lack of standards in the architect industry obstructs the use of CBIS for displaying products through CAD software. However, as the main study illustrates, through Houses, Inc., CAD software is used for product display, where the customer visits the firm to view the product.
10.3.3 Storage of information as an aspect of multilateral use of CBIS

One data-processing activity that seems to influence the choice of using CBIS for multilateral purposes in the product development process is the possibility to store information and communication as evidenced in the pre- and main study.

One reason for using CBIS for multilateral purposes could be described as its ability to store information and communication, exchanged through electronic mail. Several empirical examples indicated that electronic mail was used as a media for storing what has been communicated during the product development processes, rendering the possible use of CBIS as a media which makes documentation of agreements possible. This use of CBIS was evident in both cases in the main study, where it was revealed that the use of electronic mail was determined by whether or not the communication was perceived as important enough to be stored. The influence of storing communication in the product development process was argued by Shelving Systems, Inc. to be useful if the customer changed his/hers mind on matters that had already been agreed upon.

Another reason for using CBIS regards the information consistency in collaboration. This was evident in the pre-study, where one firm argued that they would like to keep all blueprints on a website which would enable the firm and its customer to always have access to the latest version of the blueprint, thereby decreasing the risk for communicating wrong versions of blueprints. This reason for using CBIS instead of other medias could be described as the need for maintaining consistency across different versions of information (Court, 1997). The use of CBIS would therefore serve as a system that maintains consistency in the information in the collaborative product development process.

10.3.4 Retrieval of information as an aspect of multilateral use of CBIS

A further data processing activity that seems to influence how and why CBIS is multilateral, used for product development is labelled as retrieve. Shelving Systems, Inc., used this to connect to their English retailer’s computer system. This computer system was perceived to be able to solve administrative tasks during the product development process, and through this increase the efficiency of the product development process.

The selection to choose to use CBIS instead of other media seems to be influenced by the perception about the amount of information needed. Shelving Systems, Inc. connected to the English retailer’s computer system, offered the CEO information to his cell phone every time a single product was sold, a feature that he felt unnecessary.
10.4 A first step towards analysis of contextual influences

According to the empirical material from the pre- and the main study, the use of CBIS for the product development processes differs between the firms. The empirical descriptions from the main study are presented below. In Shelving Systems, Inc., the use of CBIS for product development is more directed towards a unilateral use, with the exception of the product development process of a shelving system where the product was developed together with the customer. In Houses, Inc., the use of CBIS is used completely as multilateral CBIS. Besides the differences in the main usage area, the way in which CBIS was used and the influences CBIS had for product development also differed between the firms. In this section a discussion about the possible reasons for these differences will be presented. It is possible to ask if the differences in the use of CBIS are due to differences in contexts of products, firms, and environments.

Apart from the difference between the usage areas of CBIS, products, firm, and environment characteristics also differed between the firms. At a product level, for instance the product complexity varies between. In the case of Shelving Systems, Inc., products were produced based on few components. In the case of Houses, Inc., however, products consisted of many components, indicating different complexities of the products.

At a firm level, differences are evident in technology, organization and strategy. Regarding technology differences, Shelving Systems, Inc. has a technologically intensive production that is non flexible and produces series, while Houses, Inc. has a labour intensive production that is flexible and produces singular products. At an organizational level, Shelving Systems, Inc. has more of a centralized organization, where the CEO works the production, and there are close connections between the actors in the firm. In Houses, Inc. the organization can be described as closer to a decentralized organization, where there is a distance between the strategic/tactic level and the operative level. At a strategic level, Shelving Systems, Inc. has more of a low cost strategy and has firm internal solutions regarding competence and resources. Houses, Inc. has more of a differentiated strategy and buys competence and resources outside the firm’s boundaries.

At an environment level, there are differences in how the firms collaborate, their competitiveness, and their market characteristics. For instance, Shelving Systems, Inc. develops products in a business-to-business relation while Houses, Inc. develops products in a business to private consumer.
10.5 Product related differences in product development

Based on the differences illustrated, this section analyses how product strategy, and product characteristics can be related to the use of CBIS for product development in the firms studied.

10.5.1 Product strategy

Pratali (2003) indicated that a product development strategy arises from the need to establish a link between customer needs and the needs satisfied by a firms product. Here it is argued that it is possible to distinguish between a market push and a market pull strategy for product development processes. It is possible to argue that unilateral use of CBIS for product development is more pronounced for a market push strategy, while multilateral use of CBIS for product development is more pronounced for a market pull strategy.

When comparing the firms from the main study, it is possible to view Houses, Inc. product development processes as dependant on market pull strategies. Houses, Inc. products can be divided into two categories, contract manufacturing to larger building constructors, and houses developed for private consumers. The products discussed here regard the houses developed for private consumers, which are developed in response to customer requirements and are completely developed as a customer based product, which can be compared to the market pull strategy. Regarding the product development processes of houses to private consumers, Houses, Inc. mentioned that CBIS was multilaterally used. In the product development process of a house for a private consumer, CBIS was multilaterally used in order to confirm that the customer’s wishes were fulfilled. Based on CAD drawings, the firm can communicate the product with the customer. Due to that, the customer is a part of the decisions made. Co-operating firms assist with the work on blueprints, so the firm uses CBIS for collaborative product development. In the development of a house concept, CBIS was used to facilitate the collaborative product development, where the customer has requirements for the product developed. The firm uses CBIS in order to illustrate the product and the assembling of the product for the customer.

Shelving Systems, Inc. product development processes are more dependant on market push strategies, apart from the product development process of a shelving system to an English retailer, which was were more of a market pull strategy since the originating idea came from the customer, and where the market/customer can be viewed as taking initiative for the development of the product. Regarding this
product development process, CBIS was mainly used for multilateral purposes. Regarding their products based on waste material, the product strategies were more aligned to a market push strategy, where the firm bases product development processes on its existing technology. The product development processes regarding waste material was developed to fit firm internal objectives, rather than the market and firm external objectives. In fact, the resulting products were destined to fit the thoughts of the business logic and the technology, which sometimes conflicts with the needs of the customers. Regarding the products developed from waste material, a market push strategy, Shelving Systems, Inc. mentioned that the use of CBIS was foremost unilateral, where information was gathered about competing products and the market. However, an exception from this is the development of a wall shelf, where the firm did not use CBIS at all, due to information not being perceived as important.

This discussion implies that when the product strategy relies on a market pull strategy CBIS has been multilaterally used, and as a link between the firm and the customers. When the product strategy is more of a market push and relies on internal product development sources, CBIS has been unilaterally used, as a way of retrieving information from and about the market. It seems that the use of CBIS regarding market push strategies are more of unilateral while the use of CBIS for market pull strategies are more of multilateral.

10.5.2 Product characteristics

Product development processes can range from honing of existing products to novel innovations, and also range from new to the firm, new for the market, or new for the world. Relating this subject to the literature, it is possible to assume that the higher a product can be rated on a newness scale, the more important and useful CBIS is. More innovative products involve greater uncertainties (Ozer, 2003, 2004) and uncertainty leads to gathering of information from external sources (Daft, Lengel et al., 1987). In this, it seems that unilateral use of CBIS would be higher for more innovative products. Although, it is also supposed that multilateral use of CBIS is higher for more innovative products, which can be argued through the equivocality explanation for information processing. According to Weick, this theory assumes that information is processed in order to establish mutual understandings between individuals (Weick, 1979), and the need to establish mutual understandings could be logically argued as more important when there are more complexities and newness attributed to the phenomena.
10.6 Firm related differences in product development

Firm related differences that are analysed towards CBIS usage for product development in this section concerns firm strategy, production technology, and organization.

10.6.1 Firm strategy

In Shelving Systems, Inc., cost efficiency has been indicated as a prerequisite for being competitive. The CEO perceives competition as coming from countries with low labour costs. In response, the firm has chosen a certain type of wood dimension, develops products that require as little labour as possible, and buy those products that are not affordable to produce. Furthermore, the firm are also plan the production of products in order to have as little waste material as possible. The CEO also mentions that the products developed are planned to suit the existing production, which makes it possible for the firm to have as few changes as possible in production. Shelving Systems, Inc.’s use of CBIS is directed towards cost reduction. Several examples indicate this. One example can be illustrated when the firm mentioned that opportunities regarding products developed based on waste material were generated from the firm’s customer’s websites. The alternative to this would be to hire a designer, which was perceived to be too costly. In the case of Shelving System, Inc., a low cost strategy directs the focus of the CBIS usage to information and collaboration.

House’s business idea was, from the beginning, to be a supplier of building material for the large building constructors; a strategy that according to the CEO has changed over time. The CEO further remarks that the firm’s strategy has to be decided upon, as the firm needs a balance between the two customer groups, which have different sets of requirements. The firm’s activities towards the customer group of private consumers can be described as a differentiated strategy, since the focus is to meet customer requirements to a niche which the firm has identified. In Houses, Inc. CBIS is used in order to make certain that customer requirements are fulfilled. This can be illustrated by the work with different CAD applications to illustrate the end product for the customer, where the product development process is kept at a speed where the customers have the possibility to change their minds. Houses, Inc. has more of a differentiated strategy and the use of CBIS seems to be directed to support this strategy. It seems as if a differentiated strategy directs the use of CBIS to mainly support effectiveness in product development.
It seems, when comparing these empirical examples, that firm strategy might influence the use of CBIS for product development activities. In the two cases compared, the use of CBIS is developed in order to support the firm strategies. The use of CBIS for product development in a low cost strategy focuses on efficiency enhancing activities. The focus of the CBIS usage in product development processes where the firm strategy is differentiated, however, seems to be more directed towards effectiveness enhancing activities.

10.6.2 Production technology

Similar to the nature of the product, Balachandra and Friar (1999) have also proposed that the nature of the technology can influence the management of product development. Technology is, according to their view, “how familiar a company is with the underlying technology of the new product”.

Shelving Systems, Inc. has a technology intensive production, where the production is highly automatic. The technology is non-flexible and the products developed are adjusted to fit the technology to as large an extent as possible, with the exception of the product development process of a shelving system to the English retailer. Regarding the connection between the production and product development, the CEO remarked that technology has to be considered for the products developed. This implies that the firm adjusts the products to their technology or even decides not to develop a product that is not possible to adjust to the technology. In this, CBIS is used as a tool for searching for possible products to produce given the firm’s technology.

In Houses, Inc. the production is highly labour intensive, and is adjusted to fit single production of houses, and is as a cause of this flexible and possible to alter fast. The technology is supposed to meet the different customer requirements and is why the firm has no lines, robots or automatic production. CBIS are used through CAD applications in order to facilitate the production through rendering production lists, that is it serves as a tool for how the product should be produced.

10.6.3 Organization

Comparing the organizations between Shelving Systems, Inc. and Houses, Inc. reveals that Shelving Systems, Inc. has a more centralized organization, while Houses, Inc. has a more decentralized organization. The CEO of Shelving Systems, Inc. stated that he works a lot in the production, while the personnel at the strategic and tactical level of Houses, Inc. has administrative work and are
separated from the production. The respondents from Houses, Inc. mentioned that when the firm had developed a house with CAD applications, production lists were printed out and distributed to the production. In this it seems possible that the use of CBIS for firm internal purposes are greater in decentralized organizations, compared to the use of CBIS in centralized organizations.

10.7 Environment related differences in product development

Environment related differences, market characteristics, collaboration and competition are discussed as having a possible influence on the use of CBIS for product development in the cases studied.

10.7.1 Market characteristics

As for the nature of the product and the nature of the technology, the nature of market can also be categorized into a dimension of newness. Balachandra and Friar (1999) argues that this dimension is correlated to the market uncertainty for the new product. This also implies that information about the market will vary depending on the newness dimension, and that the firm’s activities towards the market varies depending on the newness of the market. Hence, management of product development differs with regard to the nature of the market. As was indicated in the empirical material, the unilateral use of CBIS for product development is a way of gathering information from and about the environment. In this, the amount of CBIS usage could be assumed to depend on the knowledge about the environment (i.e. the perceived necessity to gather more information) and through this also by how volatile the market is (i.e. a more turbulent market requires more necessary information).

10.7.2 Collaboration in the value chain

At start, the firms serve different customer groups. Shelving Systems, Inc. has a business-to-business relation, where the more important customers are large firms. The part of the production/product development that is focused upon in the empirical description of Houses, Inc. is business-to-consumer, where Houses, Inc. develops and produces products towards private consumers. Shelving Systems, Inc. collaborated with a customer during the product development process of a shelving system. Houses, Inc. involves the customer in all product development processes.
The use of CBIS during these collaboration processes seems to differ to some extent. In Shelving Systems, Inc. CBIS was used for transferring information by electronic mail. The communication did not require any additional software except ordinary applications, such as the operating system, and standard applications for text editing and image viewing. In Houses, Inc. product development processes the applications used were more special, as different versions of CAD. This also made respondents from the firm state that communication depended on the CBIS resources held by the collaborating firm. In this, it seems as CBIS resources similarly determine the possibilities of using CBIS for multilateral purposes in collaborative product development.

Further, the differences in the relationships between Shelving Systems, Inc. and Houses, Inc. to their customers also propose another difference in CBIS for product development. In the product development process where Shelving Systems, Inc. collaborated with a customer, there were large differences in firm size and also in the power relation between the firms. The CEO of Shelving System, Inc. commented that these kinds of retailers are always on the hunt for competing or substituting products. This implies that the customer exercise influence in the relationship. When Houses, Inc. develops products there are several different collaborators, which differ to some extent but the power relation seems to be less extreme. It could be supposed that in collaborative product development, the multilateral use of CBIS is determined by influence and power in the relationship.

10.7.3 Competition and competitive advantage

Somewhat related to the firm strategy, the competition differs between the firms. Shelving Systems, Inc. focuses on a low cost strategy and perceives tough competition, while Houses has found a niche where competition is not perceived to be tough.

Shelving Systems, Inc. perceives it’s production technique to give the firm a competitive advantage and is why it is perceived as important to not spread this production technique. From the empirical description of the firm, it once showed it’s packaging technique to a competitor, which led to customer losses. This resulted in the firm gathering information that can help strengthen it’s competitiveness. Through using CBIS for unilateral purposes the firm has captured information about competing products, which has been perceived as valuable for positioning of products and for opportunity recognition. An example
from the pre-study also indicates that there is a perceived risk of using CBIS for communication, i.e. knowledge spillover effects

Houses, Inc. does not perceive any risk for knowledge spillover when communicating during product development processes, not even when sending blueprints. The mentioned reasons for this are that Houses, Inc. trusts the firms it cooperates with. Also, the information provided does not contain any technical secrets.

10.8 Summary

In this chapter, the results of the pre-study and the main study have been analyzed using the knowledge overview (i.e. the literature review) presented earlier. The chapter starts out with analyzing why CBIS is adopted for product development, because this perceived necessity and perceived benefits seem to have a reciprocal effect on the adoption of CBIS resources and for specific tasks as product development. On the other hand possessed or accessed CBIS competence seems to have an indirect influence on the adoption of CBIS resources, by influencing the perceived necessity and perceived benefits with adopting CBIS.

Thereafter the unilateral and multilateral usage of CBIS for product development was examined. Regarding how CBIS was used, data processing activities were used for describing the usage of CBIS, while media selection theories were used for understanding why CBIS was used and also in relation to product development literature for understanding the influence on product development processes and activities.

At the end of the chapter, a first step towards an analysis of contextual influences is presented. Due to the many different reasons for using CBIS for product development, differences in the frequency and amount of CBIS usage it is likely that there are contextual influences. Three contexts are discussed as influencing the use of CBIS for product development, the product, the firm, and the environment.
In this chapter, conclusions from the licentiate thesis are presented. Based on the results from the pre- and main study, the feedback to the research questions is given. Three areas are discussed: adoption of CBIS into the firm for a specific task, the use of CBIS in product development, and contextual influence on the relation between CBIS and product development. Further, directions for future research and implications for practice are also presented in this chapter.

In the first chapter of this licentiate thesis, the importance of small firm product development was argued. Techniques and methods for enhancing management and work with product development can thus be viewed as central. More and more discussions and debates are disseminated in research journals, although few are underpinning their arguments and propositions with empirical material. Furthermore, few have come to address the small firm context. In response, this licentiate thesis pre-study questions how and why small firms use CBIS for product development. A part of the purpose of the pre-study is also to identify how further research, in form of the main study, can address this research area. The results, from 36 interviews with CEOs of small firms in the wood industry, reveal two distinct usage areas of CBIS for product development: unilateral and multilateral usage. The main study set out to address questions such as: Why do some small firms use CBIS for product development? How do these small firms use CBIS for product development? How does the use of CBIS influence their product development? Based on interviews with informants from two firms, and regarding a total of five product development processes, the results are discussed along three parts: 1) adoption of CBIS into the firm and for product development (see section 11.1), 2) use and influence of CBIS for product development (see section 11.2), and 3) the role of contextual influences on CBIS for product development (see section 11.3).

11.1 Adoption of CBIS into the firm and for product development

One stream of literature on CBIS focuses on the adoption of CBIS resources into the firm. Similar to the results presented by Mehrtens, Cragg et al. (2001), the results of this licentiate thesis reveal that adoption of CBIS into the firm and for product development can be divided into perceived benefits, perceived necessity and CBIS competence. Furthermore, this licentiate thesis proposes an extension to this, by indicating that these constructs seems to be influential for the adoption/usage of CBIS resources for a specific task, as well as for adoption of CBIS resources into the firm.
Furthermore, the results of this licentiate thesis indicate that perceived benefits and perceived necessity individually form motives to adopt and use CBIS for product development. These can also have a reciprocal action for the adoption of CBIS resources and for the acquisition of CBIS competence. For instance, what seems to be a necessity gives rise to what could be a possible benefit, leading to further adoption of CBIS resources and competence.

A further result from the adoption literature in this study concerns the role of CBIS competence. CBIS competence has been viewed as having a direct effect on adoption of CBIS resources in the literature. However, in this study CBIS competence seems to relate to the perceived benefits and the perceived necessity of adopting CBIS. In this, the proposed relation between CBIS competence and CBIS adoption is indirect, through concepts such as perceived benefits and perceived necessity.

11.2 The use of CBIS for product development

Early studies about small firm use of CBIS revealed that the main usage was for efficiency enhancing activities, and that CBIS was used for accounting and firm internal administrative tasks. Later studies have proposed more and more areas of use for CBIS in the small firm. Also, empirical evidence for influence, along with logically derived propositions (see for instance Ozer), illustrate that CBIS is used and has an impact on organizations. In this study, research problems stated regard how and why some small firms use CBIS for product development, and what influences this use has for their product development processes.

Regarding the first question, how CBIS is used for product development, two forms of CBIS usage are identified in the pre- and main study of this licentiate thesis: unilateral and multilateral. Unilateral use of CBIS concerns the use of CBIS for the gathering of information from firm external sources, while multilateral use of CBIS concerns the use of CBIS for communication between the firm and firm external parties. Turning to the second questions, there are several different reasons for using CBIS for product development, with many complex relations between the concepts of CBIS and product development. This study has indicated that media selection theories can be used to some extant for understanding why small firms select a certain media for unilateral and/or multilateral use in their product development processes. Finally, the third question concerns the influence that the use of CBIS has on product development related activities and processes. Similar to what is stated by Powell and Dent-Micallef (1997), CBIS (in the article cited as IT) produces not itself sustainable competitive advantage, but advantages
can be gained through using CBIS. In the following sub-sections the main conclusions of the usage, including the reasons for selecting CBIS as media and the influences the media has are presented.

11.2.1 Unilateral use of CBIS for product development

The results concerning how and why CBIS is unilateral, used for product development, and what influences this use has on product development related activities and processes, can be divided into data processing activities with information retrieval on the one hand, and storage and manipulation on the other.

Regarding information retrieval as a data processing activity, there are at least two different motives for unilateral use of CBIS. The first motive can be understood through the media selection theory labelled as access/quality approach, where the main reason for selection of a certain media concerns the comparison of the cost for information to the quality of information. The theory postulates that information with inferior quality can be chosen when the cost for information is lower. CBIS is considered a media through which information is more accessible and where the cost for information is low. Another way of understanding this would be to assume that since CBIS is chosen due to that it is less costly, it is possible that more information could be gathered through the use of CBIS. The second motive concerns the perceived need to avoid social presence, in opposite to what social presence theory postulates, as reasons for media selection.

The other data processing activity for which CBIS was unilaterally used in product development regards the storage and manipulation of information. The reason for why CBIS is used for this activity seems to be through the perception that it is the most efficient media for gathering and manipulation of information. The influence from the use supports the knowledge about the environment and decision making activities regarding product development activities and processes.

11.2.2 Multilateral use of CBIS for product development

Regarding the questions how and why CBIS is used multilaterally for product development, and the influences of multilateral use of CBIS on product development, it is possible to divide the results as transmit, display, store, and retrieve.
The data processing activity regarding transmission of information was mainly present through the use of electronic mail with and without attachments such as CAD files. The decision to use CBIS seems to be influenced by whether CBIS can facilitate or improve communication. In turn, the influence the CBIS usage has on product development concerns the way in which communication is facilitated or improved. For instance, if time to market is perceived as an important aspect and CBIS is used because it is perceived as having characteristics as being faster to communicate through, the influence on product development regards the speed of the product development process.

Another data processing activity that seems to describe the multilateral use of CBIS is labelled display, due to the fact that CBIS was used in order to communicate complex product development information by presenting illustrations to customers. Reasons mentioned for selecting CBIS to display information in the product development process was that the media could facilitate the work with large amounts of information, while it also made it easier to make changes to information easier. However, the selection of using CBIS to support communication is due to the need to create shared meaning between the communicating parties, realizing the objectives of the product development process.

Further, a data processing activity suitable for describing the multilateral use of CBIS for product development, regards storage. The results reveal that storage of electronic mails can be used for documenting agreements made between parties during the product development process. Besides this, CBIS was also argued to be important due to its feature for maintaining information consistency between collaborating parties.

Regarding the relation between the data processing activity of retrieval and the multilateral use of CBIS for product development, it seems that media selection is influenced by the amount of information needed.

11.3 The role of contextual influences for CBIS usage in product development

Based on the results from this study, it is reasonable to assume that some form of contextual variables influence small firm usage of CBIS for product development. Several dimensions are possible to relate contextual influences, such as how frequently CBIS is used, how it is used, why it is used, and what influences it will have for product development related activities. Three different contexts are discussed as having possible influence.
The first context discussed is the product, where both product strategy and product characteristics seem to be influential on CBIS usage for product development. Regarding product strategy, the results indicate that when the product strategy is directed towards a market pull strategy, CBIS is multilaterally used as a connection between the firm and its customers. The opposite is true for a market push strategy, where CBIS is unilaterally used. Product characteristics, on the other hand, seem to influence CBIS usage for product development. The more innovative products are the more complex and hence involve greater uncertainties and a greater need for equivocality. This implies that CBIS is likely to be more used (both unilaterally and multilaterally) as the product characteristics become more innovative.

The second context discussed is the firm, where firm strategy, production technology, organization and CBIS resources and competence are derived as likely influential on the use of CBIS for product development. Concerning firm strategy, it is likely that CBIS is used to support the overall strategy, and through this is more likely to be directed towards efficiency enhancing activities when the strategy is directed towards low costs. Differentiated strategy, however, moves more towards effectiveness enhancing activities. As to production technology, the results reveal that production technology influences the way in which CBIS is directed. When the technology is stable, CBIS, is used for finding opportunities that fit the technology, but when the production technology is inflexible CBIS is used to facilitate the production. Centralization was also discussed as influential when CBIS is used for product development. It is proposed that CBIS for firm internal purposes is greater in decentralised organizations than in centralised organisations.

The third, and final, context discussed is the environment, where market characteristics, collaboration in the value chain, and competition and competitive advantage is discussed as likely influencing the use of CBIS for product development. Market characteristics can also be discussed along a newness dimension, where the amount of CBIS usage can be argued to depend on the knowledge about the market, and how volatile the market is. A more volatile market would require more information. Regarding collaboration in the value chain, it seems as if CBIS resource similarity determines the possibilities of using CBIS for multilateral purposes. Competition and competitive advantage is the last concept discussed, which seem to influence multilateral use of CBIS for product development.
11.4 Directions for future research

This research has shed some light on the small firm use of CBIS for product development. Although, more empirical studies are needed in order to understand the phenomena addressed in this licentiate thesis. As this licentiate thesis is highly explorative, further studies are necessary to understand the many and complex relations between CBIS (adoption, usage and influences) and small firm product development.

One way of advancing the understanding for this area is to focus more qualitative studies on any of the areas (adoption, use, and influence), or on to the entire phenomena. Further research about CBIS adoption could, for instance, benefit from focus on the interrelationship between perceived necessity, perceived benefits and CBIS competence. Another suggestion is to focus on how and why CBIS is used in small firm product development, where it is possible to focus specifically on the interrelationships between the concepts found in this study, and where process studies can focus on the use of CBIS for product development. Yet another possibility is to focus on the contextual influences, where this study has been especially explorative. Here, it is important to try to focus to solve those limitations in causality that exists through following product development processes over time, with longitudinal studies.

Another way of advancing knowledge about the phenomenon of interest could be to use quantitative methods. As stated in the beginning of this licentiate thesis, an understanding for the relationship between CBIS and product development is lacking in the small firm context. The results from this study have revealed that several small firms indicate that the use of CBIS is important for business activities and that the use of CBIS is considered to be more and more important with time. As empirical studies and studies based on logically derived propositions (see for instance Ozer) increases, our understanding the phenomenon of interest increases. It is important to test our inductive or deductive assumptions about aspects of the phenomena. For this, quantitative studies are a valuable method for modelling and testing propositions or hypotheses which are possible to formulate due to an increased understanding of the area.
11.5 Implications for practice

The results from this licentiate thesis are possible to view as through a lens, rendering a spectrum of implications based on the angle/reader. For the small firm, and the small firm manager, the results of this study can assist with information on examples on how CBIS can be adopted and used for product development and also how the use might influence product development activities and processes.

From another perspective, the literature on this subject proposes that the vast majority of small firms rely on standard applications to a large extent, and very few have especially designed applications. For developers of software, this licentiate thesis reveals that adoption of CBIS resources depends on the perceived necessity and benefits of using CBIS resources. In this, the applications provided to small firms need to extensively assist business activities. Furthermore, adoption of CBIS resources seems to be a process where perceived necessity and benefits have a reciprocal influence on each other. This makes it possible for the implementation of larger CBIS to be divided into parts, where the triad of competence, benefits and necessity can form synergies for the implementation and the further adoption.

Other potential benefactors from the results of this licentiate thesis are governments and organizations supporting and funding small firm computerization. During the last years, or even decade, government organizations have supported the adoption processes of CBIS resources for small firms. Hopefully, parts of this licentiate thesis could be of use for disentangling some of the questions concerning the making of such investments.


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Popay, J., A. Rogers and G. Williams (1998) "Rationale and standards for the systematic review of qualitative literature in health services research" Qualitative Health Research 8(3): 341-351


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Teo, T. S. H. and W. Y. Choo (2001) "Assessing the impact of using the Internet for competitive intelligence" Information and Management 39: 67-83
Young, R. C., J. D. Francis and C. H. Young (1993) "Innovation, High-Technology Use, and Flexibility in Small Manufacturing Firms" Growth and Change 24: 67-86
APPENDIX A: INTERVIEW GUIDE FOR THE PRE-STUDY IN SWEDISH

Intervjuerna tog mellan 10 och 20 minuter med samtliga 36 företag. För mer information om datainsamling se metodavsnittet.

1. Generell information
1.1 Datum:
1.2 Företag:
1.3 Respondent, namn, titel:
1.4 Antal anställda:
1.5 Verksamhetsbeskrivning:

2. Frågor rörande produktutveckling
2.1 I vilken utsträckning har företaget utvecklat produkter under de senaste två åren?
2.2 Hur kan företagets utveckling under de senaste två åren beskrivas med avseende på hur nya produkterna har varit och vilken inblandning andra aktörer har haft?

3. Frågor rörande användning av CBIS
3.1 Hur ser ni på användningen av datorer?
3.2 Vilka attityder har ni gentemot användningen?
3.3 Hur använder ni datorer, datorsystem och Internet för produktutvecklingssyften?
APPENDIX B: INTERVIEW GUIDE FOR THE PRE-STUDY IN ENGLISH

The interviews lasted between 10 and 20 minutes with all 36 firms. For more information about the data collection see the chapter about research methods.

1. Information in general
   1.1 Date:
   1.2 Firm:
   1.3 Respondent, name, title:
   1.4 Number of employees:
   1.5 Descriptions of business field:

2. Questions regarding product development
   2.1 To what extent have the firm developed products during the last two years?
   2.2 How can the firm’s development during the last two years be described with regard to the newness of the products and the involvement of other actors?

3. Questions regarding the use of CBIS
   3.1 What is your opinion on the use of computers?
   3.2 What attitudes do you have towards the use of computers?
   3.3 How do you use computers, software and/or Internet for product development purposes?
APPENDIX C: EMPIRICAL MATERIAL FROM THE PRE-STUDY

The table below presents field notes of the empirical material that has been generated in the pre-study. Further information about the data collection and the codification of firms can be found in chapter three, the pre-study. The questions answered in the first cell concern the regularity of product development, innovativeness, and external influences in product development. The second cell consists of information regarding the attitudes and use of CBIS.

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<th>A1:WH:s18</th>
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<th>☒ Yes ☐ No</th>
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<td>The firm has customer driven handicraft based production, and the products therefore change for every customer. Changes in products are often relatively small. “The products are mostly the same, with some details shifting to make every product unique for the customer.” Customers are a strong driving force in the firm’s development process and they have great influence over the products, states the CEO. During the last year the firm has lost many orders from customers, which, according to the CEO has forced the firm to find new working models. Among other alternatives, the firm is quite interested in using the Internet. The CEO expresses, however, that he feels that there is a risk that innovations can get “lost” on the Internet. He motivates this fear with by high risk of plagiarism if security isn’t sufficient. In spite of this, he feels that there are more incentives than impediments to use the Internet. “If someone would like to get hold of a certain information they would get it anyway, even if its getting harder if we don’t put it out on the internet” Further, the CEO express that he doesn’t belong to the computer generation and he does not handle the practical things with the firm’s interest regarding internet. “I still like to make decisions about how information should be spread over the Internet, but our factory manager is very good in implementing Internet solutions for the firm”. The firm first turned to the Internet when they created a website for marketing purposes. The firm now has two computers that are connected to the internet. “These computers are used foremost to handle our economy, and to search for material through the internet. We also use Internet to send information with electronic mail. A lot of our blueprints are made using CAD and we send them to constructors and architects. We find this most efficient because everybody can work on the material as they get it and send changes back immediately; it doesn’t include any extra work for anyone.” The CEO further expresses that he would like to get rid of all paper-blueprints and replace them with electronic versions. He motivates this by saying, “I have experienced customers receiving blueprints that are out of date because of communication losses. I would like to have a website were the customer can always retrieve the latest version of the blueprint so that these kind of mistakes are not repeated.”</td>
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<th>A2:WH:s7</th>
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<td>Product development processes are organized in a way that there is almost always a development project ongoing. The rate of innovation varies among the development processes in the firm, some are more radical and others are more incremental. “Some products take several years to develop, while others reach production fast. Our long term competitiveness comes from the radical development processes, while incremental changes are more important in short term.” There are some external influences in the product development processes, but according to the CEO, most processes are driven by the firm.</td>
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The CEO sees computer use and internet use as something obvious for the firm. “The use of computer systems to receive and distribute information is far superior to other methods.” The CEO further expresses that the firm uses search engines to find information about material and products, which provides the firm with new knowledge. The strength of computers is that there are so many different systems that can be used with the one technology. “We use CAD to create and redact blueprints. For distribution, we mainly use electronic mail, but we also have other forms of distribution over the Internet. That was one example of how we use different systems. We feel it is also important to use the variations in different software’s. We have to use the applications we are used to, and have knowledge about, to make it work.”

A3:WH:s15 | Use of CBIS for product development: Yes No

The firm is constantly developing new products, and during the last years there has been a number of new products introduced. We have made extensive changes in our products during the last time period, states the CEO. The CEO further expresses that there is some external influence in the firm’s development processes. The customers are the driving force, when developing new products since the firm produces customer based houses.

The firm has one computer that is connected to Internet. According to the CEO, this computer is used daily by a third of the office personnel for different purposes. The Internet, however, is not used for development purposes, expresses the CEO. Blueprints and development projects in the firm are of a simple nature, therefore with CAD or the Internet is of no use in these kinds of development processes. Computer systems became important regarding product development when it comes to documentation of product development processes.

A4:WH:s8 | Use of CBIS for product development: Yes No

The CEO states that there have been some changes in the firms product supply, although he mentions that these changes are quite small. The firm produces floors and the CEO mentions that the recent changes in the market for floors has caused the firm to make some changes. However, the CEO expressed his belief that “alone is strong” and that he does not collaborate during the product development processes.

The firm has also developed an interest in the Asian market and therefore the CEO is interested in work tools that can improve information flow. Computer systems in the firm today are not used for more than administrative and accounting purposes.

A5:HF:s2 | Use of CBIS for product development: Yes No

The CEO mentions “I live for developing new products. It is a natural extension of my work. It’s a combination between handicraft and inventor. My business is more about art than traditional wood-working and I must always develop new ideas and get them to the market.” The CEO continues by stating that “I have tried to develop products in everything from furniture in wood and metal to plates in glass. I’m always trying something new, and there are seldom any similarities between products.” Regarding external influences in product development the CEO mentions, ”I like to work alone. I want to follow my own inspiration and I certainly don’t want to be obstructed by what others think or feel is right. I don’t even test my ideas or concepts on others, it’s just about feeling what’s right, and I always follow my instincts.”

“I have limited knowledge about computers. I think that computerized systems can be good, but according to my experience you have to know how to work the computers to receive any benefits from them.” Some of the firm’s sales come from their website. The CEO is not satisfied with the website and he feels that he doesn’t support the site in the way he should.
According to him, this is due to his inexperience with computers. Further, cooperation or shared information through computers is not a consideration due to the CEOs attitude towards cooperation.

A6:MW:s90  Use of CBIS for product development: ☒ Yes ☐ No

According to the CEO the firm has developed products during the last years. Although, there are no great differences in the firm’s product portfolio, more modifications and extensions. The CEO further mentions that customers and suppliers influence the firm’s product portfolio, through both influences and customer demand.

"I do not see any threat from the Internet. The risks combined with hacking or lost knowledge through the Internet is insignificant. There are great opportunities associated with the Internet when it comes to information and communication. It can also be a valuable resource for knowledge management in the future. The reason for us not using the Internet to a high extent today is due to laziness in accepting the new possibilities it offers. We have high hopes for the possibilities of the Internet. For us, it’s just to shape up and start using the technology.” The CEO doesn’t believe in a common system for collaboration. “Because the firms have different maturity levels, it is better that they use systems that they are familiar with. A common system can obstruct creativity, and therefore stunt how they are used”. The current use of Internet technologies is mainly focused on searching for information, finding resources, and establishing contacts. Business is not created through the Internet, and the use of the Internet for development purposes is mainly about gathering relevant information.

A7:WH:s8  Use of CBIS for product development: ☐ Yes ☒ No

The firm has customer based production, where the customer is the focus for both the development and production of each product. The CEO mentions that environmental influences of the products all originate from the customers.

The CEO states that the firm is very positive towards the use of computer systems in product development. Existing computer support for development projects is planned to be extended in a couple of years. It is felt that people will have more knowledge about how to use computers at this time and it is less likely that single people will obstruct computer use because of refusal to use them or a limited knowledge base. ”A great deal of information is exchanged between the firm it’s customers due to customer driven production. The majority of the information (about 95%) is distributed using ordinary mail or by fax. Only about 5% of communication is generated from electronic mail and websites.” The CEO also mentions that he feels that it is a problem that there is still many that refuse to use computers, or have limited knowledge in using them. Another thing that obstructs the use of computer systems, according to the CEO, is the lack of standards in the architect industry. This implies that the format of electronic blueprints varies and that end users must have support for different software. This is not economically feasible for firms, and while there is a possibility to export the blueprints as digital pictures, the advantages of manipulating them electronically disappears.

A8:CA:s1  Use of CBIS for product development: ☐ Yes ☒ No

The CEO mentions that he is active in several industries and that he lives for learning new things about the products and their possible use in the industries, he works in. The firm is mainly concerned with development, although production is necessary to keep food on the table, says the CEO.

"There are great opportunities to use CBIS within several areas of the business. Further, the use of CBIS can make it easier for small firms through connecting them and letting them act as one big firm through an Internet portal.” One problem, according to the CEO, is that many
firms do not have the maturity to use computers, or for that matter, computer systems. The use of CBIS demands continuity. It is, therefore, important that all involved firms have a working knowledge of computers. “I have seen several attempts to use these kind of systems that haven’t worked because of a link in the chain who didn’t have a working knowledge of computers. This weak link is enough to stop the use of the system”. The CEO expresses that the firm uses computer systems to handle the distribution of information for product development purposes. Further, the CEO comments that many firms use what he believes is a non-rational system of distributing information. He points out that they send blueprints for comments with ordinary mail or fax. His point being that changes cannot be directly added to the blueprint which make it possible to see the consequences of the changes instantly. This creates double the work when changes have to be registered in the CAD software, or if the blueprint has been written by hand, entirely rewritten. “The use of blueprints is drastically decreased when it can’t be reworked”. The CEO also comments that the printed or faxed blueprints are such bad resolution in some cases, there is no way in which you can see what they are supposed to represent.

The CEO states that there have been relatively small changes in the products during the last years. “There are few radical changes in this industry” states the CEO, he goes on to say that changes happen mainly in production. Although there is some renewal in the products as well, most changes to existing products are minor.

The CEO feels like computer systems can be used for something, he just doesn’t know what. He feels that his knowledge about computers is to low. There are some computers at the office that are connected to internet, he points out, and he is certain that there must be some ways in which he can use these for something. "There are not so many development collaborations, and it doesn’t feel relevant to scan our environment with a computer system. We believe that our knowledge about our environment is sufficient, and there are not so many millworks in this area, so we think that we know most about our competitors already”.

The CEO express that Internet support can be of importance for the firm and that the Internet is a good tool for the distribution of information. Further, the CEO express that he believes that internet is the future and that it is important to take time to learn about computers now, before it’s an absolute requirement. The use of computers is mostly about electronic mail and Internet for sending and retrieving information. Information that is retrieved from the Internet is mostly about customer needs, products and raw material. The CEO express that internet is a great tool for sending and retrieving information. “It is an information channel that can be used freely”.

The firm has customer driven product development, and therefore products change with new customers or with new customer demands. The CEO believes that the firm’s product development can be summarized as small changes in existing products. There is one main product that is modified due to customer influence and, is therefore of great importance to the
development processes in the firm, states the CEO. The firm has computers that are connected to the Internet. They are used for searching for information about certain customer groups, and a place where a certain information is shared with the customers. According to the firm, it is information in the early process of product development that is shared through internet. The reason for this is that the cost of sharing information is low, in comparison to the risk that the customer is not interested in the product. When the customer gets more interested, the information results in personal contacts. For the firm, Internet is not necessary for blueprints or detailed product information due to the simplicity of the firms products.

Use of CBIS for product development: ☒ Yes ☐ No

The CEO mentions that the firm has developed several new products, many of these are made in collaboration with the firm’s largest customer, who also has ownership interest in the firm. Otherwise, the CEO mentions that he believes that the firm could be better when it comes to cooperation in product development. He feels he does not know enough about the firms in the region, so he is unsure where to turn for assistance.

“There are many opportunities, and few threats, when it comes to computer systems.” One main interest is to use computer systems to scan other firms to assess their resources. There has not been much use of computer systems for enhancing technical aspects of the products, due to the simplicity of the products. “If the products were of more complex nature, it would be an interesting alternative to use computers for experimenting, scanning material characteristics, as well as receive information from other firms. It is much more effective to receive information through the Internet in comparison with other alternatives”.

Use of CBIS for product development: ☐ Yes ☒ No

The firm has launched few new products during the last years. The CEO expresses that the firm has saved for large investments in development processes for the future. The last couple of years have been quite turbulent, with a shift of CEO, and there has also been some changes in the firms existing products. But, as the CEO express it, there is more work to do with the firms product supply. The new CEO mentions that he has had much help from other firms while starting in the industry. He credits this help as very important as he has been working in a completely different industry before.

“We use computers to some extent today, and our equipment is modern. I believe that it is important to keep all information channels open and I’m certain that the use of computer systems will grow in the future.” The firm doesn’t use the Internet in development processes to any high extent, according to the CEO. “We receive some orders through the Internet today, and our customers often send information through electronic mail, but that’s about it.”

Use of CBIS for product development: ☐ Yes ☒ No

The firm has developed several new products during the last two years. The reason for this is, according to the CEO, that profitability has been low and the firm has had to engage in risky projects in order to improve its long term competitiveness. Most development is about incremental changes, according to the CEO. The CEO expresses that projects have often been developed together with customers.

“We are very interested in computerized solutions. We have just not found the right systems for our purposes yet. I would like a system that could connect us to a sales channel and through which product development information could be exchanged. I think that’s possible as long as it is efficient.” The CEO comments that he uses the Internet for some scanning purposes. “Its interesting to see what resources other firms have and what information they
put out on their websites, but its just curiosity that drives this use. We don’t use this information for anything special.”

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<th>A15:JO:s2</th>
<th>Use of CBIS for product development:</th>
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<td>“We have not developed any new products during the last years. We have focused on existing products and made some big changes in them.” The work has mostly been directed to improving already existing products, according to the CEO. In some cases this has lead to big changes in the products, expresses the CEO. He also mentions that all work regarding this has been developed within the firm.</td>
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The CEO express that there are many that are reluctant to use computers, besides himself. He states that the interest in computer use decreases with every negative user, and to his knowledge, there is not much use of computerized systems within the firms in his value chain. Besides using the Internet to increase knowledge about other firms within the industry, the CEO cannot see the use of computerized solutions for product development purposes.

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<th>A16:WH:s2</th>
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<td>According to the CEO, the firm produces custom-made wooden houses. “Everything we do is about developing for new customers. But it is not innovations; it is rather small changes in the products.” The CEO express that it is mainly about incremental changes in products. “We do what we do and it doesn’t feel like we are launching any new products. In some cases it isn’t even about new designs.” Further, the CEO express that development is about the honing of existing products. “We are getting better and better at what we do”, according to the CEO. The firm is mostly conducting development processes with the customers and from their own experience. The CEO also express that he has had thoughts about larger development projects. “We can not consider large scale processes alone. It demands some collaboration to put out larger projects.” According to the CEO, he has thought about changing existing house materials to timber, a new area of usage for their firm’s production.</td>
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The CEO expresses that he is not interested in computerized solutions. Further, the CEO expresses that the firm has outsourced their electronic mail in order to be free from computer use. “It is only bothersome with computers”.

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<th>Yes</th>
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<td>“About 80% of our production is piecework, and the remaining 20% is our own products”. The CEO express that this is the why the firm has not developed any new products during the last years. “We rely on our production of piecework”. According to the CEO, the firm has made some adjustments in their products due to customer wishes; and that the closest thing to development is new directives for the firm’s piecework.</td>
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“I don’t see a direct use for computers in our product development. Nothing that I can think of anyway.” The CEO further states that the firm doesn’t use computers to any high extent. “Perhaps we could search for information over the Internet, but I’m not sure that it would be of any use.”

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<th>A18:JO:s1</th>
<th>Use of CBIS for product development:</th>
<th>Yes</th>
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<td>The CEO express that product development often is due to customers wishes. “We have small projects now and then that we work on”. It is mainly about incremental changes in products,”…but every now and then we do something that is new for us”. When it is about new products for the firm, the firm is assisted by suppliers and also by a contact that works within the industry. “When it comes to new products, were we lack competence we often turn to this contact person to get assistance”. The CEO express that this person is also responsible for the sales of some of the firms products.</td>
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177
“I like computers” expresses the CEO. He further reveals that he uses a variety of computer applications. “At one time we repaired computers for other firms”. According to the CEO he sometimes receives blueprints through electronic mail. He also uses CAD, or similar software, to construct blueprints for new products. “That’s about what we use regarding product development with the use of CBIS”.

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<th>A19:MW:s2</th>
<th>Use of CBIS for product development: ☐ Yes ☒ No</th>
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<td>&quot;We have made small adjustments in our products during the last years”, says the CEO. He further mentions that the firm has established its business, and changes in the products are not necessary to any greater extent. In this, the firm does not perceive it to be important to collaborate in regards to the changes made in their products.</td>
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The main reasons for using computer systems for product development would be to increase the information processing capacity of the firm, mentions the CEO. The firm doesn’t use computer systems for information and communication in their product development processes, as the firm does not cooperate to any high extent.

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<td>“I make specially constructed timber houses” expresses the CEO. The firm wants to expand their product portfolio to offer a larger variety of houses, but lacks the financial capital to do this. Mainly incremental changes have been made in the products so far, states the CEO. He hopes that he will be able to afford to make more radical changes in the future. Customers are an important part of the incremental changes, according to the CEO.</td>
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The CEO express that he doesn’t see any advantages with using CBIS for product development. “When I’m about to make changes in products, I simply ask the customers what they want and then we discuss possible solutions”. The firm doesn’t use computerized systems for product development processes.

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<th>A21:HF:s15</th>
<th>Use of CBIS for product development: ☒ Yes ☐ No</th>
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<td>“We have developed several new products during the last two years” states the CEO. He motivates this with commenting the importance of continually changes in the product portfolio when it comes to office furniture’s, since the market for office furniture’s is based on fashion. There are always new materials and designs that the firm has to scan in order to keep up with the competitors, states the CEO. “We have an advantage in competition to our large competitors. We can change our entire production much faster then they can because we are small and flexible.” The CEO expresses that standard components are often used in the new products. He continues by mentioning that the firm has had incremental and radical changes in their products during the last two years and occasionally produce an entirely new series of products. “There is something unique with every product we make” concludes the CEO. He states that the firm makes adjustments in products for different customers. “It is fashion that drives the products. It is all about trends, so it is important to be very sensitive to the market”.</td>
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</tbody>
</table>

According to the CEO it is important to meet people; that communication should take place between people and not their machines. He does state, however, that computers do have some good features. “Some information can be received through Internet. As I have said, it is important to have the ears of an elephant to keep up with the market.” According to the CEO, product development is also much about experimenting and trying. He feels like computer systems can’t assist him when it comes to this. “We don’t have the kind of products that require blueprints, or that can be assisted from computer systems during the development phase”.

<table>
<thead>
<tr>
<th>A22:JO:s5</th>
<th>Use of CBIS for product development: ☒ Yes ☐ No</th>
</tr>
</thead>
</table>
The firm has developed several new products during the last two years, as well as making some changes to existing products. It is more incremental changes in the development processes, which have been implemented, expresses the CEO. "A large part of our products are adjusted for the customers," he states. He goes on to say that he believes it is important to get external influences for the development of new products.

"I can see a great potential for computer solutions. I have some ideas about the future use of different systems, but today’s use is quite simple.” The firm uses the Internet to scan information about other firms in the industry, and also to communicate with these firms. The CEO states that it’s more rational to use computers for information distribution. “We are connected to a portal with several other firms in the wood industry and we use our website to inform and present activities, and also for marketing purposes.” The CEO states that he would like to improve the system to give customers the possibility to express ideas for new products. “This system could bring on some coordination effects that we could have great use of in our development processes”.

A23:JO:s1  Use of CBIS for product development: ☑ Yes ☒ No

The CEO states that the firm has had several development processes running the last years. Further, the CEO expresses that changes on the market have forced the firm to make changes in their existing products. According to the CEO, the market has been important for development processes. "Customers, suppliers and firms with which I have social relations, have been useful in our development processes".

Regarding computer usage, the CEO express that he has low confidence and that they are difficult to learn to use. He further states that he is too old to have a good working knowledge about computers, and that he doesn’t see any use for them that can outweigh the difficulty in learning to use them.

A24:WH:s15  Use of CBIS for product development: ☒ Yes ☑ No

Several new products have been launched during the last two years, states the CEO. “It is quite natural for us. We want to expand, and product development is a means to reach an end. It is natural to have changes in the supply of products” states the CEO. The firm collaborates with other firms within the industry when developing new products. The CEO goes on the mention that it is really important to involve customers in the product development processes.

The firm does not have much interest in using computerized systems to do the development of product development. Their usefulness is seen in relation to information possibilities, as either scanning functions or to improve the information distribution between the firms. ”Our business is remotely located and we are using computer systems, to some extent, to improve our communication with the market and with the firms we collaborate with.”

A25:WH:s4  Use of CBIS for product development: ☐ Yes ☒ No

The CEO express that the firm not has launched any new products during the last two years. "It is mostly about small changes in our existing products, but they are very similar to the products we had a couple of years ago”. They produce customer adjusted timber houses, and therefore the customers have some influence on the new products, states the CEO.

The CEO express that the interest in using the Internet is very low in general. Further, he points out that it is not an appropriate tool to use for development processes. “It is other things that are important, those which can’t be done through a computer” states the CEO.

A26:WH:s14  Use of CBIS for product development: ☐ Yes ☒ No

The firm has conducted several development processes during the last two years, according to the CEO. “We have had some financial troubles”. The firm has changed CEO and owner, but
according to the current CEO, the firm is on track again. Product development has mainly aimed to complement the existing portfolio of products. The CEO reveals that the firm intends to broaden their products offered in order to compete with larger firms on the Swedish market.

“We are very positive towards computer based solutions” states the CEO. The firm is interested in computer systems that can combine collaborating firms. The CEO states that the firm is interested in using CAD software together with other firms. “It could also be of some interest to see what others have in their stock, and also share administrative and accounting software among several firms”.

A27:JO:s7 Use of CBIS for product development: □ Yes ☒ No

The CEO states that the firm has been devoted to it’s products and that there haven’t been any bigger changes. ”Some small adjustments in products due to the market have been developed, but that’s about it.”

“I have nothing against computers, but I don’t have the time. I don’t see how I could get the time to play with a computer. I have one employee that does everything with accounting and things like that. I’m with the others, trying to run the business and plan; ordering and so on. I can guarantee you that its enough for me to do”

A28:JO:s12 Use of CBIS for product development: ☒ Yes □ No

“Its kind of my personality to develop new things. I like to have something that puzzles my head. It is either new products or processes” Regarding the firms products, it is mainly about incremental changes, according to the CEO. He further states that he has implemnted more radical changes in process development. “I have made some new machines for production, for instance,” reveals the CEO. According to the CEO, he has some contacts with other firms in the industry which he helps with development, and they also help him.

“I certainly don’t have anything against computers.” The CEO express that the firm uses computerized systems to scan competitors in order to reveal their products. Further, the firm uses mail to distribute information in collaborations.

A29:WH:s6 Use of CBIS for product development: □ Yes ☒ No

“We have worked hard the last couple of years with our products. We are trying to get rid of products that are not profitable, and replace them with new products. Several new products have been added and we have now a broader supply. We have made a shift for more products geared towards consumers, and tried to decrease our business geared towards other firms.” According to the CEO, there have been drastic changes in the firms products during the last years. Further, the CEO expresses that, “we have also found ways to use, for instance, the waste from our production in a way that we can sell it to other firms in the wood industry who refines it further.”

The firm is positive towards computerized solutions. The CEO expresses that “It could be fun to use … I believe that it could be of some use too. It could be interesting to use a combined system which we could sell through and could also serve as a system which we could use to receive information from customers about possible changes in our products.”

A30:WH:s5 Use of CBIS for product development: ☒ Yes □ No

“We have made great investments in development processes during the last couple of years. It has been a period where this has been necessary,” said the CEO He goes on to express that it is most important to collaborate when conducting product development activities, “We are too small for it to be possible for us to develop products by ourselves”.

The CEO express that he doesn’t have any motivation to use computerized systems for
product development processes. “In fact, I don’t believe that I have any use with Internet
technology.” According to the CEO, the firm has not used any computerized systems for
sending or retrieving information during their product development processes.

A31:WH:s15  Use of CBIS for product development: ☒ Yes ☐ No
The CEO mentioned that the firm has made big changes in their existing products during the
last years. In this, the firm’s customers (retailers) have been of importance to the modifications
of the products.

The CEO is neither enthusiastic nor negative towards computer usage. “Computers can be of
assistance but should be used as a tool”, states the CEO. The use of computer systems in
product development is relatively small, according to the CEO. “Some information has been
sent and received through electronic mail which could have been done through personal
contacts. It was easier, however, to use electronic mail as to not be dependent on people to
receive information as I send it.”

A32:JO:s5  Use of CBIS for product development: ☐ Yes ☒ No
The firm has not developed any new products during the last year, just minor changes in some
products. The minor changes are, according to the CEO, mainly about the firm removing
some products from production and making some small adjustments to the remaining
products. The CEO states that there are no external influences in the product development
processes.

The CEO expresses that he is interested in computers and computer systems. He doesn’t feel
that this use can assist technical aspects of development, such as using CAD or similar systems
among collaborating firms. He expresses “this way of working doesn’t suite our firm”. The
firm uses CBIS more for scanning the market and to find out what products exist. “The use of
computer systems is mainly to receive information, not so much about joint cooperation with
common blueprints”.

A33:MW:s33  Use of CBIS for product development: ☐ Yes ☒ No
The firm has developed products based on waste material during the last years in order to be
more competitive and to improve profitability. Further, making the firm more profitable has
also caused large differences in the firm’s existing products. The CEO states that influence
from other firms is not very important to the firm’s product development processes.

There are some ambiguous feelings about what computer systems can assist with in the firm.
“If we find a way to use computers to facilitate our development processes, we will use it”.
One motive to use computers is to scan resources and competences among collaborating
partners and potential partners. The use of computers today is mainly for internal
administrative purposes.

A34:HF:s10  Use of CBIS for product development: ☒ Yes ☐ No
There has been a lot of work with new products during the last years. It has been a necessity in
order for the firm to be competitive. The firm has developed new products and product
groups, as well as made modifications to existing products during the last years. The CEO
expresses that he had some contact with collaborating firms, and customers, when developing
new products. Most product ideas have been discussed with the firm’s customers.

“There are some ways in which the Internet can be used which I like. But my knowledge is not
so good about it, so I’m depending on my sons who have developed some IT support for us.”
“We use a website which generates some of our sales. The interesting thing with this site is that
we have a part which only we can see, and where information about visitors is presented. Both
IP numbers and statistics for how many visitors we had per day can be retrieved. We usually
scan this information for the markets reactions to changes in our products, and the effects of advertising.”

<table>
<thead>
<tr>
<th>A35:HF:s1</th>
<th>Use of CBIS for product development: Yes No</th>
</tr>
</thead>
<tbody>
<tr>
<td>“There have been enormous investments in product development during the last two years. The firm was new and started due to an idea for a new product, so pretty much everything in the firm is about the development of this product.” The product is completely new and has been patented. According to the CEO, no firm has produced a product similar to what he has patented. The CEO mentions that he has had great use of personal connections with other firms in the wood industry. “I’m new in the industry, and lack the experience and the deep knowledge. The contacts with firms that have expert knowledge have been a necessity for the product development process.”</td>
<td></td>
</tr>
</tbody>
</table>

The CEO expresses that he has great motives to use a computer based system for information and communication with other actors in the development process. One major motive to use a computerized system is the possibility to scan and receive information about competencies and resources among collaborating firms. The use of computerized systems today is mainly for sending and receiving information from other firms through electronic mail. The CEO states that he would like more computerized solutions in the future, when the firm is better established, and when the first product has reached the market.

<table>
<thead>
<tr>
<th>A36:JO:s4</th>
<th>Use of CBIS for product development: Yes No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The firm has produced new products built upon small changes of existing products, as well new products that are entirely new to the firm. All product ideas came from the firm’s customers. The CEO expresses that the market drives the firm and that, ”we don’t do anything without knowing that there is a market for it”. The firm occasionally uses suppliers in the development process in order to get access to expert competencies and resources.</td>
<td></td>
</tr>
</tbody>
</table>

There is a small interest for using computer systems. The CEO expresses that “I don’t have the interest to use computers, but it can be fun to use computers to scan other firms activities.”
APPENDIX D: GUIDE FOR NARRATIVES IN SWEDISH

Checklista för intervju med VD

Företag
Respondent
Datum
Adress
Telefon
Fax
Hemsida

Band
Från kl
Till kl

Introduktion till företaget och produktutveckling

- Beskrivning av företagets verksamhet (produktion)
- Produktutveckling i relation till verksamheten
- Datorisering (hur många datorer, hur länge, användningsområden, vilka använder)

Narratives

- Vilka produkter har ni utvecklat och hur skiljer sig produktutvecklingsprocesserna från varandra (karakteristika)?

- Produkt att diskutera ____________________________

- Företagets läge vid produktutvecklingen
  - Antal anställda, omsättning, etcetera
  - Viktigaste konkurrensfördel
  - Beskrivning av samarbetspartners, kunder, huvudkonkurrenter och leverantörer
  - Produkter, teknik, marknader, industri
  - affärsidé/strategi

- Kan du berätta hur ni gick tillväga när ni utvecklade produkten?
  - Hur gick arbetet till internt under produktutvecklingsprocessen (idéutveckling, produktutveckling, lansering)
  - Initiativ (Vem, var, när, varför, plan)
  - Arbetsfördelning
  - Ansvar och befogenheter
  - Beslutsfattande
  - Risktagande
  - Lärande
  - Kreativitet
  - Osäkerhet

---

7 Ny/befintlig marknad, Ny/befintlig produkt, Lyckad/misslyckad process/produkt etcetera
8 Starta redan från den första idén och berätta om hur processen såg ut fram till och med försäljningen av produkten. Relatera fakta till när det hände (vilken dag, månad etcetera)
Hur gick arbetet till med avseende på extern information som används samt kommunikation med externa aktörer (idéutveckling, produktutveckling, lansering)

**Information**
- Varför, till vilket ändamål information har samlats in
- När samlades information in (idéutveckling, produktutveckling, lansering)
- Från vem/varifrån information har samlats in
- Hur extern information har samlats in (personliga kontakter, Internet etc.)
- Vilken betydelse hade sättet att samla in information
- Hur informationen användes

**Kommunikation**
- Har, och om så varför har, kommunikation med externa aktörer ägt rum
- När i produktutvecklingsprocessen kommunikerade ni med externa aktörer (idéutveckling, produktutveckling, lansering)
- Med vem har kommunikation ägt rum
- Hur ägde kommunikationen rum (personliga kontakter, Internet etc.)
- Vilken betydelse hade sättet att kommunicera
- Hur användes kommunikationen i produktutvecklingsprocessen

- Vad var svårt, lätt under processen
- Vad gick bra, dåligt under processen
- Vilken betydelse har den externa informationen spelat i produktutvecklingsprocessen?
- Vilka skillnader hade det varit om ni inte använt IT (för-/nackdelar)?
- Produkten lyckad/misslyckad? Motivera!
- Det skulle vara intressant att vilken syn Ni har på hur datoriserade informationssystem används i produktutveckling och vilken betydelse användningen har?
- Är det något du vill tillägga?

**Avslutande frågor**
- företagets historik från grundaren fram till nuläget, relatera produktutveckling
- Vilka från företaget har mer varit inblandade i produktutvecklingsprojektet?
  - Vilken roll har de haft i produktutvecklingsarbetet?
  - Hur skulle du beskriva deras inblandning?

---

9 Gentemot förväntat utfall? Fanns uppsatta mål, i sådana fall vilka kriterier fanns och vad var utfallet?
Checklista för intervju med personal

Företag
Respondent
Datum
Telefon
e-post
Band
Från kl
Till kl

Bakgrundsfrågor
Frågor rörande förståelse för roll i företaget och produktutveckling
- Hur länge anställd i företaget
- vilken roll i företaget under anställningen
- Nuvarande arbetsuppgifter (ansvar och befogenheter)

Narratives
- Produkt att diskutera ____________________________________________
- Kan du berätta hur ni gick tillväga när ni utvecklade produkten

  Hur gick arbetet till internt under produktutvecklingsprocessen (idéeutveckling, produktutveckling, lansering)
  - Initiativ
  - Arbetsfördelning
  - Ansvar och befogenheter
  - Beslutsfattande
  - Risktagande
  - Lärande
  - Kreativitet
  - Osäkerhet
  Hur gick arbetet till med avseende på extern information som använts samt kommunikation med externa aktörer (idéeutveckling, produktutveckling, lansering)
  Information
  - Varför, till vilket ändamål information har samlats in
  - När samlades information in (idéeutveckling, produktutveckling, lansering)
  - Från vem/varifrån information har samlats in
  - Hur extern information har samlats in (personliga kontakter, Internet etc.)
  - Vilken betydelse hade sättet att samla in information
  - Hur informationen användes

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10 Starta redan från den första idén och berätta sekventiellt om hur processen såg ut fram till och med försäljningen av produkten. Relatera fakta till när det hände (vilken månad)
Kommunikation

- Har, och om så varför har, kommunikation med externa aktörer ägt rum
- När i produktutvecklingsprocessen kommunicerade ni med externa aktörer (idéutveckling, produktutveckling, lansering)
- Med vem har kommunikation ägt rum
- Hur ägde kommunikationen rum (personliga kontakter, Internet etc.)
- Vilken betydelse hade sättet att kommunicera
- Hur användes kommunikationen i produktutvecklingsprocessen

- Vad var svårt, lätt under processen
- Vad gick bra, dåligt under processen
- Vilken betydelse har den externa informationen spelat i produktutvecklingsprocessen?
- Vilka skillnader hade det varit om ni inte använt IT (för-/nackdelar)?
- Produkten lyckad/misslyckad? Motivera!
- Det skulle vara intressant att vilken syn Ni har på hur datoriserade informationssystem används i produktutveckling och vilken betydelse användningen har?
- Är det något du vill tillägga?

Avslutande frågor

- Vilka från företaget har mer varit inblandade i produktutvecklingsprojektet?
  - Vilken roll har de haft i produktutvecklingsarbetet?
  - Hur skulle du beskriva deras inblandning?
APPENDIX E: GUIDE FOR NARRATIVES IN ENGLISH

Checklist for interview with CEO

Firm
Respondent
Date
From
To
Adress
Phone
Fax
Website
e-mail

Introduction to firm and product development
- Description of the firm’s business (production)
- Product development in relation to business
- Computerization (how many computers, how long, usage areas, who are users)

Narratives
- What products have you developed and how does the product development processes differ (characteristics)\(^{11}\)?
- Product to discuss

- About the firm at the time for the product development
- Number of employees, sales etcetera
- Competitiveness
- Description of collaborating firms’, customers, main competitors and suppliers
- Products, technic, markets, industry
- Business idea/strategy

- Can you tell me how you went about when you developed the product\(^{12}\)
  How did you work internally in the firm during the product development process (idea generation, product development, launch)
- Initiative (Who, where, when, why, plan)
- Distribution of work
- Responsibility and authority
- Decision making
- Risk taking
- Learning
- Creativity
- Uncertainty

\(^{11}\) New/Existing market, New/Existing product, Success/Failure process/product etcetera
\(^{12}\) Start with the first idea and tell me about the process until the sales of the product. Relate fact to when it happen in time (what day, month etcetera)
How was the work put out, with regard to the external information that was used and the communication with external actors (idea generation, product development, launch)

**Information**
- Why, for what purpose has information been gathered
- When was information gathered (idea generation, product development, launch)
- From who/where has information been gathered
- How has external information been gathered (personal contacts, Internet etc)
- What importance had the way the information was gathered
- How has information been used

**Communication**
- Have, and if so why have, communication with external parties been put out
- When in the product development process was communication with external parties put out (idea generation, development, launch)
- With whom have communication been put out
- How was communication put out (personal contacts, Internet etcetera)
- What importance had the way in which communication was put out
- How was communication used in the product development process

- What was difficult, easy during the process
- What went good, bad during the process
- What importance did the external information have for the product development process?
- What differences would there have been if you would not have been used IT (advantages/disadvantages)?
- Did the product succeed/fail? Motivate!
- It would be interesting to hear your opinion regarding how computerised information systems are used in product development and the importance the use have?
- Do you want to add anything?

**Ending questions**
- Firm history from the founder to present, relate to product development
- Who from the firm has been involved in the product development project?
  - What part has they had in the product development work?
  - How would you describe their part?
Checklist for interviews with personal

Firm
Respondent
Tape
Date
From
To
Telephone
e-mail

Background questions
Questions regarding role in firm and product development
☐ How long have you been employed by the firm
☐ What roles have you had in the firm
☐ Present work tasks (responsibility and authority)

Narratives
☐ Product to discuss ______________________________________
☐ Can you tell me how you went about when you developed the product 13
  How did you work internally in the firm during the product development
  process (idea generation, product development, launch)
  □ Initiative (Who, where, when, why, plan)
  □ Distribution of work
  □ Responsibility and authority
  □ Decision making
  □ Risk taking
  □ Learning
  □ Creativity
  □ Uncertainty
  How was the work put out, with regard to the external information that was
  used and the communication with external actors (idea generation, product
  development, launch)
  Information
  □ Why, for what purpose has information been gathered
  □ When was information gathered (idea generation, product development,
    launch)
  □ From who/where has information been gathered
  □ How has external information been gathered (personal contacts, Internet etc)
  □ What importance had the way the information was gathered
  □ How has information been used

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13 Start with the first idea and tell me about the process until the sales of the product. Relate fact to
  when it happen in time (what day, month etcetera)
Communication
- Have, and if so why have, communication with external parties been put out
- When in the product development process was communication with external parties put out (idea generation, development, launch)
- With whom have communication been put out
- How was communication put out (personal contacts, Internet etcetera)
- What importance had the way in which communication was put out
- How was communication used in the product development process
- What was difficult, easy during the process
- What went good, bad during the process
- What importance did the external information have for the product development process?
- What differences would there have been if you would not have been used IT (advantages/disadvantages)?
- Did the product succeed/fail? Motivate!
- It would be interesting to hear your opinion regarding how computerised information systems are used in product development and the importance the use have?
- Do you want to add anything?

Ending questions
- Who from the firm has been involved in the product development project?
  - What part has they had in the product development work?
  - How would you describe their part?