Evaluation of implementing e-Procurement in the Swedish construction industry

Master's Thesis within Business Administration
Authors: Michael Schnitzler & Olof Österlund
Tutor: Per Hilletofth, PhD
Jönköping May 2015
Acknowledgements

This thesis was written to complete our Master’s studies in International Logistics and Supply Chain Management at the Jönköping International Business School. We owe great thanks to all those who contributed and helped us during our writing process and made this thesis possible.

First and foremost, we would like to say a special thank you to our supervisor Per Hilletofth, PhD, who always devoted his time and priceless knowledge to guide us through this journey. The sessions with him helped us to improve the thesis and kept us inspired and motivated to work. Of course, we would also like to send our thanks to our opponent group and the other participants of the seminars for their constructive feedback and support.

Furthermore, our gratitude goes to the participating companies and all the respondents to the interviews who have been very interested in the topic and the progress of the thesis. Their contribution was crucial for the successful completion of this study. In particular, we would like to name Johan Andersson and Jesper Olsson, both Peab AB, as well as Peter Fredholm, BEAst AB, who met us several times to share their opinion and to give us valuable insights into the companies’ processes which considerably enriched our thesis.
Master’s Thesis within Business Administration

Title: Evaluation of implementing e-Procurement in the Swedish construction industry

Authors: Michael Schnitzler & Olof Österlund

Tutor: Per Hilletofth, PhD

Date: 2015-05-11

Subject terms: collaboration, construction industry, e-Procurement, electronic standards, innovation, supply chain integration, Sweden.

Abstract

Background

Supply chain integration is a prevailing issue of current research and influences the competitive advantage of companies significantly. However, construction industries are argued to be the least integrated supply chains of all due to their complexity. E-Procurement is one way to improve integration in a supply chain and has currently been implemented by some actors in the Swedish construction industry.

Purpose

The purpose of this thesis is to evaluate outcomes achieved and challenges encountered when implementing e-Procurement in the Swedish construction industry in order to generate contributions to literature considering the detected research gaps.

Method

This study has been carried out according to an abductive approach given its flexibility to simultaneously review existing theory when analyzing the empirical findings. However, outcomes achieved and challenges encountered when implementing e-Procurement in the construction industry, in particular in Sweden, lacks considerably in scientific literature. Thus, an exploratory and qualitative study has been conducted in order to assess the phenomenon in a new light and generate knowledge. The empirical findings have been collected in a single holistic case study of a supply chain in the Swedish construction industry which recently has implemented e-Procurement. The empirical data emanates from semi-structured face-to-face interviews which have been conducted with nine respondents from five different organizations operating in the Swedish construction industry. The data has been analyzed using summarizing, categorizing and pattern matching.

Conclusions

The Swedish construction industry, at least the investigated supply chain, was and still is rather underdeveloped when it comes to electronic purchasing processes. However, the results of this study show that quite many outcomes and challenges with regard to e-Procurement are similar to other industries. Overall, 15 outcomes and five challenges have been detected for this supply chain. The implementation of e-Procurement in the Swedish construction industry faces positive conditions to be successful and has the potential to change routine working methods.
Table of Contents

1 Introduction .................................................................................. 1
  1.1 Background ............................................................................. 1
  1.2 Problem Discussion .................................................................. 2
  1.3 Purpose and Research Questions.......................................... 3
  1.4 Scope and Delimitations ......................................................... 4
  1.5 Outline ................................................................................. 5

2 Frame of Reference ....................................................................... 6
  2.1 Introduction ............................................................................. 6
  2.2 E-Procurement ......................................................................... 6
    2.2.1 Definition and Context ................................................. 6
    2.2.2 Information Sharing ....................................................... 6
    2.2.3 Outcomes ...................................................................... 7
    2.2.4 Challenges .................................................................... 10

3 Research Methodology ............................................................... 12
  3.1 Introduction ............................................................................. 12
  3.2 Methodology ........................................................................... 12
    3.2.1 Research Philosophy .................................................... 12
    3.2.2 Research Purpose ......................................................... 13
    3.2.3 Research Approach ...................................................... 13
    3.2.4 Qualitative Research ................................................... 14
  3.3 Research Strategy .................................................................... 14
    3.3.1 Choice of Research Strategy ......................................... 15
    3.3.2 Research Design .......................................................... 15
  3.4 Data Collection ....................................................................... 16
    3.4.1 Interview Design .......................................................... 16
    3.4.2 Interview Respondents ............................................... 16
    3.4.3 Interview Guide ............................................................ 18
    3.4.4 Interview Procedure .................................................... 18
  3.5 Data Analysis ......................................................................... 18
  3.6 Research Quality .................................................................... 20
    3.6.1 Validity ......................................................................... 20
    3.6.2 Reliability ...................................................................... 20
    3.6.3 Research Ethics ............................................................. 21

4 Empirical Study .......................................................................... 22
  4.1 Introduction ............................................................................. 22
  4.2 Case Description ..................................................................... 22
    4.2.1 Companies ................................................................... 22
    4.2.2 Context ......................................................................... 23
  4.3 Findings Outcomes ................................................................. 25
    4.3.1 BEAst ........................................................................... 25
    4.3.2 Suppliers ....................................................................... 25
    4.3.3 Focal Firm ...................................................................... 26
    4.3.4 Summary ....................................................................... 28
  4.4 Findings Challenges ................................................................. 28
    4.4.1 BEAst ......................................................................... 28
Figures
Figure 1-1 Scope of the Thesis. ........................................................... 4
Figure 1-2 Outline of the Thesis.......................................................... 5
Figure 2-1 ISM Model for Benefits of e-Procurement......................... 8
Figure 3-1 Research Methodology.................................................... 12
Figure 4-1 NeC Process.................................................................... 23

Tables
Table 2-1 Literature Review on Outcomes of e-Procurement ............... 9
Table 2-2 Literature Review on Challenges of e-Procurement............. 11
Table 3-1 Interview Respondents.................................................... 17
Table 4-1 Summary Findings Outcomes........................................ 29
Table 4-2 Summary Findings Challenges....................................... 31
Table 5-1 Analysis Outcomes.......................................................... 32
Table 5-2 Analysis Challenges....................................................... 35

Appendix
Appendix: Interview Guide ............................................................. 46
I Introduction

1.1 Background

Supply chain integration (SCI) is a prevailing issue of current research since it may have a significant influence on competitive advantage for firms (Smith, 2011) whereby possible reasons are synchronization of demand, supply and innovation processes (Cecere, O’Marah & Preslan, 2004), optimization of delivery speed and frequency (Ha, Li & Ng, 2003) or maximization of efficiency and service/product quality (D’Avanzo, von Lewinski & Van Wassenhove, 2003). However in practice, many supply chains are not well integrated to date and pursue different approaches (Childerhouse & Towill, 2011).

Some industries, such as vehicle manufacturing and retail distribution, have already been considerably successful in operating efficient in closely integrated supply chains. Other sectors, particularly the construction industry, remain having difficulties in leaving the state of supply chain inefficiency (Briscoe & Dainty, 2005). It can be argued that this is due to the complexity of this industry which has its prevalent focus on project-based construction (Dubois & Gadde, 2002). Furthermore, it faces, among other things, ever-changing product demands, uncertainty in construction site conditions and fluctuating demand cycles (Dainty, Millett & Briscoe, 2001). When it comes to large construction projects, it is common practice that hundreds of suppliers provide a wide range of materials, components and services (Dainty et al., 2001).

SCI involves that information is shared and becomes available for all the members along the stream. The aim is to avoid information delays and distortions (Cheng, Law, Bjornsson, Jones & Sriram, 2010). Information asymmetry leads to growing demand signal variation upstream the supply chain, a phenomenon called the bullwhip effect. A consequence is poor supply chain performance (Lee, Padmanabhan & Whang, 2004; Fiala, 2005). SCI and close collaboration between the actors have become a necessity to cope with this problem. This because both contribute to improved information flows, reduced uncertainty and shorter lead times. Information technologies significantly support this optimization process (Fiala, 2005; Cheng et al., 2010).

Accordingly, the implementation of a secure and flexible system that is able to communicate the information among the involved actors is crucial. This can be done with the help of communication networks like Electronic Data Interchange (EDI). Kaefer and Bendoly (2000) describe EDI as a standards-based mode of communication which allows companies to exchange information electronically and thus collaborate more efficiently. However, the implementation of EDI might be difficult in practice due to relatively high costs, complexity of operational issues and lack of information standardization between the companies (Kaefer & Bendoly, 2000; Cheng et al., 2010).

In recent years, the Internet has emerged as a cost-efficient means to support these integration endeavors whereby the term e-Business has to be named (Lee & Whang, 2005). The authors define e-Business as ‘(…) the marriage between the Internet and supply chain integration.’ and classify it into the three categories e-Commerce, e-Procurement and e-Collaboration (Lee & Whang, 2005, p. 3). Within this frame, e-Procurement includes procuring direct or indirect materials and handling of value-added services such as transportation or warehousing over the Internet (Lee & Whang, 2005). It is a critical factor for the big contractors in the construction industry to have good control over the procurement activi-
ties since their vast material flows influence their profit rate considerably (Samuelson & Björk, 2013).

Regarding the great economic significance of the construction sector, which contributes up to 10% to the GDP in most advanced economies, the importance of innovation in SCI has to be considered (Khalfan & McDermott, 2006). In Sweden, some major actors from the various parts of the industry, namely construction companies, suppliers and transportation firms have recognized this and decided to initiate a joint venture with the aim to improve and facilitate processes in this context (J. Andersson, personal communication, 2015-01-27). In close collaboration, this joint venture has implemented BEAst which stands for ‘Byggbranschens Elektroniska Affärsstandard’, meaning ‘the Swedish Construction Industry’s Electronic Business Standard’. It is a non-profit organization and contains more than 85 leading actors of the industry developing common information standards which are a prerequisite when it comes to e-Business (BEAst, 2015a). The focus of BEAst is to increase the level of integration between the companies in the Swedish construction sector and hence assist to maintain the industry’s competitiveness on the global market (BEAst, 2015a). It can be argued that Sweden’s construction industry is a real pioneer in this field since no comparable standards exist in any other construction industry in the world so far (P. Fredholm, personal communication, 2015-01-27).

This electronic meeting place contains, besides all the various standards, for instance relevant process descriptions, code lists and technical specifications tailored to the construction sector. A widely tested BEAst standard in practice is the Nordic e-Construction (NeC) which includes the supply of aggregate products, e.g. sand, gravel, concrete or asphalt, as well as transportation and machine services (BEAst, 2015b). Currently between 50 to 80 percent of the materials and machine services, depending on the local area, are ordered the same day as required. This causes the suppliers to have great troubles to be efficient in capacity usage and transportation routes (J. Andersson, personal communication, 2015-01-27). The NeC standard strives to address this problem by providing features such as electronic delivery schedules, mutual article numbers, electronic messaging between the systems (e.g. call-off orders and order confirmations) as well as electronic invoicing (BEAst, 2015b).

BEAst has developed electronic standards which include both aspects of EDI and e-Procurement. The connection to EDI can be drawn since it includes all typical features including electronic information sharing in standardized formats. But it is more than that. The online nature of its support to sourcing and planning activities corresponds very well to the above mentioned definition of e-Procurement, particularly the NeC standard.

### 1.2 Problem Discussion

Extensive previous research has been conducted on integration and coordination of partners along the supply chain in many industries as well as on the values this may create for them (Morash & Clinton, 1998; Simatupang, Wright, & Sridharan, 2002; Smith, 2011). According to Cox (1999) there is no best practice to manage supply chains since they can vary considerably in their complexity and diversity. Companies or entrepreneurs can hardly rely on benchmarking and replication of successfully operating supply chains due to the specific circumstances in place (Cox, 1999). Rather, companies have to understand the properties of the supply chain they operate in before pursuing any operational or strategic innovation efforts. This is argued to be the absolute key to business success (Cox, 1999).
This should be particularly considered when it comes to supply chain innovation in the construction industry which is, as above-mentioned, quite complex in its nature. Innovative thinking has become an essential issue since construction companies are facing increasing pressures from their customers to reduce costs, improve quality and service level or speed up the construction process (Khalfan & McDermott, 2006). SCI is a useful concept to approach these customer needs and improve the responsiveness of the entire supply chain (Cheng et al., 2010). Recent research, however, argues that the construction sector is the least integrated of all the major industrial industries (Briscoe & Dainty, 2005; Fearne & Fowler, 2006). A comprehensive literature review has revealed that the majority of scientific research in this field focuses on the UK construction industry whereby a noticeable gap can be detected when it comes to other countries. Secondary research using relevant keywords in different combinations on well-recognized databases for scientific publications, e.g. Scopus and Web of Science, returned only two relevant entries related to Sweden.

When it comes to scientific research regarding EDI, a substantial literature base exists but there are several conflicting and inconclusive research results in this field (Narayanan, Marucheck & Handfield, 2009). This is due to the fact that it has been studied from the perspective of different industries respectively management disciplines and varies in terms of theoretical foundations, research designs and methodologies (Narayanan et al., 2009). According to Narayanan et al. (2009) the benefits that companies may realize from the use of EDI appear to be the most distinct conflicts in literature. Research on pertinent databases discloses the lack of scientific studies related to the construction industry. Focusing on Sweden, only three studies have been conducted in this context, namely Laage-Hellman and Gadde (1996), Samuelson and Björk (2013) and Samuelson and Björk (2014).

Previous research points out the value which e-Procurement could create for companies, but yet, the construction sector lags behind other industries in using it to its full capacity and little is known empirically about the actual effects on this specific industry (Hadaya & Pellerin, 2010; Hashim, Said & Idris, 2013). Scientists still consider e-Procurement to be an emerging phenomenon which requires to be analyzed in depth (Hsin Chang, Tsai & Hsu, 2013). This gap in literature with respect to the implementation of e-Procurement in the construction industry can be affirmed after conducting extensive secondary research with barely adequate outcomes. Remarkable is that this issue has not been content of any study when it comes to Sweden. Thus, it is an underdeveloped but interesting research area.

1.3 Purpose and Research Questions

To sum up the above problem discussion, three main gaps in literature have been detected. Firstly, SCI in general has not been studied extensively when it comes to the construction industry, particularly with regard to Sweden. Secondly, despite the fact that EDI has been investigated in many studies, the results revealed are conflicting and ambiguous while the focus was not on the construction industry either. This is of concern for this thesis as electronic information sharing in standardized formats is a prerequisite for e-Procurement. Thirdly, e-Procurement itself noticeably lacks of scientific research considering possible outcomes and challenges to the construction industry. Thus, the purpose of this thesis is:

"To evaluate outcomes achieved and challenges encountered when implementing e-Procurement in the Swedish construction industry".
In order to fulfill the purpose of this thesis, it has been divided into two research questions. The first step in accomplishing the purpose is to reveal and assess the factual effects when implementing e-Procurement in the Swedish construction industry. Thus, the first research question is:

RQ1: What outcomes are achieved by companies in the Swedish construction industry when implementing e-Procurement?

The second step in fulfilling the purpose is to identify the challenges the companies had to deal with when implementing e-Procurement, considering the complexity of the construction industry. Thus, the second research question of this thesis is:

RQ2: What challenges have companies in the Swedish construction industry encountered when implementing e-Procurement?

In order to answer the research questions and fulfill the purpose, a holistic single case study will be conducted including firms from the Swedish construction industry. On the basis of the findings to these research questions, the goal is to generate contributions to literature considering the detected research gaps.

### 1.4 Scope and Delimitations

The scope of this thesis can be illustrated with the aid of an onion (see figure 1-1). The outer layer and main frame is the Swedish construction industry wherein SCI will be studied. Within this context, the focus will then lie on the implementation of e-Procurement and involved outcomes and challenges. As e-Procurement is supported by EDI, this means will also be considered to some degree.

![Figure 1-1 Scope of the Thesis.](image)

This scope consequently implies some delimitations to the thesis. First of all, other countries or industries will not be investigated since this would make the study too extensive and inaccurate. The core of the research will be conducted on e-Procurement which assists companies to integrate their supply chains. However, the other two categories of e-Business, aforementioned e-Commerce and e-Collaboration, will not be further considered as they are not of direct relevance to the purpose of this thesis. Moreover, the focus will lie...
on one specific standard within BEAst, namely NeC, which has already been tested in practice by a major Swedish construction company and its key suppliers. Hence, the empirical data will be collected from this particular company, the joint venture BEAst and the key suppliers involved in the pilot-projects.

1.5 Outline

This section provides a structured overview of the thesis (see figure 1-2). In the introduction, the background to the study and a problem discussion were presented which led to the purpose and the research questions of this thesis. Furthermore, the scope and delimitations are explained.

![Figure 1-2 Outline of the Thesis.](image)

In the frame of reference, a comprehensive literature review has been conducted to deliver the necessary theoretical background for the study. The subsequent part describes the research methodology applied in this thesis including research approach, research strategy, data collection and analysis as well as quality of the study. In the empirical findings section, the collected data will be presented in a structured way. The next step is to analyze the empirical data and compare it with existing theory using an abductive approach. In the end, conclusions will be drawn and discussed in the final section. This part also includes limitations to the study and suggestions for further research.
2 Frame of Reference

2.1 Introduction

This chapter is designed to deliver the necessary theoretical background in order to be able to analyze and compare existing models and concepts with the empirical findings of this thesis. The main focus lies on the concept of e-Procurement including information sharing in terms of EDI due to its great relevancy and interconnection to e-Procurement. Extensive literature reviews have been conducted on both outcomes and challenges when implementing e-Procurement and are presented in tables below. The part ‘outcomes’ is provided in order to be able to answer RQ1 while the part ‘challenges’ aims to support fulfilling RQ2. The entire section provides the basis for the subsequent analysis in accordance with an abductive approach and was revised simultaneously during the writing process of the thesis.

2.2 E-Procurement

2.2.1 Definition and Context

The above-mentioned framework by Lee and Whang (2005) classifies e-Business into the three categories e-Commerce, e-Collaboration and e-Procurement. e-Commerce helps companies to provide customers with products and services as well as to respond quickly to changing customer demands using the Internet while e-Collaboration includes the coordination of activities beyond transactions along the supply chain, e.g. Intranet, Extranet or online conferences (Lee & Whang, 2005). The authors define e-Procurement as the use of online means to source direct or indirect materials and to handle value-added services such as transportation, payments or warehousing (Lee & Whang, 2005). In addition, Presutti (2003) describes e-Procurement as an IT-based solution supporting corporate buying at the input end of a supply chain with the power to positively influence purchasing processes and performance. The implementation of e-Procurement is considered to be innovative action (Mishra & Agarwal, 2010) which is in line with the statement by Khalfan and McDermott (2006) that the construction industry requires innovation in SCI to enhance operations and value added.

SCI is greatly supported by the development of collaboration in supply chains (Adams, Richey, Autry, Morgan & Gabler, 2014) which promises mutual benefits, rewards and risk sharing for companies (Barratt, 2004). Collaboration occurs ‘(...) when two or more companies share the responsibility of exchanging common planning, management, execution, and performance measurement information.’ (Anthony, 2000, p. 41). An essential role for successful collaboration plays information sharing via information technologies such as EDI and the Internet (Min, Roath, Daugherty, Genchev, Chen, Arndt & Glenn Richey, 2005). The authors argue that the outcomes coming along with collaboration are enticing for companies, which are improvements in efficiency, effectiveness and profitability just as reinforcement and expansion of relationships (Min et al., 2005).

2.2.2 Information Sharing

According to Williams, Magee and Suzuki (1998), the automation of information is one of the most important tools for running and improving internal operations. Even more important is an information system that works inter-organizational. There are many ways of inter-organizational communication within a supply chain, everything from paper invoices
to the use of information technology (Hill & Scudder, 2002). It is of great importance that different actors along the supply chain have a good relationship which includes the coordination of logistics activities (Hill & Scudder, 2002).

A well-known example for an inter-organizational system (IOS) is Electronic Data Interchange (EDI) (Hill & Scudder, 2002). Walton and Marucheck (1997) state that EDI was founded in the late 1960's when the transportation industry used it to some extent. One definition of EDI is ‘(...) the transmission of standard business documents in a standard format between industrial trading partners from computer application to computer application.’ (Walton & Marucheck, 1997, p. 31).

A requirement needed for communication between companies is that each of the companies’ systems recognizes and understands each other. Therefore, standards have been developed for how this kind of information should be expressed (Samuelsson & Björk, 2013). When using EDI, companies can send messages in diverse formats such as the EDIFACT standard (Samuelsson & Björk, 2013) or Odette which is a standard within the automotive industry (Tuunainen, 1998).

EDI can significantly strengthen the competitiveness of a company by means of automation, streamlined communication and elimination of waste (Agdas & Ellis, 2010). According to Agdas and Ellis (2010), the short-term benefits are reduced project costs as well as better productivity and efficiency through reduced waste. This results in improving the overall profit margins of construction projects (Aglas & Ellis, 2010).

A negative aspect of EDI is that there exists a high dependence on other companies when the focal firm strives to make investments (Samuelsson & Björk, 2013). According to Son, Narasimhan and Riggins (2003), an IOS project mostly implicates a higher risk compared to an internal IT-System since the users cannot control other actor’s actions. On the other hand, investing into inter-organizational systems can be a good way to achieve a close and long-lasting relationship with customers or suppliers (Son et al., 2003). Son et al. (2003) further state that it is a more efficient strategy to offer mutual investments when it comes to EDI-related support instead of exercising power in order to increase usage of EDI in customer-supplier relationships. Moreover, trust and uncertainty have an enormous impact on the willingness of suppliers and customers to collaborate with each other (Son et al., 2003).

### 2.2.3 Outcomes

First, a basis is built by reference to the ISM model by Toktaş-Palut, Baylav, Teoman and Altunbey (2014) regarding outcomes when implementing e-Procurement. In addition, relevant benefits from other articles are highlighted which are in line with this model. However, these articles also provide other benefits related to e-Procurement. The second part is about the framework developed by Mukhopadhyay and Kekre (2002) which casts light on possible outcomes when implementation of e-Procurement from another perspective. At the end, a table is given to summarize and compress the most relevant outcomes of e-Procurement which have been detected in existing theory.

Hsin Chang et al. (2013) argue that SCI and information sharing are two crucial aspects when it comes to e-Procurement. Thus, e-Procurement can be seen as a facilitator for information flows and coordination of actions among actors in the supply chain (Hsin Chang et al., 2013). Toktaş-Palut et al. (2014) have created a model for benefits of e-Procurement using an interpretive structural modeling (ISM) approach (see figure 2-1). They claim that the most important benefit of e-Procurement is the integration of shared information be-
tween organizations. Thus, the key factor for a successful e-Procurement is well-integrated information sharing in order to boost other benefits and achieve an overall outcome of cost savings in the purchasing process. Furthermore, when e-Procurement and thus integration of shared information is implemented, additional benefits will occur (Toktaş-Palut et al., 2014).

According to Hashim et al. (2013) and Toktaş-Palut et al. (2014), e-Procurement enables companies to streamline processes and automate transactions. This will generate benefits such as a higher pace in sourcing processes, a more efficient purchasing process and increased volume of operations (Davila, Gupta & Palmer, 2003; Hashim et al., 2013; Toktaş-Palut et al., 2014). Hawking, Stein, Wyld and Foster (2004) claim that an organization can reduce its costs for inventories and achieve improved decision making. Mukhopadhyay and Kekre (2002), Davila et al. (2003), Subramaniam and Shaw (2004) as well as Toktaş-Palut et al. (2014) further state that reduced transaction costs could be one motivator for implementing e-Procurement. The most obvious reason behind the reduction of transaction costs is argued to be less paperwork (Davila et al., 2003). This results in positive externalities for the initiator of e-Procurement but negative externalities for non-cooperative suppliers. In other words, suppliers that are not implementing e-Procurement will face drawbacks in their business with customers who have implemented it (Mukhopadhyay & Kekre, 2002).

Subramaniam and Shaw (2004) claim that one benefit of e-Procurement is to reduce the time it takes for a company to complete an order. Davila et al. (2003), Hawking et al. (2004) and Subramaniam and Shaw (2004) argue that e-Procurement will result in lower prices of the products purchased. This price reduction is a result of an improved demand management capability followed by the implementation of e-Procurement (Hawking et al., 2004). According to Toktaş-Palut et al. (2014), other related benefits that come along with implementing e-Procurement are easy access to different data, exchanged intelligence, faster problem solving through access to real-time information, better developed supply chain transparency, improved communication and collaboration in supply chains and reduced process errors.

Another framework for implementation of technology deployment is developed by Mukhopadhyay and Kekre (2002). The framework describes strategic and operational bene-
fits achievable through the implementation of EDI in the procurement process, thereby e-Procurement. The framework has three phases, which are adoption, implementation and post-implementation. Many aspects, such as direct strategic impact of technology, derived strategic gains and operational improvements through impact are taken into consideration (Mukhopadhyay & Kekre, 2002). For this study, only benefits which come along with implementation and post-implementation are relevant. Therefore the adoption process has not been considered.

According to Mukhopadhyay and Kekre (2002), implementation of EDI in the procurement process will create a lot of benefits to an industrial supplier. Considerably large revenues can be generated for the supplier if the customer initiates the link and the supplier enhances it. This will also result in lower transaction costs for the customer and has a negative impact on other suppliers, which have not joined the link. In addition, the customer and the supplier can decrease the overall costs of business between each other by becoming more efficient in the order-completion process (Mukhopadhyay & Kekre, 2002; Davila et al., 2003; Toktaş-Palut et al., 2014). In relation to the improved efficiency, late payments will decrease considerably as a result of electronic invoicing. Another consequence of integrated EDI is a substantial decrease in errors in the order process. The standardization and simplification of orders will further create better business performance (Mukhopadhyay & Kekre, 2002).

However, a low level of EDI will not generate the same benefits since integration of EDI into business processes of companies is needed as well as an integration of the payment process. Of course, a drawback can be expensive investments regarding hardware, software development and training of personnel. On the other hand, the suppliers, which implement EDI, will be rewarded by its customers, including increased sales (Mukhopadhyay & Kekre, 2002).

Table 2-1 Literature Review on Outcomes of e-Procurement

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve better resource management through real-time data</td>
<td>Hawking et al., 2004; Hashim et al., 2013</td>
</tr>
<tr>
<td>Better supply chain transparency</td>
<td>Hawking et al., 2004; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Faster problem solving through access to real-time information</td>
<td>Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Improved communication and collaboration in supply chains</td>
<td>Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Increased volume of operations</td>
<td>Hashim et al., 2013</td>
</tr>
<tr>
<td>Integrated information sharing</td>
<td>Davila et al., 2003; Subramaniam &amp; Shaw, 2004; Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>More efficient purchasing process</td>
<td>Davila et al., 2003; Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Overall cost savings</td>
<td>Mukhopadhyay &amp; Kekre, 2002; Davila et al., 2003; Hawking et al., 2004; Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Price reduction of items purchased</td>
<td>Davila et al., 2003; Hawking et al., 2004; Subramaniam &amp; Shaw, 2004</td>
</tr>
<tr>
<td>Reduced process errors</td>
<td>Mukhopadhyay &amp; Kekre, 2002; Davila et al., 2003; Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Reduced transaction costs</td>
<td>Mukhopadhyay &amp; Kekre, 2002; Davila et al., 2003; Subramaniam &amp; Shaw, 2004; Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Streamline processes</td>
<td>Hashim et al., 2013; Toktaş-Palut et al., 2014</td>
</tr>
</tbody>
</table>
The above table 2-1 has been created to show in a structured way which kind of outcomes related to the implementation of e-Procurement have been detected in literature so far. A literature review consisting of six complementary articles has been conducted in order to reveal the most relevant benefits when implementing e-Procurement. This is seen as a reasonable frame with respect to the purpose of this thesis.

2.2.4 Challenges

As discussed in the previous sections, there is great potential for companies to achieve significant improvements in operations and efficiency when implementing e-Procurement, but on the other hand, they encounter a variety of barriers and challenges during this development process (Rankin, Chen & Christian, 2006). Rankin et al. (2006) have conducted a survey in the Canadian Architectural, Engineering and Construction (AEC) industry in order to quantify and assess existing challenges which they divided into organizational and technical issues. As most important organizational issues, they identified the challenge of shifting the mind-set of employees and the development of confidence to use new technologies. Other frequent barriers indicated are cost of investment, skilled people and concerns about long-term relationships with customers (Rankin et al., 2006). According to their findings, the major technical issues are finding an affordable technical solution and concerns regarding security of data transactions. Further named technical challenges are instability and compatibility of systems as well as lack of technical support (Rankin et al., 2006).

Toktaş-Palut et al. (2014) highlight several challenges to e-Procurement in their study, however, with focus on the retailing sector. The most important barrier is insufficient IT infrastructure of the actors in the supply chain which is the main root causing various challenges when implementing e-Procurement (Toktaş-Palut et al., 2014). Thus, executives should pay attention to this issue and develop a strategic plan to develop the IT infrastructure within their firm as well as the entire supply chain (Toktaş-Palut et al., 2014). Subsequent challenges are personnel that lack knowledge about e-Procurement, incompliance with company culture and cost/benefit concerns. According to Toktaş-Palut et al. (2014), bureaucratic disfunctionalities in practice are a further challenge when implementing e-Procurement. This includes specific regulations and standards in place regarding the legal institutions involved in order to ensure supply competition and transparency in procurement processes (Toktaş-Palut et al., 2014). All these challenges peak in an overall resistance to change within the organization as well as from other actors in the supply chain (Toktaş-Palut et al., 2014).

Angeles and Nath (2007) have studied the challenges to implementation of business-to-business e-Procurement from a more holistic perspective. They have categorized the challenges into three important factors of e-Procurement implementation difficulties, which are (a) lack of system integration and standardization issues, (b) immaturity of e-Procurement-based market services and end-user resistance and (c) maverick buying and difficulty in integrating e-Commerce with other systems (Angeles & Nath, 2007). Factor (a) includes among other things lack of standard interchange formats for e-Procurement, lack of base infrastructure and lack of benchmarkable reference implementations (Angeles & Nath, 2007). According to Angeles and Nath (2007), factor (b) comprises immaturities of marketplace services, suppliers and pricing models as well as the resistance of internal end-users. Maverick buying means that employees do not comply with formally defined processes and do not change their behavior even after the implementation of e-Procurement. A further challenge related to factor (c) is the difficulty to connect e-Commerce-driven transactions with purchase transaction data (Angeles & Nath, 2007).
Hawking et al. (2004) highlight the importance to consider the possible challenges for companies when implementing e-Procurement. They confirm many of the above discussed challenges when adopting e-Procurement such as security of transactions, lack of IT infrastructure and integration, concerns about high costs and lack of skilled labor. In addition, Hawking et al. (2004) bring up two other challenges, namely lack of upper management support and no real benefit on business figures. Lack of upper management support means that executives are not really convinced to encourage e-Procurement. Furthermore, no direct influence on financial figures can be identified when implementing e-Procurement (Hawking et al., 2004).

Table 2-2 Literature Review on Challenges of e-Procurement

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureaucratic disfunctionalities in practice</td>
<td>Hawking et al., 2004; Eadie et al., 2010; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Concerns about long-term relationships to customers</td>
<td>Rankin et al., 2006</td>
</tr>
<tr>
<td>Cost/benefit concerns</td>
<td>Hawking et al., 2004; Rankin et al., 2006; Angeles &amp; Nath, 2007; Eadie et al., 2010; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Immaturity of e-Procurement-based market services</td>
<td>Hawking et al., 2004; Angeles &amp; Nath, 2007</td>
</tr>
<tr>
<td>Inadequate business process to support e-Procurement</td>
<td>Hawking et al., 2004; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Incompliance with company culture</td>
<td>Hawking et al., 2004; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Lack of base IT infrastructure</td>
<td>Hawking et al., 2004; Angeles &amp; Nath, 2007; Eadie et al., 2010; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Lack of e-Procurement skilled personnel</td>
<td>Hawking et al., 2004; Rankin et al., 2006; Eadie et al., 2010; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Lack of system integration and standardization issues</td>
<td>Hawking et al., 2004; Angeles &amp; Nath, 2007; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Lack of upper management support</td>
<td>Hawking et al., 2004; Eadie et al., 2010</td>
</tr>
<tr>
<td>Maverick buying</td>
<td>Angeles &amp; Nath, 2007</td>
</tr>
<tr>
<td>No real benefit on business figures</td>
<td>Hawking et al., 2004</td>
</tr>
<tr>
<td>Resistance to change; Shifting mind-set of employees</td>
<td>Rankin et al., 2006; Angeles &amp; Nath, 2007; Eadie et al., 2010; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>Security of data transactions</td>
<td>Hawking et al., 2004; Rankin et al., 2006; Eadie et al., 2010; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
<tr>
<td>System instability, compatibility and support issues</td>
<td>Rankin et al., 2006; Eadie et al., 2010; Eei et al., 2012; Toktaş-Palut et al., 2014</td>
</tr>
</tbody>
</table>

More scientific articles, including Eadie, Perera and Heaney (2010) as well as Eei, Husain and Mustaffa (2012), have been reviewed with the result that the challenges encountered when implementing e-Procurement are repetitive in existing theory. Table 2-2 contains 15 relevant challenges in order to fulfill the purpose of this study which have been compiled from six scientific articles. All challenges to the implementation of e-Procurement are listed with the respective references.
3 Research Methodology

3.1 Introduction

In this chapter of the thesis, the entire process on how the research was designed and conducted will be outlined. Figure 3-1 illustrates all the considered steps. First, research philosophy will be elaborated with regard to this thesis and a discussion on the theoretical assumptions upon which this study is based will be presented. These assumptions influence the adopted research strategy and methods which will be explained in the subsequent section including reasons for the respective choices.

Furthermore, the data collection process will be described in detail which contains what type of data collection technique was used as well as how and why it was applied. A table will show all the respondents to the interviews and when these took place. The consequent step is to analyze this collected empirical data. These procedures will be explained in the data analysis section. In addition, the research quality regarding validity, reliability and research ethics will be clarified.

3.2 Methodology

Saunders, Lewis and Thornhill (2009, p. 585) define methodology as ‘(…) the theory of how research should be undertaken, including the theoretical and philosophical assumptions upon which research is based and the implications of these for the method or methods adopted’.

3.2.1 Research Philosophy

Research philosophy is all about the origin and development of knowledge (Saunders et al., 2009). The research philosophy can be divided into ontological and epistemological perspectives (Bryman & Bell, 2011). Ontology is about the nature of social entities while epistemology reflects what can be seen as acceptable knowledge (Bryman & Bell, 2011).

There are different philosophical views you can adopt in research, regarding epistemology and ontology. Saunders, Lewis and Thornhill (2012) divide the different stances into pragmatism, interpretivism, realism and positivism. Positivism can be seen as similar to a natural scientist’s view (Saunders et al., 2012). A positivist uses existing theory to create hypotheses which then will be tested and confirmed or rejected. A realist is different from the positivist in the sense that reality is seen as quite independent of the human mind (Saunders et al., 2012). Pragmatism is more about the importance of the research question. If the research question does not imply just one philosophical view but rather two, then pragmatism can fit your research (Saunders et al., 2012). This study adopts an interpretivistic philosophy. An interpretivistic ontological view illustrates and distinguishes between social entities and objects of natural science (Bryman & Bell, 2011). According to Saunders et al. (2012), a person with an interpretivistic ontological view claims that the social world is way too complex to understand with a positivistic view. An interpretivistic epistemological view
argues that hypotheses and law-like generalizations will reduce the understanding of our complex world (Saunders et al., 2012). Furthermore, positivism does not enable the researcher to be fully objective (Saunders et al., 2012).

The research context of this thesis is in many ways rather complex due to organizational factors involved as well as the purpose which cannot be fulfilled with law-like generalizations. The interpretivistic ontological and epistemological view will make it in the best way possible to understand the social interaction between different organizations in the context of the construction industry. This study will be more about subjective meanings and social phenomena rather than causality and structured or large samples. An alternative would have been to choose a pragmatic philosophy and a mixed method in order to interpret data from different point of views. However, the time limit bound to this thesis makes it unfeasible to investigate the subject with a multiple methods design.

3.2.2 Research Purpose

According to Saunders et al. (2012), researchers should try to capture and understand the nature of the research design. When the nature of the research design is recognized, there are three different classifications of a research purpose; exploratory, descriptive and explanatory. An exploratory study is about to explore, seek new insights and to understand different phenomena from new perspectives. According to Saunders et al. (2012), comparisons can be made by an explorative study and it can be illustrated with the activities made by a traveller in order to find new places. The flexibility and the ability to change are the greatest benefits. A descriptive study is more of a precise description of individuals or occurrences while explanatory studies try to find casual relationships among variables (Saunders et al., 2012).

Bearing in mind the nature of this research, an exploratory study is carried out. This is due to the lack of existing theory of outcomes achieved and challenges encountered regarding the implementation of e-Procurement within the Swedish construction industry. Therefore, the effects of e-Procurement can be difficult to fully understand in this context. An explorative approach allows the study to dig deeper into the effects of e-Procurement in an industry that does not have experienced similar endeavors before. By contrast, an explanatory or descriptive approach suits a study which can be based on more experienced literature respectively a better knowledge about the expected outcomes of the research questions. One could argue for a descriptive study since the research questions are two ‘what?’ questions. However, it is essential to be aware of the nature of the problem if a descriptive study should be carry out (Saunders et al., 2012). If the nature of the problem is not completely clear, an exploratory study is more appropriate (Saunders et al., 2012). Due to the lack of existing theory on e-Procurement in the construction industry in general and the Swedish construction industry in particular, certain aspects and understanding might be missing when conducting a descriptive study. Saunders et al. (2012) argue that one principle way of carrying out explorative research is to interview experts which has been done in this thesis.

3.2.3 Research Approach

According to Saunders et al. (2012), there are three types of research approaches, namely induction, deduction and abduction. These approaches will have an impact on the overall research design (Saunders et al., 2012). Deduction has a strong connection to positivism. A deductive research approach tries to generate theory by testing hypotheses based on existing theory. This approach is in line with how natural scientists conduct their research (Saunders et al., 2012). During the 20th century, social scientists became very critical to the
cause-effect link in deduction. They claim that research often lacks the understanding of how the social world is interpreted by individuals (Saunders et al., 2012). In order to gain such understanding, the inductive approach is preferred. Induction builds up new theory on the basis of collected empirical data. Abduction is a mix of the deductive and inductive approach whereby a study investigates existing theory as well as empirical data to discover themes and patterns. Thus, abduction can be seen as a rather free way of expounding gathered data and theory until the study has fulfilled its purpose (Saunders et al., 2012).

To serve the purpose of this thesis in the best way possible, an abductive approach has been chosen. Existing theory within this subject area has been extensively reviewed. The gaps in literature discussed in the introduction section make the usage of a deductive approach unreasonable. An abductive approach needs to be applied due to the shortcomings of research regarding e-Procurement within the Swedish construction industry. To get an overall view and understanding of the context studied, a combination of existing theory on e-Procurement and new collected data is necessary. A deductive approach could have been made based on theory originating from studies conducted in Malaysia and the United Kingdom. Again, the limit of time as well as the differences in the construction industries of various countries are reasons to reject the deductive approach. An inductive approach has been rejected as well in this study due to the time limit and lack of access to a large sample. New theory building only based on empirical findings would have been unfeasible. Furthermore, in the case of choosing induction or deduction, relevant aspects could have been lost due to the lack of understanding.

### 3.2.4 Qualitative Research

Saunders et al. (2012) bring up three different concepts through how methods can be examined; qualitative, quantitative and mixed-methods. A qualitative research study emphasizes mostly words instead of numbers when it comes to data collection and the analysis of the collected data (Bryman & Bell, 2011). It is more about how individuals see and interpret the social world (Bryman & Bell, 2011). Whereas a quantitative study can be seen as an approach that is more about quantification in the collection and the analysis of the data.

In this study, a clear qualitative research design is being conducted. Due to the nature of the research area and in order to fulfill the purpose, a qualitative approach is needed. Primarily, words and a wider perspective, which includes how the individuals interpret the social world, is taken into consideration in order to give reasonable answers to the research questions. To make a quantitative study, an extended time horizon would be necessary.

### 3.3 Research Strategy

When collecting empirical data, it is crucial to adhere to a consistent research strategy which enables you to achieve your intended research goal (Saunders et al., 2009). According to Yin (2014), the research strategy focuses on defining a plan of actions on how to answer the research questions and meet the objectives of the study. Researchers can choose from a various range of research strategies depending on the purpose of the research which can be, as above mentioned, either exploratory, descriptive or explanatory (Yin, 2014). Common research strategies or methods outlined in literature are experiment, survey, case study, action research, grounded theory and archival research (Saunders et al., 2009; Yin, 2014).
3.3.1 Choice of Research Strategy

Since this thesis aims to provide a rich understanding of the subject, which is outcomes achieved and challenges encountered when implementing e-Procurement in the Swedish construction industry, the strategy of conducting a case study has been chosen. Robson (2002, p. 178) defines a case study as ‘(…) a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence’. This definition fits the purpose of this study very well since the Swedish construction industry is the real life context and several companies will be interviewed. Further reasoning is that the case study is most often used in exploratory research because ‘why?’, ‘what?’ and ‘how?’ questions can be answered (Saunders et al., 2009). Other research strategies, for instance a survey, would not serve the purpose of this study as accurate. This is because the ability to explore and understand the context is limited in a survey due to the number of variables for which data can be gathered (Saunders et al., 2009).

3.3.2 Research Design

There are four different ways on how a case study can be conducted based on two distinct dimensions which Yin (2014) distinguishes as follows:

- single case vs. multiple case
- holistic case vs. embedded case

A single case design refers to a critical or unique case, e.g. one company, while a multiple case design implies the investigation of several cases (Blumberg, Cooper & Schindler, 2011). Blumberg et al. (2011) argue that there are justifiable occasions when a single case study is adequate but multiple case studies are preferable since they deliver more robust results. However, the findings of a multiple case study need to be generalized (Blumberg, 2011).

In this thesis, a single case study will be applied since the investigated implementation process of e-Procurement in one supply chain, namely purchasing of aggregate products and machine services in the Swedish construction industry, is seen as one case. This supply chain refers to the above-mentioned NeC standard. In order to get a comprehensive view on this supply chain, nine respondents from five different organizations who participated in the implementation process of e-Procurement have been selected. This selection process will be explained in detail in the subsequent section.

The focus of Yin’s second dimension lies on the unit of analysis. A holistic case study refers to an industry or an organization as a whole while an embedded case study is designed to examine logical sub-units within an organization, e.g. departments or work groups (Yin, 2014). Since the unit of analysis of this thesis is the implementation process of e-Procurement in one supply chain, it can be argued to be a holistic case study.

Consequently, the research strategy of this thesis complies with the requirements to be a holistic single case study. The case companies were selected due to their relevancy to the studied implementation process of e-Procurement. The focal firm, Peab, is the only big construction company in Sweden which has actually implemented the NeC standard and the three chosen suppliers were involved to the greatest degree in this process. BEASt was selected since it is the joint venture for integrating the Swedish construction industry and can provide a holistic perspective.
3.4 Data Collection

This study can clearly be seen as qualitative while the research strategy is to carry out a case study. There are a limited number of methods to generate data in a case study. According to Bryman and Bell (2011), the two most typical collection methods are ethnography and qualitative interviews. Ethnography implies that a phenomenon is investigated within the context in which it occurs, e.g. an organization. Knowledge can be attained by listening to conversations and extended participant observation.

The other method is interviewing which is probably the most common method in qualitative research worldwide (Bryman & Bell, 2011). A reason for that could be the valuable flexibility that an interview offers. Interviewing usually takes a lot of time to conduct, considering transcription and further analysis of the mass amount of collected data which interviews imply (Bryman & Bell, 2011). In this thesis qualitative interviews have been carried out.

3.4.1 Interview Design

The choice of conducting qualitative interviews is based on the purpose and the context of the study. A deeper knowledge is required in order to be able to develop good answers to the research questions. Since one focal firm in the Swedish construction industry, the joint venture BEAst and three key suppliers will be questioned, ethnography would be very hard to accomplish due to the time limit and availability. By interviewing the case companies, flexibility will arise in order to get good answers to the questions. More specific, non-standardized and semi-structured interviews have been chosen in order to stick to the area of research. A choice for unstructured interviews might result in floating away too much from the purpose of the study. Since outcomes and challenges when implementing e-Procurement are the focus of this thesis, the interviews are designed based on existing theory in this field and encourage discovering possible new aspects. Thus, without losing flexibility but still sticking to the agenda, faith has been put in semi-structured interviews.

Furthermore, face-to-face interviews have been conducted. The most important advantage of this interview method is the attendance of the questioner which makes it possible to ask follow-up questions (Bryman & Bell, 2011). The presence of the interviewer also enables the respondent to elaborate more in the answers given to the questioner. A disadvantage of face-to-face interviews is the short time that the respondent has to think before the answer is given. If an internet survey is sent out, the respondent has much more time. Another disadvantage is the time spent and the cost of carrying out face-to-face interviews (Bryman & Bell, 2011). In this study, the advantages of face-to-face interviews overweigh the disadvantages why this type of interviews has been chosen.

3.4.2 Interview Respondents

According to Bryman and Bell (2011), lack of transparency is an issue in many qualitative studies. This issue is often raised in relation to the sampling. Convenient sampling respectively the amount of interviews carried out can be seen as method problems (Bryman & Bell, 2011). The selection of the respondents to the interviews has been based on the following three criteria:

- Does the respondent represent an organization operating in the Swedish construction industry?
• Has this organization been involved during the implementation of NeC which is understood as part of e-Procurement?
• Does the respondent hold a managerial position or at least have a comprehensive overview of the implementation process?

The first criterion was developed in accordance with the scope of this thesis which is the Swedish construction industry. The second criterion emanates from the purpose of the research to investigate the outcomes achieved and challenges encountered when implementing e-Procurement. Thus, the interviewed organizations need to have actively participated in the process of implementing NeC in the Swedish construction industry. This ensures relevant data output regarding the expertise of the respondents and their proximity to the process. It is necessary that the respondents are able to answer from a more managerial perspective since this study aims to provide a holistic view of the entire industry. This results in the third selection criterion. Hence, end users executing the operational work in the system will not be part of this particular study. Table 3-1 shows the selected respondents from the different organizations and when the interviews have been conducted. It further states the duration of the respective interviews.

Table 3-1 Interview Respondents

<table>
<thead>
<tr>
<th>Organization</th>
<th>Respondent's Position</th>
<th>Interview Date</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAst AB</td>
<td>CEO</td>
<td>2015-03-31</td>
<td>45 min.</td>
</tr>
<tr>
<td>Bellmans</td>
<td>Manager Operations &amp; IT</td>
<td>2015-03-24</td>
<td>40 min.</td>
</tr>
<tr>
<td>Clifton</td>
<td>Project Developer</td>
<td>2015-03-27</td>
<td>40 min.</td>
</tr>
<tr>
<td>Clifton</td>
<td>Regional Manager Machine Services</td>
<td>2015-03-27</td>
<td>35 min.</td>
</tr>
<tr>
<td>FORIA AB</td>
<td>Resource Manager Construction &amp; Infrastructure</td>
<td>2015-03-25</td>
<td>50 min.</td>
</tr>
<tr>
<td>FORIA AB</td>
<td>Manager E-Com</td>
<td>2015-03-25</td>
<td>50 min.</td>
</tr>
<tr>
<td>PEAB AB</td>
<td>Project Manager</td>
<td>2015-03-27</td>
<td>50 min.</td>
</tr>
<tr>
<td>PEAB AB</td>
<td>Regional Head of Purchasing</td>
<td>2015-03-27</td>
<td>60 min.</td>
</tr>
<tr>
<td>PEAB AB</td>
<td>Strategic Buyer</td>
<td>2015-03-31</td>
<td>40 min.</td>
</tr>
</tbody>
</table>

The NeC standard has been tested in the region around Stockholm as well as in Skåne. Thus, interview respondents have been chosen from both the area around Stockholm and Skåne. Three persons from the focal firm have been selected, both from Stockholm and Skåne. All three persons fulfill the aforementioned criteria including a managerial position and involvement in the implementation of e-Procurement.

This thesis will, due to the time limit, not include more than nine interviews. Of course, more interviews would have strengthened the credibility of this study. At the same time, nine interviews can be seen as a reasonable amount regarding the involved organizations in the pilot-projects when implementing e-Procurement in the Swedish construction industry. The choice of the focal firm is based on the fact that Peab has recently implemented e-Procurement. The choice of the three key suppliers is based on the fact that these companies were involved to the greatest degree when implementing e-Procurement. The respondents from these three companies are the ones with a deep knowledge about the implementation and management of the process. The choice of a respondent from BEAst is self-explaining since this is the actual e-Procurement platform for the Swedish construction industry.
3.4.3 Interview Guide

An interview guide has been made in order to cover the relevant subjects of this study (see Appendix). With regard to the following analysis, three different categories have been created, namely introduction/context, outcomes achieved through e-Procurement and challenges encountered by e-Procurement. This was made in order to collect relevant data to be able to fulfill the purpose of this thesis. The creation of these categories will be explained in detail in the data analysis section.

A serious attempt has been made in order not to ask leading questions. Question 7 could be seen as leading but this subject is a side subject of this study and therefore just a simple question about the power relationship will be asked. Depending on the answers from the respondents, few or several follow-up questions will be asked which is in line with the frame of semi-structured interviews (Bryman & Bell, 2011).

3.4.4 Interview Procedure

The interviews of this thesis have been conducted face-to-face with a few exceptions. Two of the respondents were not available during the period when the empirical data was collected. Instead, two web-based video interviews have been carried out with these respondents. All the interviews were performed in Swedish. This choice was based on the fact that only Swedish people were questioned and therefore language barriers could have occurred if the interviews would have been made in English. Thus, no data will be lost in translation. Transcriptions of the interviews were made and sent out to all the respondents. The respondents then had the chance to change and approve the interview material.

The interviews lasted between 35 and 60 minutes whereby the respondents had unlimited time to describe and discuss different aspects. The above mentioned interview guide was followed in order to provide a structure to the interviews. In addition to the questions of the interview guide, some follow-up questions were asked.

3.5 Data Analysis

Once the empirical data has been collected, it needs to be clear how this data will be analyzed. In literature, two different types to do so can be found, namely quantitative data analysis and qualitative data analysis (Welman, Kruger & Mitchell, 2005; Saunders et al., 2009). According to Saunders et al. (2009), quantitative data analysis refers to analysis techniques such as charts, graphs and statistics which allows us to explore, describe and examine relationships and trends within the data. Quantitative data in its raw form would not mean much to most people (Saunders et al., 2009). Qualitative data analysis whereas implies all non-numerical data which can range from short lists of responses to open-ended questions to more complex data like transcripts of in-depth interviews (Saunders et al., 2009). Different analysis techniques allow us to create meanings to the data, develop theory and make it understandable (Saunders et al., 2009). Since this thesis applies a qualitative research method and data is collected by more open semi-structured interviews, qualitative data analysis will be conducted. The analysis is not based on meanings derived from numbers but on meanings expressed through words. Dey (2003, p. 29) argues that ‘(...) the more ambiguous and elastic our concepts, the less possible it is to quantify our data in a meaningful way’. This statement backs up the decision very well since e-Procurement in the Swedish construction industry is a rather complex concept which makes a quantitative approach impracticable.
The non-standardized and complex nature of qualitative data impacts its analysis. According to Saunders et al. (2009), the following three types exist in order to analyze data qualitatively:

- summarizing of meanings
- categorizing of meanings
- structuring of meanings using narrative

All of these types can be conducted on their own or in combination (Saunders et al., 2009). Dey (2003) illustrates qualitative data analysis as a circular process starting with describing, then classifying and finally connecting the collected data. In this thesis, a combination of summarizing and categorizing data will be applied.

After transcribing the records of the interviews, these transcripts will be summarized in order to compress the statements and produce an overview of the key points. This rephrasing in a few words will help to understand the information given in the interviews aiming to the purpose of this study. As Robson (2002) suggests, the produced summary of the interviews will be provided in the findings section of the thesis for validity reasons and further reference. This summarizing makes it possible to identify relationships between the statements and support the categorizing process (Saunders et al., 2009).

The next step in the analysis is to categorize the data. As mentioned before, the interview guide has already been set up in the constructs introduction/context, outcomes and challenges with regard to e-Procurement. These categories have been derived from the research purpose and the frame of reference, thus before the actual data analysis. This is in line with the statement by Saunders et al. (2009) to use codes or labels in order to group the data. The category introduction/context was created for research quality issues, to raise the attention of the respondent to the topic and to detect the respondent’s view to the subject. The subsequent two constructs aim to fulfill the purpose of this thesis and answer the research questions. The category outcomes achieved through e-Procurement is designated to the first research questions. Consequently, the category challenges encountered by e-Procurement aims to answer the second research question of this study. This categorization makes it possible to compare the data, recognize relationships and draw conclusions (Saunders et al., 2009).

As an abductive approach is applied, the empirical findings have to be analyzed and compared with literature in place. In this thesis, pattern matching is used which means to predict a pattern of outcomes based on existing theory in order to explain the expected findings (Saunders et al., 2009). This was made by developing the frame of reference with the major constructs outcomes and challenges of e-Procurement. The created tables 2-1 and 2-2 summarize the existing theory and deliver the predicted pattern of outcomes for the findings. In the subsequent analysis, the collected data is compared and matched with this pattern in order to test the accuracy or explain new findings. During the data collection and analysis process, the frame of reference was simultaneously revised and adapted in order to best fulfill the purpose of this study.

As a tool to support the data analysis process, Microsoft Excel has been used since specifically developed computer aided qualitative data analysis software (CAQDAS), such as NVivo™ or HyperRESEARCH™, was not available.
3.6 Research Quality

To ensure the quality and credibility of the research, Yin (2014) suggests conducting a consistent test on the study from the research purpose, across data collection through to the results. This includes construct validity, internal validity, external validity and reliability, all discussed below. In addition, issues of research ethics will be considered to further enhance the quality of this thesis.

3.6.1 Validity

According to Yin (2014), the validity of the research can be affected if a researcher has emotional connections to the studied cases, e.g. any relationship to employees within the organizations. The term construct validity refers to how subjective the judgments of the researchers are in the data collection process and how well the constructs can be measured (Yin, 2014). Firstly, it is to say that the authors of this thesis verifiable have no personal relationships to employees of the case companies. Only professional relationships have been established during the writing process of this thesis. Secondly, data triangulation was applied since data was collected from different types of organizations within the Swedish construction industry; the focal firm, key suppliers and the joint venture BEAst. Thus, the collected data emanates from different perspectives and raises the generalizability of the measured constructs. Thirdly, due to the fact that two authors are writing this thesis, different opinions to the findings arise which need to be discussed resulting in a more objective view.

Yin (2014) argues that the result and the internal composition of the content should align with reality, which is internal validity. It also refers to the ability to measure what you intend to measure (Yin, 2014). This can be achieved since the empirical findings were compared and matched to existing theory. The interview questions were designed clearly and understandable in order to gain accurate data for the intended outcomes. Furthermore, the questions were explained more in detailed if requested from the respondent. Follow-up questions were asked in order to understand the meaning of the respondent’s answer to its full extent.

External validity is related to the real world of organizations, includes the simplification of the findings and to which degree these can be generalized to other cases or situations (Yin, 2014). This is done with regard to the different answers of the case companies. The constructs generated for the interview guide are followed consistently through the data collection and analysis process. The findings are matched to existing theory and compressed to generalized categories. However, external validity is difficult to achieve since case studies are very specific and qualitative studies in general not really appropriate for generalization. There are many aspects to consider in other cases and circumstances which will question the generalized findings.

3.6.2 Reliability

Reliability implies the concept of consistency. This means that other researchers would be able to obtain the same findings and conclusions in the same kind of study, following the same procedures (Yin, 2014). In this context, transparency regarding data collection and analyzing techniques plays an important role (Yin, 2014). To achieve reliability, high emphasis was given to transparency in this study. The criteria for selection of respondents to the interviews are provided in detail. Furthermore, the designed interview guide is explained and attached in the appendix which allows other researchers to use the same ques-
tions or develop them for further research. However, the follow-up questions used in the semi-structured interviews might be a drawback to transparency. But further pushing up the reliability of this thesis, a detailed description of the analyzing procedures is presented, easy to duplicate by other researchers.

3.6.3 Research Ethics

In addition to validity and reliability, research ethics including among other things integrity, voluntary nature of respondent participation, privacy, confidentiality or responsible reporting, also enhance the quality of the research (Oliver, 2010).

All these aspects have been considered in this thesis as well. First of all, the purpose and the content of the study were explained to the potential respondents in advance in order to get their consent for voluntary participation. Then, during the execution of the interviews, the respondents were asked for their consent to record the interview as well as if they would like to remain anonymous within this thesis. However, no respondent had concerns regarding these points. To prevent the possibility of bias during the interviews, the respondents were able to talk as open as possible with regard to semi-structured interviews. Due to the nature of the research purpose, the moderators stuck to the interview guide in order to keep the discussion in line with the topic. After the interviews, the transcribed records were sent out to the respondents to get them approved and see if information should be excluded.

To be in line with confidentiality, the collected data will only be saved on the personal computers of the authors and only these two persons have access to it. It is clearly stated that this data will only be used for the purpose of this thesis. Unless otherwise requested, this data will be deleted after a time of five years.

Responsible reporting and maintaining a source of evidence is achieved through the usage of the Harvard citing system. All existing theory and thus intellectual property is clearly cited according to this system. Other findings and conclusions emanate from the empirical data or the knowledge and experience of the authors.
4 Empirical Study

4.1 Introduction

In this chapter, the empirical findings of the data collection will be presented whereby the sections are designed in line with the constructs created for the interview guide. First of all, the case companies will be introduced and the case context will be explained more in detail. Moreover, the transcribed interviews will be summarized in fewer words and direct quotations of different respondents will be given to raise the quality of the section. The findings are further structured into outcomes and challenges when implementing e-Procurement and with regard to the case companies which have been classified as the organization BEAst, the suppliers and the focal firm.

4.2 Case Description

4.2.1 Companies

As introduced above, BEAst is the joint venture by currently 85 actors of the Swedish construction industry. The companies involved are leading organizations from different parts of the industry and aim to increase integration within the industry by developing common information standards (BEAst, 2015a). BEAst was already founded in 1988, however with a different name. In the beginning of the 90s and the following decade, BEAst focused on participation in international standards under the framework of UN/CEFACT and the previous European EDI BUILD Europe. During this time, BEAst had between 20 and 30 members but when the interest for e-Business increased, a lot of new members joined. In recent years, many efforts have been made to implement the developed standards in practice (BEAst, 2015a).

The three selected suppliers of the case are Foria, Bellmans and Cliffton which all provide supply and transportation of aggregate products (e.g. sand, gravel or concrete) as well as machine services for the Swedish construction industry. Foria is one of the largest transport and machinery service provider in Sweden. They have offices at nine different places in Stockholm and the surrounding cities (Foria AB, 2015). Bellmans is considered to be one of the biggest actors when it comes to transportation and machinery services in the Stockholm region. Previous year, it generated a turnover of 700 million SEK by offering the services of a number of 600 different types of vehicles (Bellmans, 2015). Cliffton is a trademark of Swerock which is owned by Peab. Cliffton has many offices within Sweden and provides transportation of aggregate products and machine services for the construction industry (Cliffton, 2015).

Furthermore, the focal firm Peab is one of the leading construction and civil engineering companies in Sweden (Peab AB, 2015) which participated to a great degree in the process of implementing e-Procurement. Peab has around 13,000 employees and generated sales exceeding 43 billion SEK in 2014. The main office is located in Förslöv, Skåne. They operate in four different business areas which are building, infrastructure, industry and project development. This thesis focused on the infrastructure unit. Peab’s infrastructure unit is mainly focused on the local market. This unit is again divided into geographical regions and specialized product categories. Since Peab is such a huge company, it has created economies of scale in large and complex projects (Peab AB, 2015).
4.2.2 Context

As mentioned above, BEASt has created several different electronic standards in order to integrate the Swedish construction industry. However, in this study the standard ”Nordic e-Construction” (NeC) was the focus.

According to the CEO at BEASt, interviews were conducted a few years back with personnel from the Swedish construction industry. The result was that transportation of material to construction sites and the hiring of machine services were extremely manually handled. The need for a more efficient way of working became obvious. The CEO at BEASt states:

"A lot of mistakes have been made and it was surprising for me how it could have been like this for so long. These are huge companies we are talking about."

Another thing that surprised the CEO at BEASt was that the suppliers were the actors which had big problems with their information flows. Many of the suppliers had support for receiving electronic orders and did that with customers in other product categories. The huge construction companies had to make the biggest changes in order to be able to have an electronic information flow.

After the result of the study regarding the purchasing of transportation of material and machine services was presented, all the actors involved agreed to make changes in order to become more efficient with regard to their information flows. A project was started to create a standard for which the CEO at BEASt was the responsible Project Manager. In particular, this is the NeC standard which includes all the processes related to purchasing of transportation of material and machine services illustrated in detail in figure 4-1.

Figure 4-1 NeC Process.
(Source: BEASt, 2015b)
In the first phase of the project, a process description was created including system support and electronic communication. Standard messages, delivery schedules, call off orders, etc. were introduced. In the second phase, improvements have been made to the standard and 16 different pilot-projects have been conducted. Unfortunately, Peab was the only big construction company that has tested the NeC standard in practice. A further aspect during phase two was the implementation of environmental data.

Foria, Bellmans and Cliffton were all involved quite early in the process of developing the NeC standard, together with leading construction companies and other organizations from the Swedish construction industry. The suppliers have not had extensive integration with its customers in the past. They also claim that the construction industry is underdeveloped when it comes to e-Procurement and other types of e-Business. The suppliers have tried to develop electronic orders on a basic level as well as the usage of mobile data but the big construction companies have not been interested before. The reason behind this is the tradition of having papers within the construction industry as the Manager E-Com at Foria states:

"It has always worked out this way and it will always do. I think it has a lot to do with the strong tradition."

Considering power relationships, Foria, Bellmans and Cliffton argue that Peab is the customer and therefore has more power in setting the terms. At the same time, they state that all actors have been involved in the development of the NeC standard. It is a collaboration wherein all the actors have a say. All the suppliers have a positive attitude towards e-Procurement and would like to promote it further.

Peab and these three key suppliers have been running 16 pilot-projects on the NeC standard in Skåne and the region around Stockholm over the past three years and are now in a phase to roll this out on a big scale. The Project Manager responsible for the implementation of e-Procurement says that:

"e-Procurement is considered to be the future working method!"

According to the Regional Head of Purchasing, some years ago not even electronic invoicing was used. Thus, the discussion on supply chain integration and implementing e-Procurement has been a prevailing issue within the company for many years. Especially aspects such as information sharing and reduction of manual and administrative work are seen as very important. The overall attitude of the focal firm to this concept is very positive. However, the change process of such an encompassing project takes time since it is such a big company with many subsidiaries and managers on the construction sites might not have the holistic view. But all the respondents state that the users who have experienced the new system do not want to go back to the former working method.

Peab does not see itself in a buyer dominant position regarding the power structure. But it is actively driving the process within a constructive collaboration to achieve a new and more efficient working method. However, the Project Manager states that the suppliers who adopt e-Procurement will be more attractive in future selection. The respondents argue that these endeavors are not only beneficial for themselves but also for other entrepreneurs and all kind of suppliers, thus the entire industry.
4.3 Findings Outcomes

4.3.1 BEAst

The CEO at BEAst points out several outcomes that can be achieved when implementing e-Procurement. One important aspect is the automation of the orders sent from the construction company to the suppliers. This will save time and administration work as well as fewer mistakes will occur in the operational processes. The CEO at BEAst says:

"If you send information from one system directly to another system, no more failures will occur."

If the site managers at the focal firm start to make the delivery schedules and provide them a few days in advance, then the suppliers will get a better overview of the demand and can plan their operational processes in a better way. This has a remarkable positive impact on the capacity usage of the suppliers. In those pilot-projects where the site managers have made plans, the focal firm experienced a better delivery reliability which is the benefit side for the focal firm.

According to the CEO at BEAst, an investigation has been carried out on the amount of kilometers driven by the truck drivers. The delivery schedules also enabled the suppliers to optimize the trip routes which has a positive effect on the emissions from the trucks and thus the industry.

4.3.2 Suppliers

First of all, the industry has agreed on common article numbers which facilitate electronic messages between the organizations. The order receipt has worked out well for all of the suppliers. This saves a lot of paperwork.

Another advantage is that money comes in faster to the supplier’s accounts. Earlier, they had to send out orders to the vehicle drivers. Then they waited until the end of the week before they reported back what they have done. Then they could begin to set prices and bill the focal firm. But today, the suppliers are able to do so at the same day when the job is done. If a supplier has approximately an annual turnover of 700 million SEK, the daily turnover easily sums up to 2 million SEK. Bellmans’ Manager Operations & IT explains:

"Each day’s faster billing means 2 million SEK extra on the company’s accounts. Assumed we can speed this up for five days, then 10 million SEK will be in our hands earlier instead of lying on the customers’ accounts."

In theory, this is called the order-to-cash cycle which includes all processes connected to a customer sale from order entry across order fulfillment until collection of payment (Weiss, 2011). This is particularly important for the supplying side since capital employed can be used for other resources respectively investments instead.

A better orderliness is a key advantage for the suppliers. e-Procurement has facilitated electronic compilation of different numbers. Now they can follow up prices, sold items and get a clearer picture of what has been done in a project. It has also decreased the time it takes for the truck and machine drivers. Now they can report the tons of material and the amount of hours spent directly back to the office. The Resource Manager at Foria states:

"It minimizes mistakes, creating more time for the people who manage the planning of the trucks and machinery as well as for the drivers when they can report back to the office at the same day."
If some mistakes will show up, the suppliers and the construction company will see it right away and can fix it instead of waiting for two weeks until the invoice is issued.

A key step for the suppliers is the electronic delivery schedule. The delivery schedules have been implemented in both regions but with different results. In the Skåne region, these schedules have not worked out that well. In the region around Stockholm the schedules have performed well for Bellmans while Foria has not experienced any success from the delivery schedules. This is due to the fact that some of the site managers have been better in creating delivery schedules in comparison to others.

e-Procurement has resulted in better transparency between the suppliers and the focal firm. The delivery schedule and the electronic order receipt has facilitated the information flow between the actors. According to the suppliers, the electronic messages make it easier to get access to information as well as to structure and work with the information given.

The suppliers add that they get the information automatically into their computer systems. The drivers do not have to keep papers in the truck. Now they are able to operate with a smartphone or an iPad which makes the process quicker and easier for them to handle.

Before the implementation of e-Procurement, the suppliers used to receive orders the same day or the day before the focal firm needed the material. According to the suppliers, this makes it hard for them to reach efficiency in their capacity usage. The delivery schedule is a key step in order to improve the outcome from the suppliers’ point of view. The suppliers agree upon the fact that the capacity usage will be improved when the delivery schedule is implemented successfully. Bellmans, which has experience in well performing delivery schedules, highlights that the capacity usage is better today than before the implementation of e-Procurement. The Manager Operations & IT at Bellmans says:

“It is much easier when ordering services of our drivers, if we can guarantee that they can drive five days in a row instead of just one day. This is a considerable improvement for us.”

The Project Developer at Cliffton about the capacity usage:

“I think we can increase the capacity about 5-10% if we look a few years ahead.”

He also claims that they will save costs by implementing e-Procurement. The reduction of administrative work will result in a couple of percent cost decrease. Bellmans argues, if the focal firm and Bellmans will continue with e-Procurement, they can save a lot of money. Especially if they will implement e-Procurement in all their projects and if the whole NeC standard will be further developed.

4.3.3 Focal Firm

A positive outcome when implementing e-Procurement regarding operational processes is that this has led to a higher accuracy. For instance are prices already available in the system and allow a quick match with the order confirmation when invoicing. This reduces the error rate considerably. As a consequence, the necessity to issue credit notes retroactively could be almost eliminated due to this accuracy with the help of the system.

The electronic information sharing (e.g. call off orders or order confirmations) leads to a higher transparency in the processes and enables a better planning which has not been done before. As noted from the Regional Head of Purchasing:
"It becomes so incredibly transparent now and has to do with actual matters, that things are agreed upon in advance and performed properly."

Transparency does not imply to control each other, it is more about collaboration, communication and trust as well as a facilitator for planning. The implementation of delivery schedules forces the site managers to plan one week in advance which not only benefit them but also the suppliers. However, these delivery schedules turned out to be difficult to implement. Only around half of the pilot-projects delivered positive outcomes when it comes to the delivery schedules. This is again due to the complex and fast-paced construction industry. Sometimes it is not possible to predict what is needed on the next day. Efforts have been made to set up rough delivery schedules one week in advance and provide detailed planning in shorter notice.

A further benefit accompanying electronic information sharing is that things can be discussed on the basis of real-time data. The Regional Head of Purchasing adds that this also implies that the site managers have a better overview over the spent budget and do not have to calculate "with pen and paper" as they used to do before.

All respondents highlight that it is possible to foresee problems and solve them before they might arise. With the aid of the system, the users have direct contact to the counterpart and can communicate easily. This communication allows the parties to share thoughts and expectations which in turn lowers the risks connected to the sourcing respectively delivery processes. According to the Strategic Buyer are the construction sites very dependent on the fulfillment of the orders from the side of the suppliers. Thus, the mutual working on solutions and more planning security is highly appreciated.

Another big advantage is that capacity usage has risen through e-Procurement. It has to be noted that not the utilization of machines and equipment at the focal firm has observably improved but more things can be done with the same amount of personnel. The managers on the sites can concentrate on productive work and do not have to spend so much time on administration, e.g. checking invoices. Hence, the entire efficiency and quality of work has increased. The reduction of administrative work emerge due to the nearly complete elimination of paperwork. The site managers do no longer receive a bunch of order confirmations and invoices which they have to match with each other. The Regional Head of Purchasing describes this as:

"The elimination of unnecessary work which does not lead to anything productive!"

This saved time can be spent on value-adding processes such as forecasts on project efficiency, follow-up the project status and planning of project resources. The Project Manager adds that this also makes Peab more attractive as an employer:

"It is not attractive if you have studied for five years at university and then have to sort papers when start working."

The transportation of material such as gravel, asphalt or concrete as well as the machine hours for services are a substantial cost factor. Even little optimization in the sourcing process has a tremendous effect on the costs. The Regional Head of Purchasing estimates a price reduction of approximately 5% when implementing e-Procurement but this has not been clearly proved in the pilot-projects. Also because it is difficult to measure and connect to the NeC standard. Nevertheless, if more and more projects are accomplished by means of the NeC standard now, financial figures can be compared to the former working meth-
od. Furthermore, the feeling is that the trend of prices can be slowed down by this working method in future.

Additional outcomes mentioned are the possibility to create statistics for analysis, the uniform article numbers which facilitate communication and bookkeeping as well as that the entire industry is working on a common project to develop together. The Project Manager emphasizes:

"I think it is important that we in the whole industry have something to gather around, to work together and to develop the business."

A higher delivery reliability, to be a cooperative partner towards the suppliers in order to create a frame for more efficiency and a better working atmosphere since people do not have to argue about problems which could have been prevented from the beginning are further implications of the NeC standard. It is an "overall package".

4.3.4 Summary

Since the case study revealed quite many outcomes achieved when implementing e-Procurement, it is necessary to provide a structured overview of the findings. This is done in the below table 4-1. The summary also aims to facilitate the following analysis of the data and the comparison to existing theory.

The table is designed in the same way as the findings section regarding the categorized case companies which are BEAst, suppliers and the focal company. Key words are given for each outcome they have stated in the interviews. A short description of these outcomes provides a better connection to the case context.

It is to mention that some outcomes are interrelated and create additional benefits which is explained in the description. For instance leads integrated information sharing to a higher transparency in the process and facilitates planning activities.

4.4 Findings Challenges

4.4.1 BEAst

An important aspect is that the companies along the supply chain start to plan a few days before the demand becomes due which turned out to be one of the trickiest parts. The personnel at the construction sites have been a bit comfortable. They could just pick up the phone and call the suppliers the same day or the day before they wanted the delivery of material. This makes it hard for the suppliers but also for the construction companies since the suppliers do not have the same amount of capacity each day. In this case, the suppliers had to call competitors or other companies in order to fulfill the demand of the focal firm.

4.4.2 Suppliers

The suppliers claim that it costs money to change from manual processes to e-Procurement. First, the suppliers need to invest in adapting their IT-Systems. However, the costs for doing so have been relatively low for two of the suppliers. This is because these have already been mature in this area due to experience in other product categories. Overall are the suppliers quite satisfied with the adjustments to the IT-Systems, though with a few exceptions. Foria claims that they had some problems with different interpretations of the information that was transmitted electronically between them and the focal firm.
Table 4-1 Summary Findings Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated ordering process</td>
<td>The automated ordering process with electronic support results in fewer errors, time savings and reduction of administrative work.</td>
</tr>
<tr>
<td>Better capacity usage</td>
<td>Especially the side of the suppliers is able to allocate their resources better due to the knowledge on demand which in turn raises the delivery reliability.</td>
</tr>
<tr>
<td>Improved planning capabilities</td>
<td>Delivery schedules support planning and forecasting instead of ordering in short notice which increases the transparency in the supply chain.</td>
</tr>
<tr>
<td>Integrated information sharing</td>
<td>Direct communication between the different systems enables to work with real-time data and improves the collaboration within the supply chain.</td>
</tr>
<tr>
<td>Optimized trip routes</td>
<td>The suppliers can optimize the trip routes for the trucks which has a positive effect on emissions.</td>
</tr>
</tbody>
</table>

**Suppliers**

| Better capacity usage              | The better planning and communication between the actors makes it possible for the suppliers to use their resources better and optimize transportation routes. |
| Better orderliness in the process  | The more accurate reporting of the truck drivers allows the suppliers to follow up prices, sold items and what has been done in a project. |
| Electronic information sharing     | Electronic messaging of e.g. order confirmations or receipts facilitate the daily processes considerably and eliminates paperwork. |
| Faster problem solving             | Problems in the process can be detected and solved in advance instead of waiting for them to arise. |
| Higher transparency                | Delivery schedules facilitate the order fulfillment due to early access to information. |
| Improved order-to-cash cycle       | Real-time data enables the suppliers to start the payment collection process earlier and thus capital employed can be used for other resources. |
| Reduced transaction costs          | The streamlining of processes leads to reduced transaction costs which in turn implies overall cost savings. |

**Focal Firm**

| Better problem solving             | The availability of real-time data makes it possible to foresee and quickly solve problems. |
| Higher accuracy                    | For instance are prices already available in the system and can be matched with order confirmations. |
| Improved delivery reliability      | The delivery schedules improve the delivery reliability of the suppliers on which the construction sites are very dependent. |
| Improved resource management       | Site managers can focus on production instead of being tied up in administrative work. |
| Integrated information sharing     | Shared information leads to a higher transparency, better collaboration between the parties and facilitates planning activities. |
| More attractive employer           | Up to date technologies and avoidance of unnecessary paperwork makes the focal firm overall more attractive for highly educated personnel. |
| Overall cost savings               | Transportation of material and machine hours are a substantial cost factor whereby optimization in the purchasing process result in considerable cost savings. |
| Streamline/optimize processes      | The entire industry is working on a common project to develop together and improve communication and integration. |
The suppliers also need to educate their personnel and make sure that they learn how to manage the new way of working. The suppliers therefore argue that it is important that more companies as well as other product categories within the construction industry are switching to e-Procurement. They are a bit disappointed that the rest of the industry is not implementing e-Procurement so far. A reason for this is that the investment in a new working method could turn out fruitless.

As mentioned before, one major problem is the implementation of the delivery schedules. The suppliers say that the site managers at the focal firm have problems with making delivery schedules to a rather high extent. The Manager E-Com at Foria states:

"The site managers at the focal firm have not made the delivery schedules since it was too exhausting for them. We changed it so it would be easier for them and then it worked out for a while but unfortunately it declined again."

A statement of the Manager Operations & IT at Bellmans is:

"Peab is focusing on sending the electronic order receipts. We could have a huge benefit if the electronic call off orders will work out but it has not been fully implemented yet."

According to the suppliers, this problem refers to an old tradition in the construction industry to work manually. They argue that it can become difficult to change from an old and familiar way of working to a new one. Another reason could be that this step is not equally important for the construction companies. According to Foria, electronic orders which automatically go into their system as well as electronic delivery schedules are the key aspects. From this the suppliers can save a lot of money. These steps have not been successfully implemented yet and are the main problems for the suppliers.

4.4.3 Focal Firm

The respondents admit that not only benefits arise but also challenges are encountered when implementing e-Procurement.

According to the Regional Head of Purchasing, organizational challenges have not been detected during the pilot-projects in the Skåne region. However, some challenges regarding the IT-System have been experienced. The site managers concentrate on production and are not so used to work with computers which requires time to teach them a new IT-System. It has to be user-friendly as well as a quick and comprehensive support is necessary since they might just leave it if they do not get support from the office personnel.

The other two respondents recognize that a major problem is to change the mind of the employees and the habitual working method. It is difficult to convince people who are used to work in a certain way for many years. The Strategic Buyer says that:

"It is not only the change process of a working method within one company, it is the change process of the working method of an entire industry."

Peab has a flat hierarchical structure and the philosophy not to impose a certain working method to their employees. They must see it as an alternative and realize the benefits which in turn takes time. The end-users are a bit resistant to change so far because, among other things, they fear to lose control if they do not have the familiar papers.

The Strategic Buyer has not identified any technical shortcomings since the opportunities are available. The tricky part is to adjust the whole system to the complex construction in-
industry. In this context, the Project Manager mentions the underdevelopment of the system regarding weighing of gravel for example. He illustrates:

"The Achilles’ heel lies here."

This is where paperwork is still necessary and challenges arise to digitalize the data. Particularly, gravel is an area which is rather underdeveloped so far. The gravel sector overall does not have the same technical prerequisites. According to the Project Manager, it is important that all product categories of the supply chain will be digitalized in future in order to achieve all the positive outcomes of e-Procurement. At the same time, it is impossible to reach the full potential of the NeC standard right away. It is a process and the development is moving forward step by step. Not all product categories are included in e-Procurement to date. It is not clear yet if the tested processes work for all product categories which results in somewhat uncertainty. However, the belief is that the processes are very similar and the IT-System can be adapted. The Project Manager highlights that the next important step for the NeC standard is that more product categories and also more actors from the industry will be incorporated in order to build a "critical mass".

4.4.4 Summary

In this section, the above elaborated findings regarding challenges encountered by the actors who participated in the implementation of e-Procurement will be illustrated in a more structured way (see table 4-2).

Table 4-2 Summary Findings Challenges

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAst</td>
<td></td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Employees at the focal firm are used to order in short notice and are not so eager to change their working method.</td>
</tr>
<tr>
<td>Suppliers</td>
<td></td>
</tr>
<tr>
<td>Cost/benefit concerns</td>
<td>The investments in new systems could become unprofitable if not more product categories and more actors of the industry will be included to e-Procurement.</td>
</tr>
<tr>
<td>Lack of skilled personnel</td>
<td>Training of personnel is necessary for a successful implementation of e-Procurement.</td>
</tr>
<tr>
<td>Focal Firm</td>
<td></td>
</tr>
<tr>
<td>Building a critical mass</td>
<td>This concerns to include more product categories to e-Procurement, also with regard to weighing issues. Moreover, more actors of the entire industry should be attracted to join.</td>
</tr>
<tr>
<td>IT-system and support issues</td>
<td>IT-system needs to be user-friendly and site managers require quick support from office personnel.</td>
</tr>
<tr>
<td>Lack of skilled personnel</td>
<td>Tradition within the construction industry to work manually and with many papers.</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Employees fear to lose control without the papers. They need to be convinced of the benefits of the new working method and will not be forced to adopt it.</td>
</tr>
</tbody>
</table>

Relatively few challenges could be extracted from the empirical findings, however, this can be a good sign for the success of the implementation process of e-Procurement. This summarized table will be matched with existing theory in the subsequent analysis.
5 Analysis

5.1 Introduction

This chapter of the thesis is designed for the analysis of the empirical findings and the existing theory. As described in the methodology part, pattern matching will be applied. The predicted pattern of outcomes based on the literature review will be matched with the findings collected in the interviews (see tables 5-1 and 5-2). Additional outcomes and challenges when implementing e-Procurement which could have not been detected in theory will be presented. The three different respondent groups will be compared to each other in order to identify relationships and draw conclusions. At the end, an overall statement of outcomes achieved and challenges encountered in the process of implementing e-Procurement in the Swedish construction industry can be delivered. This is the basis for the theory building in the subsequent section.

5.2 Outcomes

The literature review revealed a number of 12 outcomes which can be achieved when implementing e-Procurement. Almost all of them are applicable for the case of this study and even four additional outcomes were identified in the empirical findings (see table 5-1). The only outcome that could not be matched to this case is increased volume of operations.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>BEAst</th>
<th>Suppliers</th>
<th>Focal Firm</th>
<th>Supply Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve better resource management through real-time data</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Better supply chain transparency</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Faster problem solving through access to real-time information</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Improved communication and collaboration in supply chains</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Increased volume of operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated information sharing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>More efficient purchasing process</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Overall cost savings</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Price reduction of items purchased</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reduced process errors</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reduced transaction costs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Streamline/optimize processes</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Absent in theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better order-to-cash cycle</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Improved delivery reliability</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>More attractive employer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimized trip routes, thus lower emissions</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Integrated information sharing is an outcome achieved according to Davila et al. (2003); Subramaniam and Shaw (2004); Hashim et al. (2013) and Toktaş-Palut et al. (2014). They all claim that a key factor for e-Procurement is well-integrated information sharing. Integrated information sharing was an aspect that BEAst, the suppliers and the focal firm mentioned consistently. They argued that integrated information sharing is the core of e-Procurement which enhances lots of other benefits. This is in line with Toktaş-Palut et al. (2014) who argue that integrated information sharing facilitate many other benefits that come along with the e-Procurement concept and in the end will lead to overall cost savings.
Hawking et al. (2004) and Toktaş-Palut et al. (2014) argue that the supply chain transparency can be improved when implementing e-Procurement. The transparency in this supply chain has significantly been improved due to the findings of the conducted case study. As noted from the Regional Head of Purchasing at the focal firm:

"It becomes so incredibly transparent now and has to do with actual matters, that things are agreed upon in advance and performed properly."

The suppliers have argued as well that the transparency has been improved. The reason behind the improvement of the transparency is above all the delivery schedule that force the focal firm to plan a few days before which results in a better transparency regarding their demand to the suppliers.

Hashim et al. (2013) and Toktaş-Palut et al. (2014) claim that streamlining processes and automation of transactions will be further outcomes achieved when implementing e-Procurement. Benefits such as a more efficient purchasing process can consequently be achieved. The suppliers mentioned that they get better orderliness in their selling process to the focal firm. Now, they can follow up and accumulate sold items, set prices and get a better overview of a construction project that they are involved in. The use of iPads instead of paperwork has also streamlined the processes for the truck and machinery drivers. Instead of waiting until the end of the week, they can report back to the office at the same day as the work has been carried out. The focal firm also noted how the site managers can spend more time on productive work and less time on administration. Less time spent on administration is a result of the decreased paperwork which implies reduced transaction costs (Mukhopadhyay & Kekre, 2002; Davila et al., 2003; Subramanian & Shaw, 2004; Toktaş-Palut et al., 2014).

Toktaş-Palut et al. (2014) state that implementation of e-Procurement will result in reduced process errors since manual handling causes much more errors compared to an electronic way of working. The CEO at BEASt supports this statement regarding handling the purchasing process electronically:

"If you send information from one system directly to another system, no more failures will occur."

Since the focal firm used to handle almost all processes manually, they did not know how many errors actually occurred. Thus, e-Procurement will not only show if mistakes occur, it will prevent them to appear at all.

Additionally, all respondents at the focal firm claimed that with the implementation of e-Procurement it is possible to foresee problems and solve them before they actually arise. The system enhances better communication between the organizations which helps the counterparts to solve problems. This supports the statement by Hashim et al. (2013) and Toktaş-Palut et al. (2014) that e-Procurement will result in improved communication and collaboration within the supply chain as well as faster problem solving through access to real-time information. According to the focal firm, the construction sites considerably depend on the order fulfillment by the suppliers. The collaboration with the aim to solve issues together as well as the delivery schedules result in a more efficient purchasing process (Davila et al., 2003; Hawking et al., 2004; Subramanian & Shaw, 2004).

Both the suppliers and the focal firm agreed upon the fact that they have improved the capacity usage, however in different ways. The suppliers get a better foresight due to the delivery schedules made by the focal firm. The better planning will consequently increase
their capacity usage since they can allocate their resources and respond to the demand in a better way. The focal firm will also gain a better capacity usage since the site managers will spend less time on paperwork and more time on planning and production.

In addition to these outcomes existing in theory, several new outcomes when implementing e-Procurement could be revealed in the empirical findings. This can be due to the absence of extensive scientific research on e-Procurement within the construction industry.

The suppliers mentioned that the order-to-cash cycle has been improved after the implementation of e-Procurement. One supplier explained that their turnover is around 2 million SEK per day. The respondent assumed that e-Procurement can speed up the cash collection process by five days. That means 10 million SEK earlier cash on their accounts instead of the customers'. This is of great importance for the suppliers since a lot of money is bounded to their assets such as machinery and trucks.

In this supply chain, e-Procurement has resulted in mutual collaboration in order to find solutions. The delivery schedules have also improved the delivery reliability. Today, the suppliers know a few days before how many trucks or machinery they have to provide. Through the better knowledge about the focal firm’s demand, a higher delivery reliability can be achieved which is of great importance for both parties.

According to the Project Manager at the focal firm, e-Procurement can raise the attractiveness of the company as an employer. It is not attractive for a person who has studied for three or five years and then has to handle a bunch of paperwork when start working. The benefit of attracting more skilled personnel has to be considered since the construction industry seems to be quite conservative and therefore require younger and highly educated employees.

The CEO at BEAst claims that e-Procurement can result in fewer kilometers driven by the trucks. The electronic delivery schedules make it possible for the suppliers to optimize the trip routes. The accompanying reduction of emissions will not only benefit the suppliers but also the industry as a whole.

5.3 Challenges

In theory, quite many challenges when implementing e-Procurement could be detected. However, in the context of other countries and industries. For this case, the Swedish construction industry, only a few of them apply and just one new challenge could be generated from the empirical findings (see table 5-2). Obviously, not so many challenges were encountered by the actors in the Swedish construction industry when implementing e-Procurement.
Table 5-2 Analysis Challenges

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Existing in theory</th>
<th>BEAst</th>
<th>Suppliers</th>
<th>Focal Firm</th>
<th>Supply Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureaucratic disfunctionalities in practice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerns about long-term relationships to customers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost/benefit concerns</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immaturity of e-Procurement-based market services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate business process to support e-Procurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incompliance with company culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of base IT infrastructure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of e-Procurement skilled personnel</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of system integration and standardization issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of upper management support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maverick buying</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No real benefit on business figures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to change; Shifting mind-set of employees</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security of data transactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System instability, compatibility and support issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent in theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No critical mass regarding other product categories and more companies included</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

The two main challenges, named by the majority of the respondents, are lack of e-Procurement skilled personnel and overall resistance to change. This coincides with the theory since five out of six articles from the literature review state these two challenges as well.

Lack of e-Procurement skilled personnel includes for instance older generations that are not so comfortable using IT-Systems and rely to a great extend to traditional working methods (Rankin et al., 2006; Toktaş-Palut et al., 2014). Both respondents from the suppliers and the focal firm highlighted this challenge. The Manager E-Com at Foria particularly stated that it is tradition in the construction industry to work manually with much paperwork.

Resistance to change means that employees do not want to learn a new system or working method, especially if this system is in an emerging phase of implementation and some features might still be adjusted (Angeles & Nath, 2007). The side of the suppliers was pretty open-minded to new technology and they didn’t experience great resistance from their employees. However, the CEO of BEAst with his holistic view and the focal firm noticed that the end users respectively site managers have been a bit averse to adopt a new working method. It is a challenge to convince them of the benefits the new system entails and to change their mind-set of working. In addition, the Strategic Buyer at the focal firm said that it is not only a change process within their company, it is a change process within the entire industry. Not all actors in the industry, in particular other big construction companies, are as far in and dedicated to the implementation process of the NeC standard as Peab is.

Also in association with this, one of the asked suppliers expressed cost/benefit concerns since their investments in IT infrastructure might become unprofitable if not more customers join e-Procurement. In literature, this challenge was mentioned in five of the six chosen articles as well. These concerns arise where the expenses of investments outweigh the benefits when implementing e-Procurement (Hawking et al., 2004; Toktaş-Palut et al., 2014).
Regarding technical issues such as system instability, compatibility and support, only the focal firm recognized challenges. The IT-System has to be user-friendly and a quick support is necessary for the site managers. Furthermore, the system is not mature yet when it comes to specific features such as weighing of aggregate products which the Project Manager sees as the "The Achilles’ heel". These system-related issues were also highlighted by four of the reviewed articles.

Apart from these challenges when implementing e-Procurement already existent in theory, only one additional challenge could be identified in the empirical findings which was absent in scientific literature. Whereby this challenge is very connected to this specific case. According to the Project Manager at the focal firm, it is important but challenging to build a "critical mass". This means to include more product categories and to convince more actors of the industry to join the implementation process of e-Procurement.
Conclusions

6 Conclusions

To conclude, it is to say that the research has reached its purpose which was “to evaluate outcomes achieved and challenges encountered when implementing e-Procurement in the Swedish construction industry”.

The research questions which have been designed in order to fulfill this purpose could be answered in the best way possible considering the scope, delimitations and limitations of the study. The results are as follows:

RQ1: What outcomes are achieved by companies in the Swedish construction industry when implementing e-Procurement?

First of all, six scientific articles have been chosen to identify relevant outcomes when it comes to implementation of e-Procurement in order to build a theoretical framework for the research. Interviews with different actors of the Swedish construction industry have been conducted to investigate outcomes from the practical perspective in the case context. During the analysis, these two data sets have been matched to each other and revealed 15 different outcomes which answer research question one. These are: (1) Better resource management through real-time data, (2) Higher supply chain transparency, (3) Faster problem solving, (4) Improves communication and collaboration, (5) Integrated information sharing, (6) More efficient purchasing process, (7) Overall cost savings, (8) Price reduction of items purchased, (9) Reduced process errors, (10) Reduced transaction costs, (11) Streamline/optimize processes, (12) Better order-to-cash cycle, (13) Improved delivery reliability, (14) More attractive employer, and (15) Optimized trip routes, thus lower emissions.

RQ2: What challenges have companies in the Swedish construction industry encountered when implementing e-Procurement?

To answer research question two, the same procedure has been carried out. Again, six relevant articles from literature built the basis for the analysis with the empirical data collected. For this case, a number of five challenges could be detected which companies encounter when they put efforts into implementing e-Procurement, namely: (1) Cost/benefit concerns, (2) Lack of e-Procurement skilled personnel, (3) Resistance to change; Shifting mindset of employees, (4) System instability, compatibility and support issues, and (5) No critical mass regarding other product categories and more companies included. The relatively low number does not imply to be an insufficient result, it is rather a sign that the implementation of e-Procurement in the Swedish construction industry faces positive conditions to be successful.

This thesis contributes knowledge to existing theory and can be used for further reference. In addition, managers from organizations operating in the Swedish construction industry may apply the results for decision making when they consider to implement e-Procurement or when they aim to assess the success of the implementation process so far.
7 Discussion

7.1 Theoretical Contributions

This thesis contributes in different ways to theory. The three detected research gaps explained in the problem discussion could be filled to some degree. Actually, they are interrelated to each other which makes the results of this study applicable to all of them.

The first gap that SCI has not been extensively studied with regard to the construction industry, particularly in Sweden, is addressed by the overall topic and the consequent results of the thesis. The scope comprises SCI in the Swedish construction industry.

The second gap concerning EDI and its conflicting results of many studies was another focus. These could be dissolved for the case of the construction industry in Sweden. The online platform BEAst aims to integrate the industry by means of electronic information sharing in standardized formats. All involved actors have had a positive attitude towards this concept.

However, the results of this thesis arguably contribute most to the third gap which was the lack of scientific research when it comes to outcomes achieved and challenges encountered when implementing e-Procurement, again with the focus on the construction industry. The purpose of this study clearly aimed to fill this gap. The empirical findings have been matched with existing theory in order to build relevant knowledge for the Swedish construction industry. After analyzing all the data, it can be stated that in total a number of 15 outcomes can be achieved by the actors when implementing e-Procurement. On the other hand, the results show that five different challenges have been encountered by the companies who participated in the pilot-projects of the NeC standard. Since the benefits distinctly outweigh the challenges, it is to suggest that the involved companies further pursue e-Procurement and more organizations should be attracted for the use of this concept.

7.2 Managerial Implications

The Swedish construction industry was or still is quite underdeveloped regarding electronic purchasing processes which is in line with the statements of the CEO at BEAst. e-Procurement is one way of integrating the supply chain and enhancing a more efficient purchasing process. Existing literature showed many possible outcomes but also challenges which come along with the implementation of e-Procurement.

An important aspect that all the respondents brought up during the interviews was that e-Procurement has become something the whole industry can work together with. The implementation of e-Procurement has changed the way of working on how the different actors solve and discuss issues regarding the purchasing process and the planning of different projects. Before, the companies involved discussed issues during the project and could argue about things such as wrong or too high pricing even after projects. After the implementation of e-Procurement, they discuss things proactively and set all the terms before the project begins. Thanks to real-time data, potential problems can be taken care of and solved the same day they arise instead of discovering them after two weeks. A better transparency has also been a positive result of e-Procurement due to more extensive information sharing between the companies. A major advantage for the entire industry is the reduced transaction costs and consequently overall cost savings. An improved order-to-cash
cycle is another outcome for the suppliers since the drivers can report back to the office earlier and collection of payment can be initiated.

However, there are a few challenges to consider when implementing e-Procurement in the case of the Swedish construction industry. The resistance to change is one big challenge and needs to be solved by persuasive communication to the employees. In order to make it more profitable, more construction companies need to be attracted to the concept. It will be rather difficult for the suppliers and the focal firm if the rest of the industry remain pursuing other ways of purchasing.

In order to develop e-Procurement within the supply chain, the delivery schedules need to be fully implemented. This has not been done completely due to heavy workload and some resistance from the site managers at the focal firm. If the focal firm will make the delivery schedules properly, many additional benefits can be achieved. The suppliers can improve their capacity usage and get a more efficient delivery process through a better planning if they get to know the focal firm’s demand a few days in advance. The delivery schedules will also benefit the focal firm since the delivery reliability from the suppliers will be improved.

e-Procurement will result in overall cost savings for the entire supply chain. Furthermore, the aspect of higher quality throughout the whole supply chain is of great importance. Digitalization of numbers regarding different practices will make the information flow, the flow of money and the product flow more transparent. Thus, possible problems or weaknesses become visual. An interesting question is if the price for aggregate products and machinery services will be reduced or if the suppliers will keep the same price. The suppliers have had different opinions about this issue. One possible consequence in the near future is that suppliers which do not implement e-Procurement will lose sales to suppliers which have implemented e-Procurement. This is due to lower costs and a more efficient purchasing process for the focal firm.

7.3 Limitations

This thesis was confronted with certain limitations. First of all, the restricted time was an issue that has affected different choices made in this study. The time horizon was cross-sectional which means that the phenomenon was studied at a particular time, in this case for around five months. By contrast, longitudinal research implies to study change and development over an extensive period, often even years. It would have been interesting to carry out a longitudinal study and investigate if outcomes and challenges with regard to e-Procurement evolve over time.

The number of case companies and respondents to the interviews is another limitation. This results in the fact that the findings of this thesis are not generalizable to other organizations or industries since the case was too specific with regard to the NeC standard. Even if more time would have been available, access to more companies would not have been possible since only the case companies actively participated in the pilot-projects of the NeC standard.

The research quality is heavily dependent on the individual skills and opinion of the researcher and influenced by personal biases. Other researchers might have assessed the outcomes and challenges in a different way or used other research methods. Since this is a qualitative study, interpretations to the data collected have been made. The scientific community might accept the results of a quantitative study to a higher degree compared to a qualitative study.
7.4 Future Research

When this study was carried out, only the chosen case companies had implemented e-Procurement in practice in the Swedish construction industry. But it is an ongoing project and more and more companies are willing to join this process. Thus, it would be interesting to investigate the outcomes and challenges again with a larger sample of case companies or to conduct a longitudinal study assessing the development over time.

The results regarding outcomes achieved and challenges encountered when implementing e-Procurement are not ranked in terms of significance in this study. Thus, a quantitative study could be carried out investigating the importance of each outcome and challenge for the involved actors.

Furthermore, construction industries of other countries, e.g. Norway or the Netherlands, got to learn about BEAst and showed interest in this concept. Therefore it is to suggest doing the same kind of study for other countries in order to see if this concept has potential to be successful there or if different outcomes and challenges can be detected.

Another suggestion for future research is to study the concept of e-Procurement on a more detailed level since this thesis was carried out from a holistic perspective. This may include daily procedures and processes connected to e-Procurement and its effects on the end users, e.g. site managers. An approach for this could be to answer more ‘how?’ instead of ‘what?’ questions.
List of references


## Appendix: Interview Guide

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Interview questions</th>
</tr>
</thead>
</table>
| **Introduction/Context** | 1. Do you consent that we record the interview?  
2. Would you and your company like to remain anonymous in the study?  
3. Which position do you hold in this company?  
4. How is supply chain integration defined and pursued by your company?  
5. How does your company think about the concept of e-Procurement?  
6. In which way have you been involved in the process of implementing e-Procurement (NeC)?  
7. How do you see the power structure in the relationship with your business partner(s)? |
| **e-Procurement outcomes** | 8. How has the implementation of e-Procurement affected your operational processes?  
9. Does e-Procurement benefit the transparency of processes and the ability of problem solving? And how?  
10. How has the amount of time spent on routine business been affected?  
11. In which way has e-Procurement affected capacity utilization?  
12. Which effects have you experienced on financial figures?  
13. Do you see any additional outcomes which came along with the implementation of e-Procurement? |
| **e-Procurement challenges** | 14. Have you experienced organizational challenges when implementing e-Procurement?  
15. Do you see any shortcomings of the system regarding security, compatibility, support, etc.?  
16. From your perspective, are there any issues in terms of IT infrastructure and standardization when implementing an e-Procurement system?  
17. How have the end users reacted to the implementation of the new system?  
18. Have you encountered other challenges during this implementation process? |