En matchning av metoder för informationsdelning med distributionskedjors kontext

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Matching Methods for Information Sharing with Supply Chain Context

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Abstract

The productivity and competitiveness of companies fundamentally depend on their ability to handle information. With the available technology, the opportunities to collect and utilise information are better than ever. One of the industries that has proven to benefit significantly from analysing large quantities of information is the retail industry. However, before information can be analysed it has to be obtained. This often means that information has to flow between members in a supply chain. The purpose of this study was to investigate which methods that are suitable for sharing information in different contexts between suppliers and retailers. The research was conducted as a case study within the Swedish sporting goods industry, where the information sharing relationship between one supplier and seven of its customers was investigated. The studied methods for information sharing were manual document handling, web portals and through a third-party EDI service provider. The third-party EDI solution benefits both parties. However, this method is not always applicable. If resources are scarce for both communicating parties and no technological solution for information sharing is in place, the manual document handling method is a suitable short-term solution. If one party with lots of resources frequently share information with parties that cannot afford to invest in technological information sharing solutions, a portal can be a suitable compromise to let the company that invests in the portal gain efficiency benefits while the other parties continue to manually provide information.

Keywords: information sharing, information integration, supply chain, retail, data sharing, data transfer, ERP
Sammanfattning


Nyckelord: informationsdelning, informationsintegrering, distributionskedja, detaljhandel, datadelning, dataöverföring, affärsystem
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Chapter 1

Introduction

This study has explored how different methods for information sharing are used in different settings of retail supply chains. In this chapter, a brief background to this study is presented followed by the purpose, the research questions and the delimitations. Lastly, the structure of the report is outlined.

1.1 Background

Today, we live in what Castells (2010) refers to as the information age. In this age, the productivity and competitiveness of companies fundamentally depend on their ability to generate, process and apply knowledge-based information. With recent advancements in information technology (IT), data can be collected and processed at higher speeds and in larger quantities than before. When large amounts of data are collected and processed successfully, a deeper understanding can be gained (Sanders, 2014). This has led to excitement in the retail industry (Barrat et al., 2015), where for example a deeper understanding has been gained about how the weather affects retail sales thanks to the ability to collect and analyse large quantities of data (Douglas, 2014).

Barrat et al. (2015) have been able to show a correlation between the extent to which a company utilises data analytics in their supply chain and their financial performance. Their results indicate that a higher utilisation of data analytics affect financial performance positively. Brynjolfsson et al. (2011) found similar results, namely that companies that have adapted data-driven decision making have a five to six per cent higher productivity and output than other companies, as well as higher asset utilisation, return on equity and market value. Some authors even ar-
gue that the flow of information is the most important flow in a supply chain (Liu et al., 2008, Dimitriadis and Koh, 2005). In the same way as data analytics and data-driven decision making have been mentioned to be beneficial on performance, there are many reports suggesting that information sharing in the supply chain also benefits the performance (Bovel and Martha, 2000, Cagliano et al., 2003, Chandrashekar and Schary, 1999, Christiaanse and Kumar, 2000, Cross, 2000, Frohlich and Westbrook, 2001, Gunasekaran and Ngai, 2004, Lancioni et al., 2003, McIvor and Humphreys, 2004, Sahin and Robinson, 2002, Seggie et al., 2006, Zhou and Benton, 2007). The field of information sharing handles information flows and methods for sharing information.

There are different methods for sharing information, both manual and technologically aided. In the most automatic settings of electronic information sharing, the IT systems of the involved parties are integrated to simplify communication. This is often enabled via **Electronic Data Interchange (EDI)**, where information is electronically exchanged directly between systems using standards that have been selected (Schneider, 2010, GS1, 2016a). Depending on what information shall be shared, different standards exists (GS1, 2016b). As convenient as it may seem that standards exist, the actual integration between parties is complicated. When there are more than one standard, this can be an obstacle when it comes to agreeing on which standard to use. Even with the existing standardisations, implementing data interchange between organisations is costly, time consuming and risky. (Lee and Whang, 2000) Harland et al. (2007) have identified fourteen barriers to electronically integrating supply chain members, where standardisation plays a central role. The barriers stretch from company-related barriers such as company size, to more context-related barriers such as industry, geographic location and regulations. Since there are both manual methods and different technological solutions for sharing information, the choice of a suitable method for a certain supply chain is not an easy task.

### 1.2 Purpose and Research Questions

The purpose of this study was to investigate which methods that are suitable for sharing information in different contexts between suppliers and retailers. To fulfil this purpose, a main research question was formulated:
Main Research Question: Which information sharing methods are suitable in different supply chain contexts?

To answer the main research question, two sub-questions were formulated. First of all, an understanding of the currently used technology and systems was needed. This was addressed by the first sub-question:

Sub-question 1: Which methods are used for sharing information in different supply chain contexts?

After that, the second sub-question addressed how these methods perform, and was divided into two parts:

Sub-question 2: How do these methods perform in regard to (a) information quality and (b) simplicity to share information?

By answering these questions, the answer to the main research question was established.

1.3 Delimitations

This research was conducted as a case study addressing information sharing methods in a retail supply chain. The focus of the research was the relationship between suppliers and retailers. The case study was performed in Sweden, where one supplier of sports- and fashion apparel (the case company), seven retailers that sell the case company’s products, and one supplier of IT solutions for sharing information between supply chain members were studied. The study has focused on information that can be, and has been, codified. Codified information is information that is expressed in numerical or textual terms (Tidd and Bessant, 2013). The study has focused on technological solutions for information sharing. Verbal information sharing has therefore not been studied. Three methods were used to communicate codified information between the case company and its studied customers: manual document handling, web portals, and a third-party EDI solution. No other methods have been studied. The investigation of these methods has been delimited to the technological- and organisational/managerial aspects of the methods, and has not studied other factors commonly related to information sharing, such as political- and policy factors. Once information has been shared, the next step is to analyse and utilise the information to generate value from it. This next step has not been covered in this study.
1.4 Structure of the Report

**Chapter 2** This chapter presents theory and previous research in the field of information sharing. The chapter is divided into four sections that cover why information is shared, how information is shared, why information is not shared, and lastly theory and research about information quality.

**Chapter 3** This chapter describes the method used in this study. It describes the research approach and process, including data collection and data analysis. It also covers the methodological rigor (validity and reliability) of the study. A discussion of ethical considerations is also presented.

**Chapter 4** This chapter presents the results and analysis from this study. The case context is described, and is followed by the empirics. The empirics have been divided into methods for sharing information and how these methods perform.

**Chapter 5** This chapter contains a discussion regarding the empirics and the insights from the study. Sustainability implications of the research, the findings and the studied field in general are also discussed.

**Chapter 6** This chapter contains the conclusions of the study. The research questions are answered and the academic contribution and managerial implications of this research are presented. Limitations of the study are also discussed, before ending with suggestions for future research.
Chapter 2

Theory: Information Sharing

This chapter explores the existing literature in the areas that are relevant for this research. It begins with describing why information is shared in supply chains, and then the different ways in which information is shared – both manually and through technological solutions. It also contains a section about previous research in the field of information quality. At the end of the chapter, barriers leading to that information is not shared are presented, followed by possible solutions found in previous research.

2.1 Why Information Is Shared

A supply chain is a network of units and activities that turns raw materials into products and delivers these products to customers (Mabert and Venkataramanan, 1998). Stadtler and Kilger (2004) define supply chain management as the task of integrating organisational units along a supply chain and coordinating material, information and financial flows to fulfill customer demands with the aim of improving the competitiveness of the supply chain as a whole. Authors seem to agree on that the information, material and financial flows are the three main flows of a supply chain (Liu et al., 2008, Lee and Whang, 2000, Lotfi et al., 2013, Baihaqi and Beaumont, 2006). Intuitively, the flow of material seems to be the most important flow of the three, since the core functionality of a supply chain most often is to move material and goods. However, some authors argue that the flow of information is the most important one (Liu et al., 2008, Dimitriadis and Koh, 2005).

Information spans over the whole supply chain and the exchange of information is needed to establish a responsive supply chain (Hult et al., 2004, Lau and Lee,
2000). The inventory levels are also dependent on the sharing of information and it has been indicated that inventory and information sharing can be financially substitutable (Milgrom and Roberts, 1988). If suppliers and retailers are to manage their inventories independently without sharing information (inventory information in this case), they may end up with double safety inventories, or being out of stock in both locations (Lee and Whang, 2000). This distortion in inventory is part of a phenomenon called the bullwhip effect (Lee et al., 1997b). The importance of information sharing to reduce the bullwhip effect has been frequently emphasised in previous research (Lee et al., 1997b,a, Lee and Whang, 2000, Chatfield et al., 2004, Baihaqi and Beaumont, 2006, Trkman et al., 2005, Lee et al., 2000, Yu et al., 2001, Lotfi et al., 2013, Croson and Donohue, 2003, Singh and Garg, 2015, Wang and Disney, 2016).

The benefits on performance from sharing information in the supply chain has been proven by many researchers (Bovel and Martha, 2000, Cagliano et al., 2003, Chandrashekar and Schary, 1999, Christiaanse and Kumar, 2000, Cross, 2000, Frohlich and Westbrook, 2001, Gunasekaran and Ngai, 2004, Lancioni et al., 2003, Kulp et al., 2004, McIvor and Humphreys, 2004, Sahin and Robinson, 2002, Seggie et al., 2006, Zhang and Chen, 2013, Wu et al., 2014, Qrunfleh and Tarafdar, 2014, Singh and Garg, 2015, Wong et al., 2015, Titah et al., 2016, Harland et al., 2007). When information is shared between supply chain partners, each party can process the information in whatever way is suitable for them. The collection and analysis of large quantities of information has gained traction in recent years much thanks to the positive effects on performance. It has been shown that the more a company utilise data analytics and data-driven decision making, the higher productivity, output, asset utilisation, return on equity and market value they have (Brynjolfsson et al., 2011). It has also been shown that companies with a higher degree of data utilisation compared to their competition outperform their competitors in financial terms (Barrat et al., 2015). Apart from the direct link between information sharing and performance, it has also been shown that information sharing can strengthen the relationship between the organisations that are involved in the information sharing (Lotfi et al., 2013, Williams and Moore, 2007).

2.2 How Information Is Shared

Information sharing is when information that is useful for systems, people or organisational units is distributed among different parties (Lotfi et al., 2013). The
most basic information that has traditionally been shared between retailers and suppliers are orders sent from the retailers to the suppliers (Gavirneni, 2001). With the increasing interest in collecting information and the development of technology that supports easier information transfer, more information can be (and is) shared (Gavirneni, 2001, Lee and Whang, 2000). Information that is commonly shared is inventory levels, sales data, order status, sales forecast, production/delivery schedules, lead times and capacity (Li et al., 2005, Lee and Whang, 2000, Marshall, 2015). When more information is to be shared, higher demands are put on the methods of sharing the information. The means by which information is shared can essentially be divided into two categories: manual and technologically aided information sharing – each of which will be addressed below.

### 2.2.1 Manual Document Handling

When manually handling documents, the buyer and the supplier are not using any system integration for business processes. Each information process step therefore results in the production of a document that must be manually sent to the receiving party (Leonard and Clemons Davis, 2006, Schneider, 2010).

![Figure 2.1: The flow of information in a manual document-based purchasing process inspired by Schneider (2010).](image)

An example of how information flows in a manually handled purchasing process is shown in Figure 2.1. When information is to be shared, it must be exported from the system – often an enterprise resource planning (ERP) system – of the sending party and manually sent through a communication platform such as mail, fax or
2.2.2 Technological Solutions for Information Sharing

The efforts of integrating the IT-systems of trading partners stems from the 1960s when businesses started to realise that much of the information they exchanged with their trading partners followed the same pattern, and that large amounts of time and money were spent on manually handling the information. This lead to the development of ways to electronically exchange information directly between systems in what is called electronic data interchange (EDI). EDI occurs when computer-readable data is transmitted between businesses and their IT systems in an agreed upon standard format. (Schneider, 2010)

Up until the late 1990s, EDI was expensive to perform due to investments needed in hardware, software and means of communication. The integrations made to one trading partner would usually only work for that particular partner, which is why custom integrations were needed for every trading partner. Due to this, EDI was only possible in and between large organisations that could afford and motivate the investments by having large information transaction volumes. Small organisations or partners with low information transaction volumes were left out. However, with the introduction of the Internet as an inexpensive means of communication, the costs of participating in EDI have been drastically decreased, which made EDI a possibility even for small organisations and between partners with low transaction volume. (Lee and Whang, 2000, Schneider, 2010)

To cope with the issue of having to make custom integrations for each trading partner, standards have been developed. The first widely used EDI standard called ASC X12 was developed in 1979 under the guidance of a committee where more than 800 organisations were represented. The ASC X12 standard spread in the United States, but around the world other standards continued to be used. In 1987, the United Nations published EDI standards that are known under the abbreviation EDIFACT or UN/EDIFACT. There have been attempts to develop one common set of international standards, but these attempts have failed. (Schneider, 2010)

Not only are there regional differences, but there are also industry-specific standards which means that companies that are interested in doing business in multiple industries have to support different standards (Lee and Whang, 2000).

One of the goals with EDI is to reduce the manual work of handling data in business transactions (Schneider, 2010, Craighead et al., 2006). The idea is to
directly connect the IT systems of the buyer and the seller. Figure 2.2 depicts an example of an EDI enabled process.

Computers that run translation software and a network that transfers the information have here replaced the manually controlled flow of documents that was described earlier. The effect is that information can be transferred between the systems of the two parties without human interaction, which increases efficiency and reduces the risk of error (Craighead et al., 2006, Schneider, 2010). There are independent companies that provide an EDI network by connecting and handling EDI transaction forwarding between businesses, in what is called a value-added network (Schneider, 2010).

Hill and Scudder (2002) studied the use of EDI as a tool for information sharing in the food industry. Their results suggested that firms view EDI as a tool for improving efficiency in traditional information transactions such as purchase orders and invoices, rather than as a tool to facilitate supply chain integration.

There are examples of companies that have implemented their own supplier portals to overcome the problems of having to support different standards when communicating with different suppliers. Boyson et al. (2003) provides multiple examples of companies that have deployed their own portals in which the communication with suppliers is managed. With this approach, the buyer gets the information in the way it wants, and has one single system towards all of its suppliers that can be integrated with the internal ERP system. For the suppliers however, it may not be as beneficial, since the means of communication and the structure of the information will be different with different customers.
2.2.3 Models for Information Sharing

Lee and Whang (2000) suggests three models for information sharing that has also been described by Gangopadhyay and Huang (2004): the information transfer model, the third-party model and the information hub model. These models are depicted in Figure 2.3, where A and B represent two communicating members of a supply chain. In the information transfer model, one partner transfers information to the other who maintains the data. Lee and Whang (2000) describes this model as a natural evolution from the EDI-based model that was described in the previous section. The problem with the information transfer model is however, just like with traditional EDI models, that companies doing business in multiple industries have to support different standards. The third-party model involves a third-party whose main function is to collect, maintain and distribute information for the supply chain. The information hub model is similar to the third-party model except that the third-party is replaced by a system that acts as an information hub in which the information resides.

![Figure 2.3: The three information sharing models suggested by Lee and Whang (2000).](image)

The different technological solutions presented in Section 2.2.2 can be linked to the models presented by Lee and Whang (2000). The information transfer model is an evolution of EDI, a value-added network fits well into the third-party model, and a supplier portal is an information hub that is owned by one of the involved parties.

2.3 Why Information Is Not Shared

So far in this chapter, it has been described why and how information is shared. It is, however, not always the case that information is shared. There are barriers that
hinder the information sharing – barriers that Yang and Maxwell (2011) has divided into three categories as depicted in Figure 2.4: organisational and managerial-, technological-, and political and policy barriers. As mentioned in the delimitations, this study has focused on the first two categories.

The technological barriers are limitations related to the used technology – for example system communication and system integration – while the organisational and managerial barriers are for example lack of resources, incentives, trust, confidentiality and priorities. Both of these categories will be described in the sections below to illustrate different views that can be applied when analysing different solutions.

### 2.3.1 Technological Barriers

Authors seem to agree that advancements in IT has made information sharing more efficient and conceivable (Lee and Whang, 2000, Choon Tan et al., 2010, Cachon and Fisher, 2000, Boyson et al., 2003, Zhang and Dawes, 2006, Yu et al., 2001, Waller et al., 1999, Sahin and Robinson, 2002, Yang and Maxwell, 2011, Lotfi et al., 2013). While there has been advancement in technology, the challenge to integrate the systems of different organisations still remains due to differing hardware, soft-
ware and data standards (Yang and Maxwell, 2011, Takac, 1992, Dawes, 1996, Lee and Whang, 2000, Atabakhsh et al., 2004, Pardo et al., 2004, Lam, 2005, Gil-Garcia et al., 2007, Klischewski and Scholl, 2008, Gil-Garcia et al., 2009). However, some authors have reported that there are no longer any technical obstacles to information sharing (Baihaqi and Beaumont, 2006). They mean that in theory, there should not be any technological obstacles with today’s technology. It should be fully possible to build communicating systems for sharing information between supply chain members. However, there are still limitations and barriers that need to be overcome to make technological solutions work in practice. Some of these barriers are on the technical side as explained above, but some are of a less technological and more of an organisational and managerial nature, which will be covered in the next section.

2.3.2 Organisational and Managerial Barriers

Some researchers claim that the organisational and managerial barriers are more complex than the technological barriers (Allen et al., 2014, Yang and Maxwell, 2011, Atabakhsh et al., 2004). It has been indicated that barriers for information sharing between organisations can be explained by the involved organisations seeing the value and benefits of information sharing differently (Yu et al., 2001, Croson and Donohue, 2003) and that the development of information sharing relationships heavily depend on trust (Trkman et al., 2005, Barratt, 2004, Ireland and Bruce, 2000, Yang and Maxwell, 2011, Dawes, 1996, Zaheer et al., 1998, Dirks and Ferrin, 2001, Dyer and Chu, 2003, Li and Lin, 2006, Akbulut et al., 2009). It has also been pointed out that organisations that have little or no experience from sharing information may lack an understanding of the benefits that can come from information sharing (Yang and Maxwell, 2011).

A lack of resources can also be a barrier. The perceived value and benefits of information sharing for the involved organisations can differ, which is why priorities can differ as well. An organisation that cannot see the benefits or incentives of participating in information sharing may focus on what for them seem to be more urgent matters (Zhang and Dawes, 2006).

2.3.3 Solutions Found in the Literature

Models and technological solutions for sharing information have been covered earlier in this chapter, where potential ways of working with information sharing were presented. These models and technologies are however not relevant until the barriers
presented in the two sections above have been overcome. So what does the literature say about how these barriers can be overcome?

Yang and Maxwell (2011) reason that the establishment of IT systems that minimise the changes in internal processes and information flow are important for successful information sharing. The ability and available resources for implementing IT solutions naturally varies with company size. Research has shown that in a supply chain relationship, larger companies must assist smaller supply chain partners with funding and support regarding IT solutions (Harland et al., 2007).

Khan et al. (2012) present a software solution that is developed to overcome problems with information sharing caused by a lack of integration mechanisms, a lack of information sharing strategy and an unsupportive IT infrastructure. They claim that their solution only requires minor changes to the existing information systems and does not call for completely new ones, which is why their solution should be affordable even to smaller organisations, according to the authors. However, their proposed software solution demands an electronic transaction of information from the currently used system and their proposed software solution. The authors claim that this should be a one-time cost that could possibly replace manual procedures and is therefore financially viable. It is unclear how the proposed solution should be able to overcome the problems any better than other existing solutions, since also the proposed solution require adaptions in the currently used system.

### 2.4 Information Quality

Information quality is the degree to which exchanged information between organisations meets the needs of the organisations (Petersen, 1999). Table 2.1 presents the characteristics of information quality suggested by different authors.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Information quality characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neumann and Segev (1979)</td>
<td>accuracy, content, recency, frequency</td>
</tr>
<tr>
<td>McCormack (1998)</td>
<td>accuracy, frequency, credibility, availability of forecast</td>
</tr>
<tr>
<td>Petersen (1999)</td>
<td>accuracy, currency, completeness</td>
</tr>
<tr>
<td>McGowan (1998)</td>
<td>accuracy, accessibility, reliability, timeliness, understandability</td>
</tr>
<tr>
<td>Zhou and Benton (2007)</td>
<td>accuracy, accessibility, availability, timeliness, internal connectivity, external connectivity, completeness, relevance, update frequency</td>
</tr>
</tbody>
</table>

Table 2.1: Characteristics of information quality

The one characteristic that all authors have in common is *accuracy* – a characteristic
that Sum et al. (1995) have found is critical for operating efficiency and customer service. As described in Section 2.1, information suffers from distortion as it moves up the supply chain. Li and Lin (2006) argues that to reduce information distortion and improve the quality of the shared information, the shared information has to be as accurate as possible and organisations must ensure that it flows with minimum delay and distortion.
Chapter 3

Method

In this chapter, the methodological approach used in the research is described. First, the research approach is described and argued for in regards to the research environment. Thereafter, the data collection process is covered, focusing on the sampling method and the collection of data. Following the data collection, the theoretical frameworks used for analysing the data is briefly described. The methodological rigor of the research is then analysed using a framework developed by Gibbert et al. (2008) before ending the chapter with a discussion regarding ethical considerations.

3.1 Research Approach

This study has used a case study approach that Yin (2008) refers to as a single-case with multiple embedded units of analysis. Marshall (2015) presented an opportunity to use case studies for researching information sharing technology, since case studies are underrepresented in the information sharing literature. The case study approach was used to expand the knowledge within the field of information sharing with empirics from the Swedish sporting goods industry.

Case studies can be divided into four types in a 2x2 matrix as depicted in Figure 3.1. There are single- and multiple-case designs, each of which either contains or does not contain embedded units of analysis. The basis for this study was a single case study of a Swedish fashion supplier and retailer, thus placing it in the single-case design category. Inside this case, the information sharing relationship with seven different customers was investigated and analysed. These relationships are categorised as embedded units of analysis. Having embedded units of analysis can often enhance the insights into the single case according to Yin (2008).
Yin (2008) presents different rationales for single-case studies. Two of these have been used to justify the suitability of a single-case study in this particular research. The first one is that a single case – just like a single experiment – can confirm, challenge or extend existing theory. With multiple units of analysis in the single-case study, the different subunits can be changed while all other factors are kept the same, just like in an experiment where all parameter but one are kept the same. While the results of a single-case study are not as generalisable as in a multiple-case study (Eisenhardt, 1989), this study has the benefit of comparing different supply chain relationships with one fixed party. The second rationale for a single-case study is when a case is representative or typical, for example a manufacturing firm that is seen as typical for many other manufacturing firms in that industry. In this situation, the findings from the single-case study can be useful in other settings. In this study, the studied case company has been considered to be typical for a Swedish fashion supplier.
3.2 Research Process

The general research process of this study is depicted in Figure 3.2 and will be described in detail in the coming sections.

![Figure 3.2: The research process](image)

3.2.1 Literature Review

A literature review is a critical evaluation of the existing knowledge on a subject and is used to demonstrate that relevant literature has been located, read and analysed (Collis and Hussey, 2013). This study has combined the areas of supply chain management and IT. It has therefore been necessary to review literature within both of these topics separately, but also in combination. To find literature that was relevant for this study, some main keywords were formulated and used to search in databases of scientific articles. Each article was analysed by reading the abstract and conclusions, after which it was decided whether it was relevant to read the article more thoroughly or not. The main search engines used were the KTHB Primo search engine of the KTH Library and Google Scholar, both of which contains articles from a vast number of scientific journals. The main focus of the literature search and review was to study published academic research papers. In some cases however, when the basics of concepts such as EDI were to be researched, books were utilised.

The keywords that were used in the literature search evolved during the study, and some examples of keywords that were used in different combinations and setups in search queries are: supply chain, supply chain management, information sharing, information transfer; information integration, information technology, edi, portal, supply chain visibility and supply chain integration. References found in the articles from the database searches were used to even further enrich the literature review. The literature review was a continuous process throughout the study, as depicted in Figure 3.2, to reflect the most recent body of knowledge and to fully match the focus of this study.
3.2.2 Data Collection

To get an understanding of the studied field, the case company and its problems, a series of initial interviews of an unstructured nature were conducted. The unstructured nature allowed flexibility in the interviews, which was deemed necessary to cover as many aspects as possible in the initial phase. The first two interviews were held with the IT Manager of the case company to discuss the used practice, the company’s interests and their vision for the future. These interviews were then complemented with two study visits. The first study visit was to the clothing company American Apparel, which has applied technological solutions and innovated in their supply chain process. Even though American Apparel is a vertically integrated company that owns each step of the supply chain, a study of the company and its information sharing processes helped generating ideas for the research. The second study visit was to the standardisation organisation GS1 Sweden who, in their portfolio of standards, has standards for EDI. This visit gave insight into what standards exist, how they work, how they are used and what benefits and struggles companies find when implementing and using EDI. The gained knowledge from the initial interviews at the case company and the two study visits were used to guide the literature review and to define the problem.

The largest part of the empirics collected in this study was collected via interviews. All conducted interviews are found in table 3.1. The organisations and the interviewees were carefully chosen to get different views on information sharing. The organisations were chosen to jointly include all possible information sharing methods within the case. The interviewees within the studied organisations were then chosen based on their knowledge about the used technology and their knowledge and experience from using the technology. In some of the studied companies, the knowledge within these two perspectives was found within different roles and therefore different persons, while in other companies the knowledge was found in the same person.

Once the problem had been formulated, the interviews were designed based on the problem formulation. The questions regarding the main topic were prepared before the interview and more questions were developed as the interview progressed. This structure allowed the interviews to resemble a conversation, where new information that arose during the interview could be used to formulate new questions. Formulating new questions based on information that arose during the interviews enabled a collection of information that would not have been possible in a strictly structured interview. The interviews were conducted at the case company, at seven
<table>
<thead>
<tr>
<th>Company</th>
<th>Position</th>
<th>Topics</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Björn Borg AB</td>
<td>IT Manager</td>
<td>information sharing, IT systems, communication, future potential</td>
<td>In-person</td>
</tr>
<tr>
<td>Björn Borg AB</td>
<td>Logistics Manager</td>
<td>information sharing, ERP-systems, logistics workflow</td>
<td>In-person</td>
</tr>
<tr>
<td>Björn Borg AB</td>
<td>Buyer/Customer Service Manager</td>
<td>information sharing, ERP-systems, customer relations, order workflow</td>
<td>In-person</td>
</tr>
<tr>
<td>Björn Borg AB</td>
<td>Sales/Back-Office Coordinator</td>
<td>information sharing, ERP-systems, EDI, order workflow</td>
<td>In-person</td>
</tr>
<tr>
<td>Björn Borg AB</td>
<td>Brand Communications Manager</td>
<td>information needs, market communication, market relationships</td>
<td>In-person</td>
</tr>
<tr>
<td>GS1 Sweden</td>
<td>Head of Transport &amp; Logistics and Construction Value Chain</td>
<td>information sharing, standards, EDI</td>
<td>In-person</td>
</tr>
<tr>
<td>American Apparel, Inc</td>
<td>Backstock Manager</td>
<td>information sharing, RFID, inventory, continuous replenishment</td>
<td>In-person</td>
</tr>
<tr>
<td>Twentyfour</td>
<td>Co-Founder</td>
<td>information sharing, EDI</td>
<td>In-person</td>
</tr>
<tr>
<td>Intersport Sverige AB</td>
<td>Integration Specialist</td>
<td>information sharing, EDI, ERP systems, system integration</td>
<td>Telephone</td>
</tr>
<tr>
<td>Intersport Sverige AB</td>
<td>Supply Chain Manager</td>
<td>information sharing, EDI, ERP systems, order workflow</td>
<td>Telephone</td>
</tr>
<tr>
<td>Swedemount Sportswear &amp; Fashion AB</td>
<td>Purchasing Manager, Formerly responsible for ERP implementation.</td>
<td>information sharing, EDI, ERP systems, order workflow</td>
<td>Telephone</td>
</tr>
<tr>
<td>Stadium AB</td>
<td>IT Manager</td>
<td>information sharing, portals</td>
<td>Telephone</td>
</tr>
<tr>
<td>Stadium AB</td>
<td>Head of Business Support</td>
<td>information sharing, portals, order workflow</td>
<td>Telephone</td>
</tr>
<tr>
<td>MQ Retail AB</td>
<td>IT Manager</td>
<td>information sharing, portals, IT workflow, manual document handling</td>
<td>Telephone</td>
</tr>
<tr>
<td>MQ Retail AB</td>
<td>Business Area Manager</td>
<td>information sharing, portals, manual document handling, order workflow</td>
<td>Telephone</td>
</tr>
<tr>
<td>Volt Fashion AB</td>
<td>Controller</td>
<td>information sharing, manual document handling, order workflow</td>
<td>Telephone</td>
</tr>
<tr>
<td>Kennedies AB</td>
<td>Co-Owner. Handles purchasing and invoices among other tasks.</td>
<td>information sharing, manual document handling, order workflow</td>
<td>Telephone</td>
</tr>
<tr>
<td>Åhléns AB</td>
<td>Supply Planner</td>
<td>information sharing, EDI, order workflow</td>
<td>In-person</td>
</tr>
<tr>
<td>Åhléns AB</td>
<td>Logistics Developer</td>
<td>information sharing, EDI, ERP-systems, system integration</td>
<td>In-person</td>
</tr>
</tbody>
</table>

Table 3.1: Conducted interviews

of the case company’s customers, and at a supplier of IT solutions for sharing information between supply chain members.

During all interviews, notes were taken. All interviews were also recorded to enable later analysis of the interviews where more detailed notes were taken and parts of the interviews were transcribed. The interview that was conducted through email correspondence used a list of initial questions that were answered and then followed by complementing follow-up questions.

Once all interviews had been conducted, the interviews with the retailers and
the customer service staff at the case companies were followed up by a web-based questionnaire. Using multiple data collection methods, both interviews and questionnaires in this case, can provide stronger substantiation to a study (Eisenhardt, 1989). The combined use of interviews and questionnaires gave information that would not have been possible or convenient to collect with the use of only one of the methods. The interviews were used to collect qualitative information and somewhat guide the research, while the questionnaires were used to receive quantitative data on some isolated areas once the interviews had been conducted. The questionnaires aimed to quantify some of the findings, especially regarding information quality and the simplicity to share information, and were sent to thirteen respondents. This is a relatively small number of respondents, and therefore, no considerable generalisation can be made from the questionnaire results. However, it was never the intention to generalise the results from the questionnaire, but rather to strengthen and clarify some of the aspects from the interviews.

The questionnaire sent to the case company (the supplier) and the retailers differed slightly. The case company answered the same set of questions for the three information sharing contexts: manual document handling, web portals and third-party EDI. The retailers answered only one set of questions. To be able to separate the answers from the different companies and to be able to remind the respondents to complete the questionnaire, the names of the respondents were recorded for these purposes only.

The questionnaire to the case company consisted of sixteen questions, while the questionnaire to the retailers consisted of six questions. It is known that the length of a questionnaire affects the response rate (Forza, 2002), which is partially why the questionnaires were relatively short. The response rate of the questionnaires was 100 per cent. All questions used a 7-graded Likert scale – a scale invented by Likert (1932). When deciding on what scale to use, there is an option if a midpoint should be available or not. Likert (1932) suggested a midpoint, but there has been a lot of discussion on whether a midpoint should be included or not (Armstrong, 1987, Garland, 1991, Jamieson et al., 2004, Norman, 2010). The choice to use a 7-graded scale, which has a midpoint, was in this study actively made not to force the respondent to take a side.

3.2.3 Data Analysis
When the interviews had been conducted, detailed notes had been compiled and some parts of the interviews had been transcribed, the empirics from the interviews
were analysed together with the answers from the questionnaires. Results were then extracted and conclusions formulated. The collected information was thematically coded. The information from the interviews was coded in the themes: needs, incentives, barriers, information quality, easiness to share information, demands, manual information sharing, portals, EDI, improvements and company size. The coding was used to obtain an overview of the information and make it easier to discover patterns.

For questionnaires with closed questions, it is easy to code the information since the coding is essentially the questions themselves Forza (2002). In the case of the questionnaires used in this study, the questions covered the simplicity to share information, information quality and how the used IT systems support the information sharing. These areas were chosen to give quantitative answers to sub-question 2.

Once the information from both the interviews and the questionnaires had been coded, similarities and differences were searched for within and between the studied organisations. The numbers that the respondents provided as answers in the questionnaire were not used for direct numerical comparison, since a numerical rating is subjective and may differ between the respondents. Instead, the data was analysed looking for trends and patterns that could be found within the answers of each respondent.

3.3 Methodological Rigor

The method of this research will now be analysed with a framework suggested by Gibbert et al. (2008) for investigating methodological rigor of a case study. This framework has four criteria of analysis: internal validity, construct validity, external validity, and reliability. Each part of the framework will now be briefly described based on the work of Gibbert et al. (2008), and then applied to this case study.

3.3.1 Internal Validity

Internal validity refers to the data analysis, where the relationship between empirics and results is established. Table 3.2 lists the three objectives for internal validity presented by Gibbert et al. (2008) in the Objective column, and the actions taken in this study to fulfil each objective are presented in the Action column.
Objective | Action
--- | ---
Clear research framework | A mixed method research framework with interviews and complementing questionnaires were used to verify and strengthen the results.
Pattern matching | In Chapter 5 and Section 6.2 of Chapter 6, some of the results found in this study was compared with the findings established in previous studies presented in Chapter 2.
Theory triangulation | This study has used theories about information sharing from both technological and operation managerial fields.

Table 3.2: Objectives and actions for internal validity

### 3.3.2 Construct Validity

Construct validity refers to the extent to which a method accurately observes the reality, and thereby the extent to which a study investigates what it claims to investigate. Table 3.3 lists the seven objectives for construct validity presented by Gibbert et al. (2008) in the *Objective* column, and the actions taken in this study to fulfil each objective are presented in the *Action* column.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data triangulation</td>
<td>The data used in this study was derived from different sources. Both interviews and questionnaires were used to collect information. Observations were also made from provided data in the form of EDI messages and screenshots from applications.</td>
</tr>
<tr>
<td>Review of transcripts and draft by peers (peers are academics not co-authoring the paper)</td>
<td>Peer students and the supervisor have reviewed drafts of the report during the research process. One peer student has also reviewed the transcripts and notes from the interviews.</td>
</tr>
<tr>
<td>Review of transcripts and draft by key informants (key informants are or have been working at organisation investigated)</td>
<td>All interviewees presented in table 3.1 have been sent transcripts or notes from their interview and a draft of the parts of the report that are related to the interview.</td>
</tr>
<tr>
<td>Clear chain of evidence</td>
<td>The research process has been described in Section 3.1. In Chapter 4, the findings are presented in a structure that corresponds to the research questions.</td>
</tr>
<tr>
<td>Indication of data collection circumstances (explanation how access to data has been achieved)</td>
<td>The data collection is described in Section 3.2.2.</td>
</tr>
<tr>
<td>Check for circumstances of data collection vs. actual procedure (reflection of how actual course of research affected data collection process)</td>
<td>The complete research approach, including the data collection, is described in Section 3.2.</td>
</tr>
<tr>
<td>Explanation of data analysis (clarification of data analysis procedure)</td>
<td>The data analysis is described in Section 3.2.3.</td>
</tr>
</tbody>
</table>

Table 3.3: Objectives and actions for construct validity
3.3.3 External Validity

External validity is often called generalisability. It is the term that is used to discuss to what extent theories can be applied to other settings than the one that is studied. Table 3.4 lists the three objectives for external validity presented by Gibbert et al. (2008) in the *Objective* column, and the actions taken in this study to fulfil each objective are presented in the *Action* column.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross case analysis</td>
<td>This study is a single-case study, but has multiple embedded units of analysis which can be seen as cases within the case. This is described in Section 3.1.</td>
</tr>
<tr>
<td>Rationale for case study selection</td>
<td>The access to information and contacts within all studied organisations was fundamental when choosing the case. Besides the access to information, this case study was appropriate for answering the research questions thanks to the use of different methods for sharing information.</td>
</tr>
<tr>
<td>Details on case study context</td>
<td>The case study context is described in Section 4.1.</td>
</tr>
</tbody>
</table>

Table 3.4: Objectives and actions for external validity

3.3.4 Reliability

Reliability refers to the absence of random error. In practice, high reliability implies that researchers conducting the same study would arrive at the same results. To enable this, transparency is key and can be enhanced through careful documentation and by clarifying the research process and by mentioning the actual names of organisations in the case study. Table 3.5 lists the three objectives for reliability presented by Gibbert et al. (2008) in the *Objective* column, and the actions taken in this study to fulfil each objective are presented in the *Action* column.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case study protocol</td>
<td>This method chapter acts as the case study protocol. This chapter describes how the case study was conducted.</td>
</tr>
<tr>
<td>Case study database</td>
<td>All voice recordings, transcripts and notes from the interviews as well as the answers from the questionnaires have been stored.</td>
</tr>
<tr>
<td>Organisation’s actual name given</td>
<td>All studied organisations are mentioned by name. See table 3.1 on page 19.</td>
</tr>
</tbody>
</table>

Table 3.5: Objectives and actions for reliability
3.4 Ethical Considerations

This study has relied heavily on the voluntary participation of interviewees. When initiating contact with the interviewees, it has been a top priority to highlight the affiliation with the case company Björn Borg and KTH. During the research, all interviewees have been very helpful and cooperative in answering questions and providing valuable information. Since the interviewees were helpful and generous with information, some information that could be considered sensitive surfaced during the research. Actions were taken to protect this information. For example, prices and quantities were censored in one of the figures in the report. All interviewees agreed to have their name and company name presented in the report. An ethical decision was however made not to present the names of the interviewees to protect their integrity. Presenting their position and company name was considered as a good balance between reliability and integrity.

To minimise the risk of misinterpretations in the findings, each interviewee were given notes or a transcript from their interview session along with a draft of the result chapter. By having the interviewees analysing a draft of the results, this also acted as a double check so that no sensitive information had been included that could harm the interviewee or the company.
Chapter 4

Results and Analysis

In this chapter, the results of the study are presented. The chapter starts with a description of the case context. The empirics are then presented in a structure that corresponds with the research questions. Section 4.2 presents findings related to the first sub-research question while section 4.3 presents findings related to the second sub-research question.

4.1 The Case Context

Björn Borg AB is a Swedish fashion supplier and retailer. They sell their products through their own stores, but the largest amount of sales is through external retailers. Björn Borg’s collection is divided in seasons. For each season, the external retailers place orders before a predetermined deadline. The quantities from these orders act as a basis for the production. The most part of all sales for a season is made in this initial order phase, after which some complementary orders can be made. There are also some “never out of stock” products that are independent of seasons. All retail customers, small and large, follow this order structure.

Like any company, Björn Borg wishes to make their processes more efficient to be more profitable. One of the identified areas for efficiency improvement is the information sharing and administrative tasks in the communication with customers. The company also wishes to get a better understanding of how their products are selling in stores, which can be done by gaining access to external retailers sales information. With more insight into the data of the retailers, the belief within Björn Borg is that the service to their customers can increase. In previous research, the benefits of information sharing have been thoroughly investigated, as covered
in Section 2.1.

An hypothesis that came up during an interview at Björn Borg was that retailers often wait a bit too long to submit their orders for various reasons. In the worst-case scenario, this can result in products going out of stock. By gaining access to the inventory and sales data, Björn Borg can notify the retailer when they are running low on a particular product and ought to place an order, or even develop a vendor-managed inventory or continuous replenishment collaboration with retailers. Apart from being able to deliver these extra services to the customers, data access would also give Björn Borg insight to the sell-through, i.e. how their products sell to the end consumer. More and more focus is put on sell-through within Björn Borg. It does not matter how many products Björn Borg sell to the retailers if the end consumers do not purchase the products. To maximise the sell-through, actions should be taken as early as possible with products that do not sell well, such as replacing these products with products that do sell well. Currently, Björn Borg does not receive enough information from the retailers to make these decisions in time.

On the retailer side, seven of Björn Borg’s retail customers of varying size have been studied. The retailers, as well as Björn Borg, are listed in Table 4.1 alongside their 2014 turnover. The turnover is included to provide an indication and understanding of the company size, which is relevant for future reference. All retailers sell Björn Borg’s products through their own brick and mortar stores, and some also via the Internet. No information about turnover was available for Åhléns, which is why the turnover for the owner Axstores is listed.

<table>
<thead>
<tr>
<th>Company</th>
<th>Turnover (kSEK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Björn Borg AB</td>
<td>544 497</td>
</tr>
<tr>
<td>Intersport Sverige AB</td>
<td>1 902 603</td>
</tr>
<tr>
<td>Kennedies AB</td>
<td>9 427</td>
</tr>
<tr>
<td>MQ Retail AB</td>
<td>1 524 926</td>
</tr>
<tr>
<td>Stadium AB</td>
<td>5 101 776</td>
</tr>
<tr>
<td>Swedemount Sportwear &amp; Fashion AB</td>
<td>471 774</td>
</tr>
<tr>
<td>Volt Fashion AB</td>
<td>135 845</td>
</tr>
<tr>
<td>Åhléns (turnover is for the owner Axstores)</td>
<td>7 548 400</td>
</tr>
</tbody>
</table>

Table 4.1: The turnover in 2014 in thousand SEK from allabolag.se (2016)

Within Björn Borg, the general belief is that communicating information directly between the IT systems of Björn Borg and its retail customers is difficult. One part of the problem that came up during the interviews was that direct com-
communication between IT systems requires custom integrations. Since Björn Borg has many customers, a lot of integrations would have to be made. With these problems in mind, Björn Borg wants to look into alternative ways to receive the information. In receiving sales data for example, one idea has been to develop a “smart” product stand with radio-frequency identification (RFID) that would be able to report product status back to Björn Borg without interaction with the IT systems of the customer. However, there are a lot of problems with this approach: potential misplacement of products, products placed in backstock, lacking electricity supply and Internet connectivity, just to mention a few. The observations at Björn Borg indicate that there are barriers that hinder the development of efficient information sharing methods between the company and its customer.

4.2 Methods for Sharing Information

This section presents the empirics that are related to the first sub-research question regarding which information sharing methods are used in different supply chain contexts.

4.2.1 The Different Information Sharing Methods

As mentioned in the delimitations (Section 1.3), methods for sharing codified information between the case company (the supplier) and its customers has been investigated. In the case study, three methods have been identified for sharing codified information:

(1) by manually sending the information in documents – either in digital or in paper format
(2) through web portals owned by the customer
(3) through a third-party EDI service provider (Btwentyfour)

The three methods for sharing information listed above are illustrated in Figure 4.1, where the information sharing links between Björn Borg and the studied customer companies are illustrated. Each of the methods represents a unit of analysis in the case study.

In the coming sections, each of these three types of information sharing methods will be described.
4.2.2 Manual Document Handling

Sharing information manually means that both parties involved in the information sharing manually compile the documents containing the information that shall be shared – a process that was described in general in Section 2.2.1. This is the method that is used between Björn Borg and most of their customers. In this case study, the studied relationships that involves manual document handling are between the supplier Björn Borg and its customers Volt, Kennedies and MQ – as depicted in Figure 4.2.

Both MQ and Volt sends their purchase orders to Björn Borg via e-mail. The content of a purchase order varies depending on the customer. Some parameters such as article, quantity, price, delivery date and delivery address are always in the order document. There can be different wishes and demands on how and where the order confirmation and invoice should be sent, how these documents should be labelled and if they should contain some customer-specific information or not. All of this requires manual work from the customer service team, who manually enters all the required information into Björn Borg’s ERP system where the information is then exported and sent. Kennedies place their orders verbally with a Björn Borg sales representative, which is why the purchase order information has not been investigated in the relationship between Björn Borg and Kennedies.

Once an order has been placed and delivered, the next document with informa-
Of the studied retailers, Kennedies is the one with the lowest turnover. They do not have the technological capabilities and cannot prioritise an investment in an expensive IT solution. At MQ, one of the interviewees expressed a wish to go away from the manual handling of information, but to do this, investments in the IT system is needed – investments that the interviewee did not think was prioritised by the company management. This is the main reason why MQ still do a lot of manual work. Other companies that have been studied that have a lower turnover than MQ have implemented more IT solutions than MQ. This is an indication that company size does not necessarily correlate with IT system maturity, at least not for companies over a certain size. Volt adapts their way of working to the supplier,
where information from some suppliers is handled manually and some via other methods. In the relationship between Björn Borg and Volt, all information sharing is made through manual document handling.

### 4.2.3 Web Portals

Information sharing through web portals is when one of the communicating parties has a platform that the other party can access and receive information from and enter information into, as described in Section 2.2.2. In this particular case study, the links that utilise web portals for sharing information is between the supplier Björn Borg and the customers Stadium and MQ. In both of these cases, the portal is on the customer side, as depicted in Figure 4.3.

![Figure 4.3: The links with information sharing portals](image)

Stadium and MQ have their own web portals in which information is both downloaded from and uploaded to by the supplier Björn Borg. In Stadium’s case, all information that surrounds an order (product information, the order itself, order confirmation, delivery notification and invoice) is communicated through the portal. In MQ’s case, the only information that is communicated through the portal is product information from the supplier to MQ, making it a one-way communication. All other information that is shared with MQ is handled manually as described in the previous section.
The information that is shared through MQ’s portal is first entered by Björn Borg employees into an Excel sheet, as illustrated in the example in Figure 4.4. All fields have to be entered, and the format in which the information should be entered is very specific and exact. The reason for this is that MQ uses the Excel sheet to import the information into their ERP system. While the work with entering the information into the Excel sheet requires manual work from Björn Borg’s side, MQ can save time and effort by being able to import the information into their ERP system. Since the information should be structured and formatted in a specific way, it was mentioned during an interview that it is common that suppliers – especially new ones – have problems to follow the required structure and format. This is something that can, and do, negatively affect the information quality, as discussed in Section 4.3.1.

![The Excel sheet used in MQ’s portal](image)

In Stadium’s case, all information surrounding an order is communicated through their portal, as mentioned earlier. This portal is called PipeChain, and is integrated with Stadiums ERP system so that information can be sent both to and from the ERP system through the portal. Since Stadium has their ERP system integrated with the portal, tasks such as placing an order or handling an invoice can be done without ever leaving the ERP system. Björn Borg as a supplier gains access to the portal by logging in with a username and a password via an Internet browser. Once logged in, they can see the purchase orders sent by Stadium as well as send order confirmations and invoices. All of these tasks are performed directly in the portal, but since Björn Borg’s ERP system is not integrated with the portal, they have to manually enter the same information that is sent or received through the portal into their own ERP system as well. During one interview, it was explained that Stadium chose to use the portal solution PipeChain because it was the best solution they could find at that time. If they were to make an implementation today, the solution they are currently using is probably not the one they would implement. The reason why Stadium continues to use PipeChain, even though it would not be the chosen solution today, is that they have invested significant amounts of money

<table>
<thead>
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<th>Description</th>
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<th>Colorname</th>
<th>Size</th>
<th>EAN</th>
<th>Purchase</th>
<th>Season</th>
<th>Department</th>
<th>Materialgroup</th>
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</tr>
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<td>16</td>
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<td>031</td>
<td>1699</td>
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<td>16</td>
<td>2015</td>
<td>1</td>
</tr>
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<td>60</td>
<td>T blue</td>
<td>S</td>
<td>7325319000000</td>
<td>100</td>
<td>349</td>
<td>1</td>
<td>26</td>
<td>2015</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2000001</td>
<td>Jack stripe is short</td>
<td>60</td>
<td>T blue</td>
<td>M</td>
<td>7325319000000</td>
<td>100</td>
<td>349</td>
<td>1</td>
<td>26</td>
<td>2015</td>
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<td>2000001</td>
<td>Jack stripe is short</td>
<td>60</td>
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<td>Jack stripe is short</td>
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<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.4: The Excel sheet used in MQ’s portal
in the system and that it works well from their point of view.

Figure 4.5: Overview of open orders in PipeChain

Figure 4.6: Order details in PipeChain

Figure 4.5 shows the order overview page of PipeChain. In this view, all active orders, general information about the orders and their status are presented. Each order can be shown in more detail, as illustrated in the detailed order view in Figure 4.6. In the detailed order view, each order line can be seen, and the quantity and price can be changed if necessary. It is the information from this view that must match with Björn Borg’s ERP system, so that both parties have the same information. Once an order has been delivered, Björn Borg has the possibility to update the delivered quantity and then send the invoice through the portal. Figure 4.7 shows the overview that Björn Borg then can use to see the status of the invoices they have sent through the portal.

The reason why MQ and Stadium have developed and implemented their portals
is to reduce the amount of manual work needed from their side to share information, and that it is quick and easy for them to introduce new suppliers into the portal.

**4.2.4 Third-Party EDI Service Provider**

The information sharing relationships that use a third-party service provider and was analysed in this study are the links between the supplier Björn Borg and its customers Intersport, Swedemount and Åhléns. In all of these relationships, the same third-party service provider is used, namely Btwentyfour, which has also been interviewed and studied. The information sharing links are depicted in Figure 4.8.

Btwentyfour started their business by focusing on the sporting goods industry, and it is within this industry that they have grown the most and have most of their clients. Each party that is going to communicate via Btwentyfour have two options; they can either use a web portal that Btwentyfour provide, much like the solutions described in Section 2.2.2 and 4.2.3, or they can integrate their ERP system directly with Btwentyfour. All of the studied information sharing links in this study uses the latter method with integrations between the ERP system and Btwentyfour.

When integration is to be made between a communicating party and Btwentyfour, the first step is to decide which type of information shall be sent. There are different types of information that can be sent including price/sales catalogues, purchase orders, despatch advices and invoices, to mention the most frequently used. For each message type, integration has to be made between Btwentyfour and the communicating party. This integration is only required once per message. If it is a message that should be sent from Btwentyfour to a receiving party, for exam-
Figure 4.8: The links with information sharing through a third-party solution

A purchase order to a supplier, the integration consists of Btwentyfour making a translation from its internal purchase order message format to a format that is desired by the supplier. If it on the other hand is a message sent to Btwentyfour, for example an invoice from a supplier, Btwentyfour makes a translation from the message it receives to its internal format. Once two communicating parties have integrated the message types they wish to send/receive through Btwentyfour, the actual information sharing can begin.

The sharing of each message through Btwentyfour is essentially divided into three steps, as illustrated in Figure 4.9. The first step is that the sending party send the information from their ERP system to Btwentyfour. In this case, the sending party can be either Björn Borg or one of its customers. The second step is that the information gets translated to Btwentyfour’s internal format and stored in their database. The third step is that Btwentyfour translates the information into the format that the receiving party desires and then sends the message to the receiving party.

Since integration with Btwentyfour only needs to be made once per message type, it is easy to share information with multiple parties that are integrated to Btwentyfour once the integration is completed. Björn Borg have integrated the message for purchase orders once towards Btwentyfour, and are then able to utilise this integration with Intersport, Swedemount and Åhléns.
EDI solutions have, much like the portal solutions, been implemented to reduce the amount of manual work needed for sharing information. Unlike portals however, the reduction in manual work can be realised for both parties with EDI. The reason for using a third-party EDI service provider is to make the integration work smoother. Without the third-party, each message type to each communicating party would require a custom integration, which is a tedious and expensive process. As explained earlier, each message only has to be implemented once towards the third-party service provider and can then be utilised to share information with all parties that use the same third-party service provider.

Since Btwentyfour is an external party, their service has to be paid for. Each party pays for the initial integration work that has to be made for each message type. After the initial integration cost, there is a monthly fee for each EDI connection, which is paid by the suppliers. The retailers do not have to pay monthly fees to use the service. This business model, where the suppliers pay for the running costs of the service, is something that has been decided by Btwentyfour.

EDI services are, just like web portals, used to simplify and make the information sharing process more efficient. The difference between portals and EDI services is
that both parties gain the same benefits with EDI. For retailers, the only cost that has to be considered is the initial integration cost. This lowers the barrier for integration and makes it easier to recoup the cost. Suppliers are sometimes more or less forced by the retailers to use EDI services. As an example, Swedemount's suppliers have to pay a penalty if they do not use the EDI services that Swedemount uses.

### 4.3 How the Information Sharing Methods Perform

This section presents the empirics that can be related to the second sub-research question regarding how information sharing methods perform in regards to information quality and simplicity to share information.

#### 4.3.1 Information Quality

One difference between manually handling information and sharing information electronically, which has been mentioned during the interviews, is that all the transferred information is double-checked by a human in the manual process. This has come up as both a positive and a negative aspect. While some interviewees expressed that the double-checking is good for removing errors, others stated the opposite – namely that the risk of error increase with more human handling of the information.

A benefit with the manual method of sharing information is that no large investments have to be made into IT systems. In the manual method of sharing information, where IT systems are not used to a great extent, the quality of the information is highly dependent on the skills, mindfulness and attention of the persons handling the information. Experience is required for accurately and efficiently performing the work tasks, which is why introducing new staff to perform the tasks can take some time. Some of the interviewees that work for companies that have moved away from the manual way of handling information expressed that one of the main reasons for the transition was that they wanted to improve the information quality.

MQ’s primary goal with their portal solution was not to increase information quality, but rather the efficiency. A representative at MQ admitted that the data sheet that is used to supply information through their portal is difficult to use correctly, especially for new users. New users can be either completely new suppliers, or new staff at an existing supplier. The difficulty lies in that the system is very...
sensitive to data formatting. A whitespace at the end of an article number or the use of a hyphen instead of a colon, which is difficult to notice when compiling the information, can for example be a big enough error for the system to not function properly.

Most interviewees involved in information sharing through the third-party EDI service provider mention not only benefits in increased efficiency, but also in increased data quality. When clients first started working with Btwentyfour, the priority was to get a more efficient information exchange, but this has evolved into other benefits. The efficient exchange of information that was initially the goal is now taken for granted, and the biggest improvements lies within information quality according to some of the interviewees. The next step in the development towards higher information quality is to add comprehensive information validation at the third-party. This would enable the information to be “cleaned” before it gets transferred, and in that way enable the discovery of errors in an early phase. This validation is argued to be a way to further increase the efficiency of the information sharing process, since the sending party could be notified and be able to correct errors in the information before it is sent to the recipient.

![Figure 4.10: Quality of received and sent information with different methods. 1 = very poor, 7 = very good.](image)

An interesting result was found regarding information quality. Figure 4.10 displays the results from the questionnaire on questions regarding the information quality of received and sent information. The results have been divided into supplier and retail answers in the three different information sharing methods. The
most interesting finding here was that all parties perceive that the quality in the information they send is higher than the information they receive. It is also interesting to see that the results for the three methods from the supplier point of view, which can be compared since the same persons have answered the same set of questions for all three methods, show just a slight difference in the perceived information quality for the three methods.

4.3.2 Simplicity to Share Information

When information is shared by manually sending documents to the receiving party, the simplicity to share information depends partly on what type of information is shared, and partly on the involved individuals. The type of information, that is the focus of this study, is structured information originating from ERP or similar systems. This means that the sending party can typically export or print the information that is to be shared. To send the information to the recipient requires nothing more than e-mailing, faxing or mailing it. For the sending party, this is an easy and quick task. However, for information to be considered shared, it is not enough to just send the information. The receiving party needs to receive the information and utilise it as well. When a receiving party receives a document of information that has been exported or printed from an ERP-system – be it product information, a purchase order, an order confirmation, an invoice or sales information – the information must be analysed and acted on. All the investigated companies involved in manual document handling in this study have an ERP system of their own where the information must be entered, which requires a person to manually enter the information into the ERP system.

As mentioned earlier, the investigated portal solutions are used to simplify the information sharing process by reducing the amount of manual work. It has been found in this research that while the portal solutions can drastically simplify and make the process more efficient for the party owning the portal, the other party receives little or no benefits from portal solutions. The third-party EDI solution is more mutually beneficial in this sense, where both parties can have direct integration with their ERP system. Figure 4.11 represents the supplier’s view on overall functionality and efficiency of the three information sharing methods. The third-party EDI method scores highest in both overall functionality and efficiency. The portal and manual methods receives the same score on overall functionality, while the manual method has a marginally lower score than portal solutions in efficiency. This result correlates with the findings from the interviews that indicated that with
portal solutions, the party not owning the portal benefits less than the party owning the portal, while the EDI solution is more mutually beneficial. No similar comparison was possible from the retailer point of view, since the results for the different information sharing methods then would come from different sources.

![Figure 4.11: Supplier’s perspective on functionality and efficiency with different methods. 1 = very low, 7 = very high.](image)

The systems that are used to aid the information sharing are mainly the ERP systems used by each party. The functionality of these systems naturally varies between companies. When using the third-party EDI service, the handling of all information that is to be shared is managed within the local ERP system. How easy it is to share information through the EDI service is therefore dependent on how easy it is to use the ERP system. Even though ERP systems can contain a lot of functionality and be complex to use, the local ERP system is something that employees are familiar with and use on a regular basis. Portals look different for different actors, and are often only used a couple of times a year. The infrequent use and the complexity of some of the portals are factors that make it more difficult to share information through portals.

The usability of traditional ERP systems was also discussed during some interviews. It was mentioned that the complexity and lack of usability of some ERP systems probably stems from that ERP systems are an extension of economy systems. The economy systems were not designed for communicating, but for controlling the internal operations. One interviewee mentioned that because the ERP systems are based on economy systems, they have suffered from the lacking communication possibilities within economy systems.
Chapter 5

Discussion

In this chapter, some of the insights and empirics found during the study are discussed. The chapter also presents a discussion of sustainability implications of the findings and the studied field in general.

5.1 Supply Chain Relationships

In the supply chain relationships that have been studied, there are two aspects that have been recognised as especially interesting, namely trust and self-interest.

5.1.1 Trust

Many authors state that the development of information sharing relationships heavily depend on trust, as covered in Chapter 2. In this study, trust did not come up as an important and critical factor for information sharing in any of the interviews. This does not mean that trust is unimportant, but can be an indication that it is taken for granted. A case study within another culture or industry setting may show completely different results. In some of the interviews that covered trust in terms of information integrity, it was taken for granted that the other party handled the information with care and has taken necessary measures to keep the information secure. Every party focus on their own work, and expects that others securely handle and store the shared information.

5.1.2 Self-interest

As presented in the previous chapter, all parties perceive that the quality in the information they send is higher than what they receive. This indicates a lack of un-
derstanding of the receiving parties situation. The party that sends the information does not have to correct the errors – that has to be performed by the recipient. This indication of self-interest has been noted on several occasions during the study with the attitude ‘as long as it is good for me/my company, it is ok’. It seems like this attitude stems from not realising the opportunities that can come from cooperation within information sharing. If all members of a supply chain can be more efficient and lower their costs, the whole supply chain could gain from it. If everyone just works to make their own processes efficient without thinking about how it affects other supply chain members, this can cause problems for the efficiency of the whole chain. An example of this is the web portal systems in this study, which are highly beneficial for the owner of the portal but not the external parties. It seems like the larger and more powerful company in a supply chain relationship, whether it is a supplier or a customer, can have a superior influence on what method that should be used for sharing information. This has to do with which party that has the most to win from the relationship. In a supplier and retailer relationship, where the retailer is the supplier’s customer, it seems as if the retailer is often the stronger party. This may have to do with the traditional ‘the customer is always right’ mentality. However, it does not always apply. If, for example, a retailer is working with a strong brand that many end-customers request, this brand can be the more powerful party. As in any business relationship when one party is stronger than the other, it can to some extent satisfy its own interests and needs by dictating what information sharing methods to use despite the expenses for the other party.

As presented in Chapter 2, Harland et al. (2007) advocate that larger companies should assist smaller supply chain partners with funding and support surrounding IT solutions. There are some technical support for the web portals and EDI implementation, but when it comes to funding, it is sometimes the smaller and less financially strong party that funds the IT solutions. Since the payment setup that is used with Btwentyfour dictates that the suppliers pay for the running cost of the service, while the retailers does not pay, this can lead to that the less financially strong party is funding the information sharing in the supply chain. This business model is ingeniously constructed to the cases where the retailer is the stronger party in a relationship. Since the retailers do not pay any running costs, it is an appealing solution for them. Once the retailers use the service, they can use their powerful position to have their suppliers connected to the service. Even though this business model would seem to be perfect for the retailers, it was indicated during an interview with a retailer that it was not only a positive thing. There was a feeling that
since they did not pay for the service, they could not have as high demands and put as much pressure on Btwentyfour as they would have if they paid for the service.

Besides funding, another aspect related to self-interest that was presented in the previous chapter is regarding the request that Kennedies have made to receive invoices via e-mail instead of mail. This is not an unreasonable request, and other retailers do already receive invoices via e-mail. MQ and Volt for example, which are both substantially larger companies than Kennedies, get their invoices via e-mail. Since Björn Borg’s ERP system cannot automatically send invoices via e-mail, manual work is needed to send invoices in this way. That Björn Borg does this manual work for some of its customers, but not all, once again indicates that the stronger party sometimes satisfy their own needs and interests at the expense of the other party. MQ and Volt have their needs satisfied by having invoices delivered via e-mail at the expense of Björn Borg’s resources, while Björn Borg have decided not to deliver invoices via e-mail to Kennedies to save resources, even though it would benefit Kennedies. The issue with delivering invoices via e-mail is an IT (ERP) system limitation – a matter that will be discussed in the next section.

5.2 IT Systems and Usability

Interviewees on both the retailer and the supplier side expressed dissatisfaction and frustration with their IT systems and mentioned that more investments are needed to improve the systems. The dissatisfaction stems from having too many and too old IT systems, while the frustration comes from a perceived lack of priority regarding the IT systems from company management, which makes investments into new systems seem distant. There seems to exist unwillingness to upgrade ERP systems since it is a burdensome and expensive task. Instead of upgrading, in-house solutions have been implemented as workarounds to the problems within the systems. The software quality in terms of usability, reliability and modifiability of these solutions can be questioned. For example, it was expressed that it is easy to make errors in MQ’s portal. The portal was implemented to increase the information sharing efficiency, but seems to have missed out on the quality aspect. While the system is efficient when it works properly, the errors that easily occur have to be manually resolved and thereby have a negative impact on the efficiency.

What seems to be a general lack of usability in ERP systems have been observed during this study. The systems are complex and often contain more functionality than what is used by one single user. A customisation of what functions to display to
each user would be a way to increase the usability by making each user’s workspace more easily overviewed. The ERP systems seem to dictate the internal processes to some extent, for example the mailing of invoices due to limitations in the system. This is contrary to what Yang and Maxwell (2011) argue for is important for successful information sharing, namely that IT systems should not force changes to internal processes, as covered in Section 2.3.3. Among the studied information sharing methods that requires the least changes to internal processes is the third party EDI solution, since it allows users to do all the work in their internal ERP system. The easiness to use this method is therefore dependent on the usability of the ERP system that is used.

Since the information that is transferred in EDI solutions is sent directly from the senders to recipients ERP system, the quality of the data is of high importance. It was therefore indicated during the study that a thorough quality check and validation functionality of the information at the service provider (Btwentyfour) would be valuable. Such a validation, where the sender is notified of information abnormalities, could increase the overall quality of the information that is shared in the supply chain. By notifying the sending party of the abnormalities, instead of sending it to the recipient that has to investigate potential errors, a better understanding could be developed about the quality of the information that is sent. As indicated in the previous chapter, a better understanding or communication is necessary, since all parties consider the quality in the information they send is higher than the information they receive. A validation at the service provider could be a solution to this problem in the third party EDI method.

5.3 Data Structures and Databases for Information Sharing

The differences in the standards that exist for EDI are essentially the structure in which the data is compiled to, i.e. the data structure. As mentioned in Section 2.2.2, there are different standards in different industries, which increases the complexity for companies wanting to do business in multiple industries. This complexity has opened up a market opportunity for third-party actors such as Btwentyfour, who translates messages between different actors ERP systems. In the case of Btwentyfour, all messages are initially translated to Btwentyfour’s in-house format as described in Section 4.2.4. The internal format of Btwentyfour can be seen as a kind of standard, even though it is just used internally. The translation that is
made at Btwentyfour would not be necessary if a common standard was used in the first place. If and when a common data structure is agreed upon, or an easy conversion between different data structures is made possible within ERP systems, the translation part of the third-party would in theory be redundant. However, since no common standard has been agreed upon since the initial work with EDI standards in the late 1970’s, it is perhaps too optimistic to think that it would be resolved in the near future. Third-party EDI services that translate messages reduce the need for a common standard, and therefore presumably also reduce the motivation for developing such a standard.

Having databases outside of the ERP systems is not necessary for a functioning EDI setup. However, when a third-party is involved in the transaction, a database at the third-party makes the translation of the messages possible and secures the data in case of potential connection interruptions. Much of the data that is transferred via EDI, such as order quantities and article prices, is confidential. The security of the connections and databases that are used is therefore of high importance. In the studied case, the third-party service provider is responsible for the security. This requires trust between the third-party service provider and its clients, not only in that the technological solutions are secure, but also in that the third-party is unbiased.

When choosing data structure and database, the main consideration is what type of data is to be stored. This study has positioned itself within the field of information sharing, in which a lot of research has been made. However, there is a difference between information and data. Data are discrete raw observations, numbers and records, while information is data that has been organised (Tidd and Bessant, 2013). With the type of analytics that is being made today, there is a need for data, not necessarily information. Much of the “information” that is shared and covered within the field of information sharing is actually data, which is refined to information and eventually knowledge by the recipient. The sharing process therefore handles data and not information. As the practices change in the industry, and the use of data analytics increase, the information sharing field should also be directed towards focusing on data, and be considered to be renamed data sharing.
5.4 Sustainability

Sustainability can be divided into three dimensions: economic, social and environmental (UN General Assembly, 2005). Briefly explained, economic sustainability is the wise use of financial resources, social sustainability is the respect for people, and environmental responsibility is the respect of life and the wise management of natural resources (Blackburn, 2007). The economic sustainability of the studied topic was covered in Section 2.1, where previous studies regarding the benefits on performance and economy from information sharing was presented. Regarding social sustainability, advancements in information sharing can improve the working conditions and simplify the work for staff with administrative tasks. However, efficiency increases in IT systems could result in redundant staff, which would be a negative implication for the staff that may lose their job. From a company standpoint, less staff means less costs, which is positive for the economic sustainability of the company. Successful information sharing can also reduce the number of transports needed, which is positive for both environmental and financial sustainability, thanks to more accurate forecasts and planning.
Chapter 6

Conclusions

This chapter contains the conclusions of the study. The research questions are answered and the academic contribution and managerial implications of the research is presented. Limitations of the study are also discussed, before ending with suggestions for future research.

6.1 Answering the Research Questions

Sub-question 1: Which methods are used for sharing information in different supply chain contexts?

In the studied supply chain contexts, three methods for sharing codified information have been observed: manual document handling, in web portals and through a third-party EDI service provider. The manual document handling method is used when no other dedicated information sharing solution is established between two supply chain parties. The absence of a dedicated information sharing method is either due to lacking resources or lacking prioritisation. An information sharing web portal is used when one of the supply chain parties have chosen to implement it, often to increase the information sharing efficiency at their company. The studied companies that are using a third-party EDI service provider are all integrated to the same service provider. Both integrated parties can improve efficiency by using this method. The EDI service was initially used to increase information sharing efficiency, but focus is increasingly being put on information quality. The barriers for starting using the EDI service that was studied are lower for retailers compared to suppliers. The retailers only have to pay their own initial integration costs, while the suppliers are paying for integration and the running costs. Suppliers
are sometimes more or less forced into using the service by the retailers to avoid penalties.

**Sub-question 2:** How do these methods perform in regard to (a) information quality and (b) simplicity to share information?

No matter what information sharing method is used, all included parties believe that the quality in the information they send is higher than what they receive. One of the great benefits of going from manual handling of information to an electronic method is increased information quality. Therefore, when moving away from manual document handling, the focus should not only be on the efficiency aspects, but also on information quality.

Regarding simplicity to share information, the manual document handling method requires much work from both parties. By using a web portal, one of the parties gets a more simple information sharing process because all information they receive is directly transferred into their ERP system, while the other party still manually enter the information into the portal. The method that simplifies for both parties is the third-party EDI solution. This method lets both parties send information from, and receive information into, their ERP system.

**Main Research Question:** Which information sharing methods are suitable in different supply chain relationship contexts?

From the answers to the research questions above, the information sharing method of the ones that have been studied that is most suitable, if the context allows it, is the third-party EDI solution. It enables enhancements in both information sharing efficiency and information quality. However, this method is not always applicable since it requires investments and that both parties are integrated to the same third-party. If resources are scarce for both communicating parties, and no method for information sharing is in place, the manual document handling method is a suitable short-term solution. If one party with lots of resources frequently share information with parties that cannot afford to invest in information sharing solutions, a portal can be a suitable compromise to let the company that invests in the portal gain efficiency benefits while the other parties continue to manually provide information.
6.2 Contribution

The contributions presented in this section are divided in the two categories academic contribution and managerial implications.

6.2.1 Academic Contribution

In his study of information sharing articles, Marshall (2015) found that a low fraction of the articles dealt with information sharing technology and it appears to be an opportunity for future research in information sharing technology, for example by conducting case studies. The research presented in this report has investigated information sharing technology, and therefore expands the available research with empirics from a case in the Swedish sporting goods industry. Marshall also stated that further investigation was needed in the field of information quality, which has also been a part of this study.

Craighead et al. (2006) and Schneider (2010) describe that information sharing without manual human interaction reduce the risk of error. However, this study showed that some people see the manual handling of information as an extra validation of the information, and that the risk of error therefore would decrease, which does not correlate with the previously mentioned theories. This study also showed that there tends to be a lack of trust in the used technological solutions from the people that use them, which leads to manual communication between the sending and receiving party to verify that the information has reached the recipient.

Hill and Scudder (2002) found that EDI was used as a tool for improving information sharing efficiency in the companies that they studied. The companies that were studied in this research had implemented EDI partly to increase information sharing efficiency, but another important reason was increased information quality. The initial reason for switching to EDI was to increase the efficiency, but once it was realised that quality benefits could be gained, more focus has been put on that aspect of EDI.

Lee and Whang (2000) discussed problems that occur when multiple standards exist – it is difficult to decide and agree on what standard to use, and companies that are interested in doing business in multiple industries potentially have to support different standards. This can be both expensive and time consuming. A third-party EDI service that translates messages is a workaround for overcoming the problems that occur from using different standards, and acts as a solution to achieve the goals that the standards intends to achieve.
Even though information and data is closely related, they are not the same. As discussed in the previous chapter, the information sharing field does cover a lot of data sharing. Data analytics is a rapidly growing practice in many industries, the retail industry in particular, which is why the sharing of data – not information – is becoming increasingly important. With this in mind, the field of information sharing might be more accurately named “data sharing” in the future.

### 6.2.2 Managerial Implications

With the main research question in mind, regarding which information sharing methods are suitable in different supply chain relationship contexts, this study provides insights into different information sharing methods that can be used when an information sharing method is to be chosen. This study has also found that in supply chain relationships, there is a tendency that self-interest trumps overall supply chain benefits. This is something that should be taken into consideration when forming or developing supply chain relationships. There seem to be an attitude within companies that the company itself is better than its communicating parties when it comes to information quality. This can naturally not be true for all involved companies. Interaction regarding information quality is therefore needed between supply chain members, so that weaknesses in information quality are revealed and can be corrected. It has also been discussed that an increased efficiency in IT systems and information sharing can result in redundant staff, which leads to layoffs.

### 6.3 Limitations

The results in this study were derived from one case study of supply chain relationships in the Swedish sporting goods industry, focusing on the relationship between suppliers and retailers. Since only one industry was studied, the same industry dynamics apply to all studied parties. This study does not give insight into other industries or the public sector.

Some limitations in the data collection have been identified. Since a relatively small sampling was made, the input of the interviewees significantly influenced the result. Other interviewees with the same role, but at another company might have given a different result. It is also possible that interviews with other persons within the studied companies would have given a different result.
6.4 Future Research

This study has only focused on the methods for sharing information. Once the information has been shared, it has to be refined and analysed to have any value. Future research could look into how shared information between supply chain members can and should be handled when it has been shared. There are also other methods for sharing information that can be researched, for example direct EDI. There are some areas surrounding ERP systems that require further investigation. One interesting path is a human-computer interaction study of the usability of ERP systems. There were also indications during the interviews that ERP software is increasingly delivered as a service. It would therefore be interesting to study how a servitisation of ERP systems would affect the future of information sharing. A future topic for research could also be to link theories such as transaction cost theory, bounded rationality theory and agency theory with information sharing relationships in supply chains. The financial aspects regarding costs and profits from different information sharing methods could be an interesting area to study as well.
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