



LUT School of Business and Management
Bachelor's thesis, Business Administration
Financial Management

Information Sharing in Supply Chains: Case Bertschi

11.12.2019
Joonas Saareto
Supervisor: Jyri Vilko

ABSTRACT

Author: Joonas Saaresto
Title: Information sharing in supply chains: Case Bertschi
School: LUT School of Business and Management
Degree programme: Financial Management
Supervisor: Jyri Vilko
Keywords: Supply chain management, information flow, information disruption

This case study researches information sharing in supply chain from intermodal logistics company's perspective with emphasis on identifying key development areas in the information sharing. The qualitative research consists of five individual semi-structured interviews in the case-company Bertschi AG, an international logistics company focusing on intermodal transfers. The interviewees are representing the Finnish business unit of the company. The research material is gathered during Q4 of 2019 consisting of interviews, surveys and company related documents.

The literature part discusses relevant literature on information sharing, tools of information sharing and findings of other research. Aspects from the advantages and disadvantages of information sharing are discussed as well. Also, the enablers and barriers are discussed to give perspective and something to reflect the empirical findings.

The results of the study implicate that there are two key development areas that should be improved in the information sharing practices. The issues of information being shattered into multiple different sources and missing information will have a negative impact on operational success and may cause a threat to the supply chain. Therefore, information systems play a big role in the information sharing.

TIIVISTELMÄ

Tekijä:	Joona Saaresto
Tutkielman nimi:	Informaation jakaminen toimitusketjuissa: Case Bertschi
Akateeminen yksikkö:	LUT-Kauppakorkeakoulu
Koulutusohjelma	Kauppätieteet, Talousjohtaminen
Ohjaaja:	Jyri Vilko
Hakusanat:	Toimitusketjun johtaminen, informaation jakaminen toimitusketjuissa, informaatiovirta, informaatiokatkokset

Tämä case-tutkimus pyrkii tarkastelemaan informaation jakamista toimitusketjuissa kansainvälisen logistiikkayhtiön näkökulmasta. Työn tarkoituksena on tuottaa kehityskohtia informaation tehokkaammalle jakamiselle toimitusketjuissa. Laadullinen tutkimus koostuu viidestä eri haastateltavasta case-yritys Bertschi AG:n Suomalaisessa tytäryhtiössä Bertschi Finland Oy:ssä. Yritys keskittyy kansainvälisiin intermodal-kuljetuksiin. Tutkimus on tehty vuoden 2019 viimeisen neljänneksen aikana, mikä koostuu haastatteluista, kyselytutkimuksesta sekä yritykseen liittyvistä dokumenteista.

Teoriaosiossa tarkastellaan alan relevanttia tutkimusta informaation jakamisesta, työkaluista sekä löydöksistä. Tarkastelun tavoitteena on saavuttaa pohja informaation jakamisen hyödyille, haitoille, mahdollistajille sekä haasteille.

Työn löydökset osoittavat, että informaation jakamisessa on kaksi isompaa kehityskohtaa. Ensimmäisenä käsitellään informaation hajaantuneisuus useisiin eri tietolähteisiin sekä järjestelmiin, sillä on olennainen vaikutus toimitusketjun tehokkuuteen sekä voi ääritapauksessa muodostua uhaksi. Toisena ongelmana on kadonnut informaatio, joka johtuu tiedon hukumisesta eri järjestelmiin tai tiedon kerääntymisestä silloihin.

TABLE OF CONTENTS:

1. Background.....	1
1.2 Research questions and limitations.....	2
1.3 Theoretical framework of the study and structure.....	2
1.4 Framework for analyzing the case company.....	3
1.5 Research methodology and material.....	6
1.6 Case company: Bertschi Finland.....	8
2. Information sharing in supply chains.....	8
2.2 Tools of information sharing	9
2.3 Advantages of information sharing.....	11
2.4 Disadvantages of information sharing.....	11
2.5 Enablers of information sharing.....	12
2.6 Barriers of information sharing	13
3. Case study findings	14
3.1 Dyadic information exchange	14
3.2 Internal chain information exchange	15
3.3 Identified problems in the information sharing	16
3.4 Analysis of the problems related to information sharing.....	17
4. Conclusions.....	20
4.1 Scientific implications.....	21
4.2 Managerial implications	22
4.3 Limitations and suggestions for further research.....	22
References.....	24

APPENDICES

APPENDIX 1: Interview questions

APPENDIX 2: Survey questions to assess the problems

1. Background

Increased competitive environment of global supply chains has forced supply chain organizations to increase collaboration and flexibility in their business processes (Seymour et al., 2008, p. 175). Collaboration in the first place means that organizations will need to share information to be effective in their processes. Information sharing in the global supply chain consists of many parties at different stages with often different business goals. While the financial and material flow are the key elements of supply chains, the information flow is as well as important. To effectively manage these flows, identifying and analyzing the interactions among the actors in the supply chain is required (Sahin and Robinson, 2007).

Although the research around information sharing in supply management is out there, many of the research discusses the value of information sharing based on the inventory level and demand forecasting (Kembro and Näslund, 2014). The collaborative supply chain should be discussed critically, since studies show that collaborative supply chains benefit mostly long-term relationships (Prajogo and Olhager, 2012). There has been academic research about the best practices in supply chain collaboration, but in some business fields the evidence of adopting the best collaborative practices is rather limited (Montoya-Torres and Ortiz-Vargas, 2014). Therefore, studies about adopting the best collaborative practices in different business fields may have a positive contribution to the existing research.

This thesis work is a qualitative research of information sharing in supply chain from logistics company perspective. The study discusses development areas in the information sharing practices. Research sample will be gathered from a case company, Bertschi AG, a global logistics company doing intermodal transports in dry-bulk, liquids and solutions in logistics.

1.2 Research questions and limitations

The objective of this study is to examine the essential tools of communication in the supply chain and furthermore investigate their value and problems. The main research question is:

- How information sharing can be developed in the supply chain?

The main research question will be supported by the following sub-questions:

- What are the advantages and disadvantages of information sharing?
- What are the enablers and barriers to information sharing?

This study has certain limitations. It reviews the supply chain from a single logistics company's perspective. Also, the case company represents the business on the Finnish environment, which is relatively small when looking at the transported goods. Further studies from a wider range of companies in the group are encouraged.

1.3 Theoretical framework of the study and structure

This research begins with a literature review of supply chain management, scientific research on the supply chain digitalization and other industry-specific articles. In the first chapter, information-sharing is presented. In the second chapter, the current practices of information sharing are presented: advantages of the tools in SC, disadvantages of the current tools in SC and enablers and obstacles of information sharing. In the case study chapter, information exchange is being summarized and key development areas of information sharing are identified and assessed. The conclusion chapter brings the study together with reflecting the case-study findings with the literature review. Figure 1 illustrates the structure of the study.

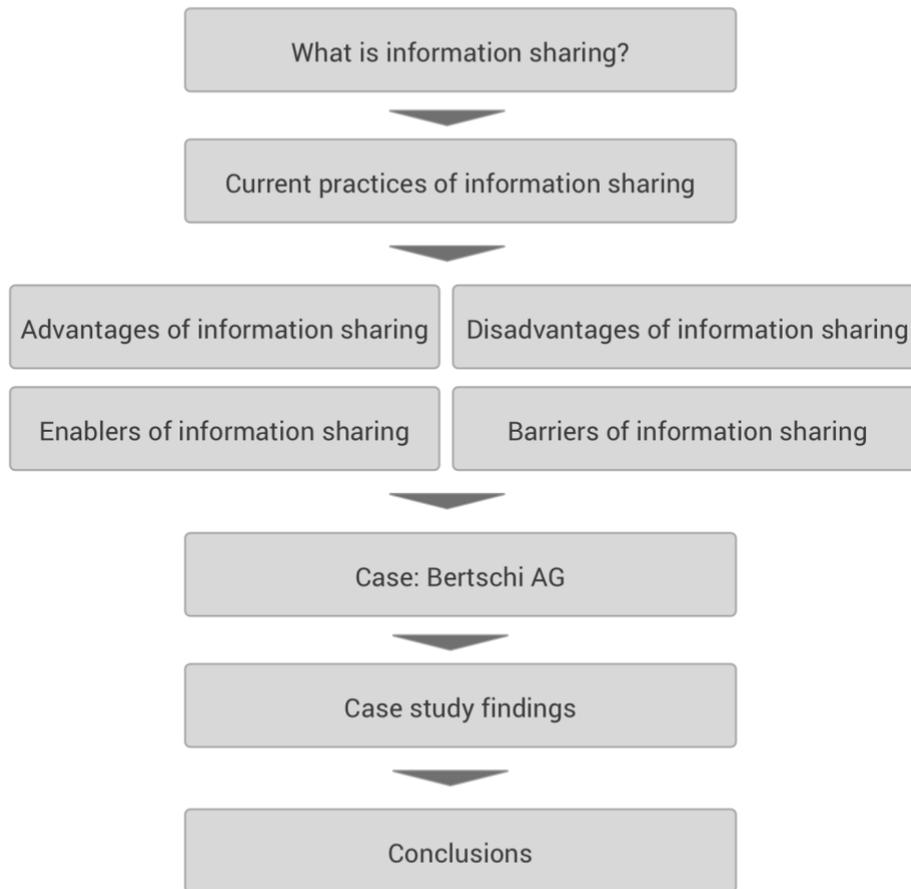


Figure 1: Structure of the study

1.4 Framework for analyzing the case company

Regarding the objectives of this study: “how information sharing can be developed” requires investigation of the problems in the information sharing. In order to identify the problems, needed data is being collected of what information is being shared. As Sahin and Robinson (2007) implied, that identifying and analyzing the interactions among the actors is required. Therefore, we have to pay attention to the interactions and different

supply chains. The three levels reflect the levels of analysis identified in the study by (Harland, 1996), where four levels of research in the supply chains were identified; Internal chain, Dyadic relationship, External chain and Network. Figure 2 illustrates the different supply chain levels and the relationship of the actors in the supply chain.

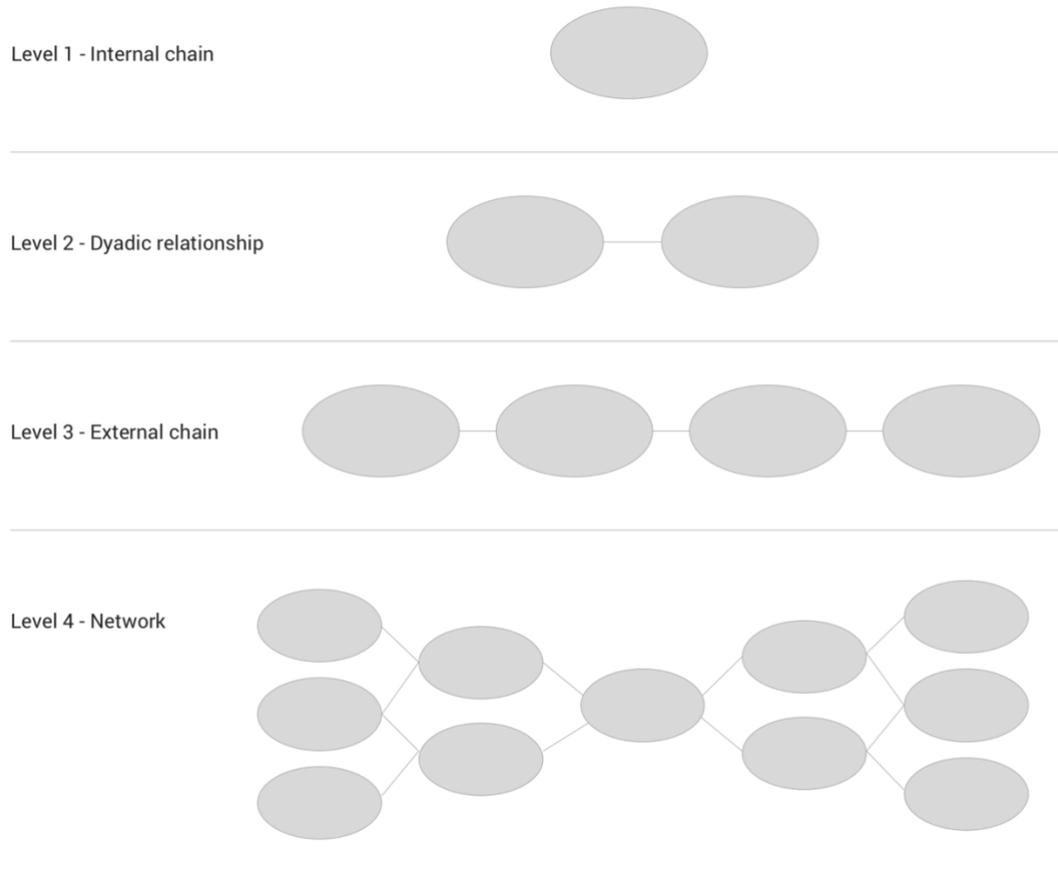


Figure 2: Levels of research of supply chains (Harland, 1996)

Information is shared at different levels of organization, information sharing at these levels have different meaning and purposes. Three different levels of information sharing in supply chains have been identified at least in a study by Kembro and Selviaridis (2015): strategic, tactical and operational information. Tactical level information is referred to managerial in this case. We may form a matrix based on the form of the supply chain and the level of information sharing.

The case material will be analyzed from the perspective of the following framework (Figure 3.) that will be a matrix consisting of two axes. Vertical axis is the supply chain, which consists of three levels: network, dyadic relationship and internal chain. Horizontal axis represents the case company's operational, managerial and strategic viewpoints. This way, we can place the problems on the matrix.

	Strategic	Managerial	Operational
Network			
Dyadic relationship			
Internal chain			

Figure 3: Analytical framework of the study (Adapted from Harland (1996); Kembro&Selviaridis (2015))

1.5 Case study and sample

Case study examines a complex environment where a person, organization or country faces dilemmas. Case study as a method allows more holistic view of the complex real-life problems that are often related to social phenomena. It is used often in situations that are related to the knowledge of an individual, group or organization. (Yin, 2003, p. 2) . Therefore, case study would be the suitable research strategy to this study to bring more insights of the problems in the case company and furthermore support the development of the complex problems. Single-case study was chosen, because there has not been much previous research in the case-company. According to Yin (2008), single-case study is revelatory case, when the phenomenon has not been accessed by scientific research before.

The interview is semi-structured and explorative. Semi structured interview as a method can bring deeper understanding of the subject as it can bring up themes that otherwise couldn't been come up in a standard questionnaire (Gwee, 2018, p. 72). In the case company, these questions are asked from both strategic, managerial and operative points of view to understand what information is being shared and identify the problems in the information sharing and how they are related to the supply chain.

The interviews were all taped and then transcribed to reduce any possible bias. The transcribed interviews will be then analyzed and organized to the framework to further analyze the impact of the problems and what is the effect of the problems.

The interview themes were the following:

- Why information is being shared and why it is not being shared?
- What information is being shared? Are there any problems in it?
- When is the correct time to share information?
- What are the advantages of information sharing? Or how about disadvantages?
- How information is being shared?

Research interviews are consisting of five different face-to-face interviews and a survey to get multiple sources of evidence. One of the interviews was done in a phone meeting. Table 1 illustrates the different roles who were interviewed on this work, what is their experience and level in the company. The interviewees are either responsible of planning the logistics process or managing the company's operations or doing the operational processes. The data was gathered during two designated interview dates and additional material were also gathered during visiting the company. During the research period, there were approximately five visits in the company, each visit being around 8 hours in the length. The visits consisted of company presentations and often hands on investigation of the daily operations in the company.

Table 1: Interviewees of this study

Role	Experience	Level in the organization
Business development	20 years	Strategic
General Manager	20 years	Managerial
Transport planner	2 years	Operational
Terminal manager	8 years	Managerial
Terminal worker	2 years	Operational

In the second step following the interviews, a survey questionnaire is being gathered to measure the impact of the identified problems. Participants are being asked to define the impact and the probability of each identified problem on a scale from 1 to 5. In the impact, the answers were described as following: 1=very low, 2=low, 3=moderate, 4=high and 5=very high. For the probability the answers were the following: 1=rare, 2=unlikely, 3=moderate, 4=likely and 5=very likely. The values of each problems are then being multiplied, resulting to a maximum score of 25.

1.6 Case company: Bertschi Finland

Bertschi Finland Oy is a subsidiary company of Swiss parent company Bertschi AG. As a logistics services provider in the supply chain, Bertschi is focusing mainly on the following business areas:

1. Liquid transportation
2. Dry bulk transportation
3. Global transportation
4. Solutions (warehousing, filling of liquids)

Bertschi is a global company with presence in 25 countries with over 50 locations. With 30 intermodal terminals and over 750 trucks it makes a massive logistics network across the globe ("Liquids | Bertschi," 2019). In 2018 it had over 3000 employees and 975 million CHF turnover.

The case study and interviews are made in the Finnish subsidiary Bertschi Finland Oy. It has an intermodal terminal located in Helsinki, where the business areas of Bertschi are being operated (liquids, dry bulk, global and solutions).

2. Information sharing in supply chains

Information sharing in supply chains has been interested researchers for decades. Information sharing can be seen as business entities exchanging information in order to plan and execute business processes more efficiently. To successfully enhance the supply chain performance, firms often share information, such as; inventory information, reports, demand forecasts, production schedules and research about customers and suppliers (Porterfield, 2007). Firms shouldn't be looking at operations in isolation from the rest of the supply chain, therefore information sharing aims to bring value to the whole supply chain (Naylor et al., 1999).

According to studies, information sharing appears to be divided in two groups. One of the groups states that sharing information will lead to improved forecasting and reduced inventory levels. Second group states that it will lead to improved planning and decision making process and lead to improved long term relationships. (Kembro and Näslund, 2014). Research also shows that supply chain configurations are mostly studied at dyadic level due to the simplicity of the relationships (Montoya-Torres and Ortiz-Vargas, 2014). However, an effective framework for the information sharing is still needed. (Li Gang, 2005, p. 44). This enables actors in supply chain to evaluate and adapt relevant information to support their business strategies.

Information sharing is categorized in three levels: strategic, tactical and operational information sharing. In the supply chain context, research shows that at the operational level for example order information, delivery schedules for upcoming days and quantities are shared. Tactical level information, in this study referred as managerial information includes quarterly forecasting and demand information. Strategic level include information such as long-term forecasts and expansion plans. (Kembro and Selviaridis, 2015, p. 463).

2.2 Tools of information sharing

While information technologies are important in the flow of information, the frequency, relevancy and the quality of information that matters. Exchanging the information in the right place at the right time makes the value of information exchange (Prajogo and Olhager, 2012). Supply management systems are used in firms to manage relationships with their suppliers. Information is being shared about orders, production, inventory levels, deliveries. (Laudon and Laudon, 2014, p. 85). The most common tools of information sharing in supply chain are; *EDI, ERP, telephone, email, web-based applications and face-to-face communication*. All the methods have their own role in the time frame of the feedback.

Electronic data interchange (EDI) has been the industry standard for decades now. It is a standard for exchanging significantly important information for effective business

operations. EDI has been used for demand forecasting, bills of lading, shipping details and invoices. (Khan and Yu, 2019, p. 250). Although EDI provides lot of benefits for companies, newer technologies such as XML are gaining traction because of its more flexible nature and also with lower operating costs (Nurmilaakso, 2008).

Enterprise resource planning (ERP). Integrating data and business processes are the most important functions for ERP systems (Srinivasan, 2016). It had focused on functions such as sales, production and inventory management, but has also functions and tools that can provide information with business partners. Having an access to suppliers' production and delivery schedules, buyers can improve their plans and schedules (Kelle and Akbulut, 2005). ERP can increase the effective information sharing inside the organization by having a system that builds upon a single database and has the connections to different systems. However, ERP systems have their own obstacles. One of the obstacles is in the philosophy of ERP, which is process based rather than function based (Hong and Kim, 2002). How would process based system perform in fast or even disruptive changes in the business environment?

Telephone and email. In the logistics point of view, phone and email are used often to communicate operational level information among the supply chain partners. A study by (Pham et al., 2019) points out that logistics companies mainly share operational information through traditional channels such as email or telephones. There is one aspect that distinguishes telephone and email, the time horizon, where telephone is used to obtain information faster than email. The traditional channels are effective in exchanging information that is related to urgent problems or if there are no other channels to exchange information.

Web-based applications can provide more accurate data in a more centralized way than other systems, such as ERP. Web-based systems are also more accessible for supply chain participants through a web browser. (Chengalur-Smith et al., 2012).

Face-to-face communication. Regardless of the evolving technologies, face-to-face communication can often be the most effective way to communicate complex issues than telephone or email. It could be utilized well, when immediate feedback is needed

(Porterfield, 2007). However, face-to-face communication may lead to misunderstandings if, for example the part of the information happens to be forgotten.

2.3 Advantages of information sharing

Information sharing surely provides benefits for multiple parties in the supply chain. However, what information to share and with who, with what systems or in which format will be always the question. Adding also the barriers factor that are people willingness to invest into these systems will bring even more complexity to the development of information sharing.

From the earlier research we may see that there is a positive relation with collaboration to the supply chain performance. Collaboration and information sharing can reduce gaps within the supply chain and reducing bullwhip effect. Therefore leading to increased performance and sales growth. (Panahifar Farhad, 2018, p. 373).

For the operational efficiency, sharing knowledge is key success factors for an organization to learn and adapt faster to various changes. However, it requires for people in an organization to create linkages and relationships towards the knowledge sharing (Nahapiet and Ghoshal, 1998). To create the best value for the customers, supply chain partners should integrate the supply chain information and work as a single entity, thereby creating a value network (Prajogo and Olhager, 2012).

2.4 Disadvantages of information sharing

There are also lot of disadvantages and risks related to the information sharing, and supply chain in general. Risks has been defined in many different ways that we may question that how the understanding can be achieved, when the focal construct appears to be so slippery (Yates and Stone, 1992). The proposed critical elements from Yates and Stone is that risk constructs of a) potential losses, b) significance of

those losses and c) the uncertainty of the losses. However, there are different type of losses, such as buyer demographics, company size or country. And the impact to the organization is a combination of the impact of the loss and the probability of the loss (Mitchell, 1995). Manuj and Metzner (2008) defines the risk the same way as Mitchell (1995), but inserts qualitative losses in addition to the quantitative losses. Example of quantitative loss could be sales, and an example of qualitative loss could be lost customers. Therefore, risk for an event is defined as:

$$Risk = P(loss) * I(Loss)$$

One of the risks can be defined as Information knowledge leakage (IKL). It can be divided into intentional and unintentional information leakage. Critical information can therefore be transferred to external parties either by verbal or written communication, what in some cases mean that information is being shared with unauthorized parties without the company even noticing the leakage (Tan et al., 2016, p. 622).

Supply chain can be seen as a complex system with many parties involved. Each party has their own roles in the chain and each one has its own business objectives. If company A cooperates with company B, company A might be working with company C, which is a direct competitor to company B. Therefore, there might be risks in information leakage if critical data is being shared. Of course, there has be legal agreements in using the critical data, but it doesn't close the chance that information can be leaked unintentionally.

2.5 Enablers of information sharing

Information technology is a huge enabler for sharing information among business partners. In supply chain management context, sharing critical real-time information has been used to minimize the inventory in all stages of supply chain. In addition, sharing real-time information can therefore produce more accurate demand forecasts (Khan and Yu, 2019, p. 26).

When discussing about the value of information sharing one key element is that it will bring more value when utilized correctly in long-term business partnerships. However, it requires foremost the design of the business models to respect and balance the interests of other partners involved (Zijm et al., 2019, p. 24).

The organizational culture has to lean towards openness, especially the management team has to see the value in the information sharing over the risks of it. If it's seen that the current systems will do the required job it leads the organization to a state where it's not willing to develop further and keep on with the competition.

2.6 Barriers of information sharing

According to research, there has been identified several categories of barriers in information sharing in supply chain what are the following: managerial, organizational, technological, individual, financial, social and cultural. First and foremost, managerial aspect is important in order to get the information sharing in place. Without the management's support towards information sharing, the other categories of the barriers will not be developed, for example financial budget or investments towards technology are not provided (Khurana et al., 2011, p. 10). There are cases in strategic alliances, that opportunistic behavior leads to not putting as much as effort and resources in information sharing (McCarter and Northcraft, 2006). Not realizing what is the best interest for the group while focusing on the individual's interest may often be a barrier for effective information sharing.

Lack of trust to partners is clearly a barrier towards more integrated supply chains. While related to the IKL mentioned in *2.4 Disadvantages of information sharing*, research implies that many of the identified issues were related to lack of meaningful relationships and trust (Tran et al., 2016). Information sharing does not always result into better performance in supply chain. Organization needs to have capabilities for information processing both internal and inter-organizational levels, as well as incentives to form more deeper relationships. Also, disruptions in information sharing are often caused by human-error, since information sharing is very person dependent and often tacit information (Uusipaavaniemi et al., 2010).

3. Case study findings

This section describes what were the main findings of the interviews and the analyzed results. Later, the development areas are discussed through the analytical framework (Figure 3). Main development areas are also discussed with the view on their importance and effect. Dyadic and operational level information sharing topics are also described in this section. Network level information sharing is not discussed in the case-company analysis, since there was not sufficient data to form reasonable analysis.

3.1 Dyadic information exchange

Dyadic relationship structures from two business entities. Two types of dyads were identified during the analysis: the sender of the goods and the recipient of the goods. Both of them having certain need to transfer information. There are certainly different levels of information that needs to be needed from the both dyads. (Figure 4) summarizes the information that is being exchanged in dyadic relationships. Mainly they are related to certain requirements of the shipments, often the transported items need to be shipped with requirements, such as certain temperature or packaging. 80% of the order information arrives as an EDI messages, the rest 20% orders come as an email. There are also requirements for the driver of the transportation. All of this information needs to be received either from the sender and the recipient of the goods. The case company had long term relationships with the senders and the recipients. Most critical part in the information sharing in dyads is that the information needs to preserve its quality when the material is being transported. Shattered information will pose a significant risk to the quality of the information needed in the operational processes in the case company. Otherwise, resulting to negative impact on delivery times and service quality.

Dyadic relationship	What information is shared	Why it is shared?	System
Operational level	Order information Special arrangements (temperature, packaging) Driver requirements and certificates Delivery time (date, time) CMR Shipping certificates	Enabling the daily operations of successful transport of the goods	EDI, Phone, Email
			Email
Managerial level	Inventory levels	Enabling customer satisfaction	Email
	Special agreements on transportation		Email, Phone
Strategic level	Service agreements and maintaining customer relationships	To plan business longer than 12 months forward	Face-to-face, Email
	Changes in overall market		Face-to-face, Email

Figure 4: Dyadic information exchange in the case company

3.2 Internal chain information exchange

The analysis identifies that most of the problems is in the internal processes. However, most of the research material were based on interviews of people representing operational role in the case company. Dyadic information feeds the planning of the operational processes. Therefore, receiving order requirements in time from the sender is critical for the correct planning of the resources. The most critical information to receive the order requirements as accurately as it is from the origin of the information. Information is often transferred through traditional channels such as telephone or email, leading to information gaps, which may result into huge risks. There are systems such as ERP and historical data of the earlier requirements, which brings some predictivity to the transportation of the goods. We need to also remember that every transportation has its own characteristics and requirements, so it is critical to have quality information about the requirements. Missing information is the worst-case scenario, which will lead to not fulfilling the customer expectations and sometimes even breaks in the recipient's operations. The following Figure 5 summarizes what information is shared, why it's shared and with what tools.

Internal processes	What information is shared	Why it is shared?	System
Operational level	Order information	Enabling the daily operations of successful transport of the goods	Phone, Email, ERP
	Special arrangements (temperature, packaging)		Phone, Email, ERP
	Driver requirements and certificates		Email
	Delivery time (date, time)		ERP, Email
	CMR		ERP, Email
	Shipping certificates	ERP, Email	
Managerial level	Customer relationships	Planning efficient operations	Face-to-face, Email, Phone
	Financial information		Face-to-face, Email
Strategic level	Customer relationships	To plan business longer than 12 months forward	Face-to-face, Email
	Changes in overall market		Face-to-face, Email
	Financial information		Face-to-face, Email

Figure 5: Process level information exchange in the case company

3.3 Identified problems in the information sharing

Regardless of the level in the organization, the problems are quite similar and often related in every level in the organization. The findings reflected clearly the results as the study by (Uusipaavalniemi et al., 2010) where the most essential problems were related to missing information and information being shattered into multiple places. Key problem areas identified in the case company are the following themes:

- Information does not reach the correct recipient
- Information is missing
- Information is shattered into multiple places
- Unnecessary work caused by missing information
- Information is not being exchanged in time
- Information is gathered in silos
- Information reaches the wrong recipient

The findings of this work reflect the theory part especially in the advantages and barriers of information sharing. For instance, many of the problems have their roots in

face-to-face communication, exchanging information more digitally should be increased to avoid missing information. ERP systems have been in place, but the study findings still indicate that it is not being advantaged enough. However, face-to-face as a communication method is suitable in some cases, it should be further identified what type of information should be exchanged in which communication method.

Studies show that there might be issues in organizational fit of ERP systems, especially when adopted in different business environments, as the systems are process based (Hong and Kim, 2002). From the advantage's perspective, information sharing is clearly seen as a key to operational success. The interview has a big emphasis on operational level information, as many of the interviewees were mostly background from operational roles, further studies about strategic roles is suggested.

3.4 Analysis of the problems related to information sharing

From the data coded based on the interviews, following themes were identified. The themes were put on the matrix and then quantified. Table 2 summarizes the themes and identifies the most common issues in the information sharing related to the supply chain. The problems identified in this study reflects the findings in a study by (Uusipaavalniemi et al., 2010).

Missing information (28%) was the most common issue based on the interviews. *Too much information (20%)*, *information is shattered into multiple places (16%)* and *unnecessary work caused by missing information (16%)* were also frequent. Missing information especially in the operational level causes problems in the proper customer delivery and can also lead to unnecessary work. Information will be transferred in normal conversations regardless of adaptation of the digital services. Too often the ERP systems still require entering information into the system manually, creating repetitive tasks of transferring information from spreadsheets to different systems. This is a perfect example of shattered information. Therefore, willingness to invest into more automatic ways for information transferring in the digital systems should be done.

Table 2: Identified problems to the supply chain

Identified problems	Strategic-Network	Strategic-Dyadic	Strategic-Process	Managerial-Network	Managerial-Dyadic	Managerial-Process	Operational-Network	Operational-Dyadic	Operational-Process	TOTAL	
Information does not reach the correct recipient						1		2	3	12%	
Information is missing					1	1		2	3	7	28%
Information is shattered into multiple places			1					3	4	16%	
Unnecessary work caused by missing information			1			1		2	4	16%	
Information is not being exchanged in time								1	1	4%	
Information is gathered in silos						1			1	4%	
Too much information			1			1		1	2	5	20%
TOTAL			3		1	5		4	12	25	
			12%		4%	20%		16%	48%		

As a second step a form survey was conducted to assess the risk of the problems mentioned in the interviews. The questionnaire was done in the case company premises via Google Forms questionnaire. The respondents were asked to define each problem and rate the impact and probability of the problem from scale 1 to 5. Then the score of impact and probability are multiplied, giving a maximum score of 25. Figure 6 describes summarizes the results of the questionnaire.

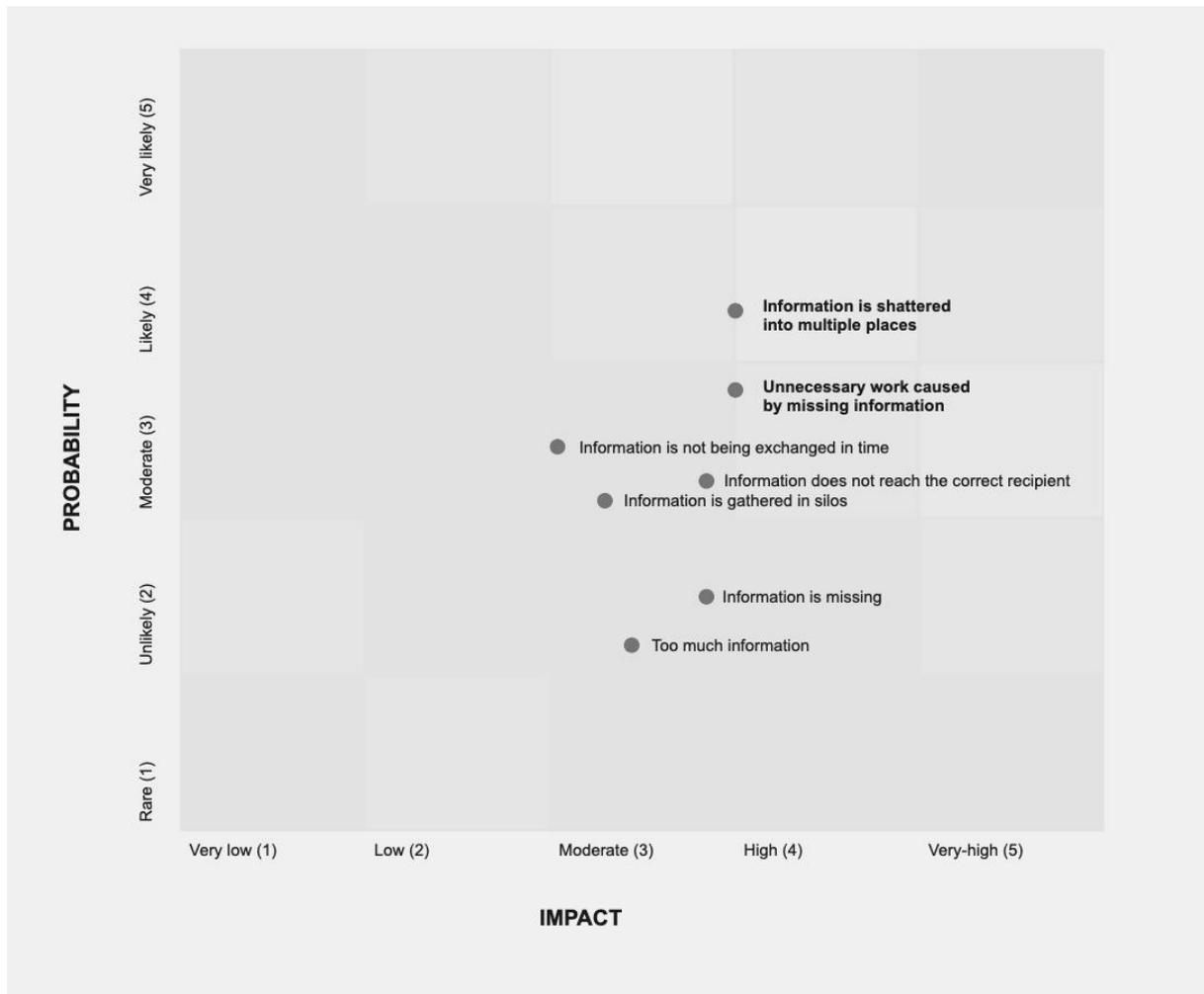


Figure 6: Risk matrix of the identified problems to the supply chain

The findings from the questionnaire was to get more validation to the problems mentioned in the interviews. In the upper right corner of the Figure 6 we can see that the problems that have the biggest impact and probability are *Information is shattered into multiple places* with risk * impact score of (12,8) and *Unnecessary work caused by missing information* (14,7).

4. Conclusions

This study was to identify key development areas in the supply chain. The qualitative study included a case-company, Bertschi Finland where the interviews were conducted. The interviews included many roles with different views on the supply chain. Based on the case-study findings, seven problems related to information sharing in supply chain were identified. After identifying the problems, a questionnaire was conducted to assess the impact and risk of the problems, leading to two key development areas.

- The main research question was *“How information sharing can be developed in the supply chain?”*

To answer the main research questions, problem areas in the information sharing were identified. As a prerequisite, information sharing among the actors were analyzed, including type of information, channels of communication and the outcomes. Case study was chosen to further investigate the problems with a respect to the analyzing framework (Figure 3). The problems were analyzed from different supply chain levels as well as different organization levels. The interview analysis pointed out main problems in the information sharing in the supply chain. In the second step of the analysis the same problems were analyzed from the risk perspective. The risk analysis reflected the interview analysis and gave a possibility to put the identified problems in order, supporting the further research and managerial actions. The key issues in the information sharing was the shattered information and missing information that leads to unnecessary work.

To support the main research question, two sub questions were asked:

- *What are the advantages and disadvantages of information sharing?*
- *What are the enablers and barriers of information sharing?*

Literacy says that information sharing is critical to firms in today's ever evolving business environment, therefore requiring companies to be more collaborative. (Naylor

et al., 1999), (Seymour et al., 2008). The case study findings show that information is being shared to support the daily operations and without sharing information accurately, the daily operations wouldn't be possible. Information is being shared about order information, quantities, special requirements or inventory levels. A summary about what kind of information is shared in dyadic relationship is in Figure 4. Operational level information sharing is in Figure 5. Willingness to go towards more accurate and centralized data is definitely the intention.

Information sharing systems act as clear enablers for information sharing. In the case study, several tools were identified, most important tools were EDI; ERP; Email, Telephone and face-to-face communication. In the different organization levels, those tools are used often in combination. For example, there could be an email discussion about a certain EDI message or telephone discussion about an urgent issue in the ERP system.

Barriers towards information sharing is clearly lack of trust among the actors in the supply chain. Not to mention that trusting the business partner to share critical information is the prerequisite for information sharing. Information leakage to unwanted parties pose a threat to the supply chain (Tan et al., 2016). An interesting finding in the case study was also that information is often not being shared, because of not knowing when the right time is to share the information or when the right channel is not created.

4.1 Scientific implications

The case-study identified problems related to the supply chain especially from the perspective of the logistics partner in the dry-bulk and chemical industry. The case study and the qualitative research gave a good base for explorative research, where the problems in information sharing could be identified. The findings of the identified problems in this study confirms the findings of the study by (Uusipaavalniemi et al., 2010) where the main problem areas in the information sharing were missing information and information being shattered to multiple places. Also the findings of this study confirms the findings of what type of information is being shared at different organizational levels that were strategic, tactical and operational level information

sharing (Kembro and Selviaridis, 2015). In addition to the previous research, this study contributes to how the identified problems in information sharing are seen at different levels of the organization and the supply chain structures.

4.2 Managerial implications

The identified key development areas in the information sharing relates highly to the information being shattered into multiple locations, meaning that information is being stored in many different information systems such as ERP, Spreadsheets, web-applications. Further consolidating different information sources is encouraged, resulting to more functional systems supporting the effective operations. More importantly, the quality of information needs to be high. Information should preserve its quality when being transferred in multiple different systems.

Information sharing, and collaborative initiatives have a significant effect to the supply chain performance. Information is being currently shared via traditional methods, such as telephone and email. However, it is worth investigating more that should there be information exchange between ERP systems with the supply chain actors.

It was also noted that there is lot of knowledge in the case-company that is not being shared inside the group organization. Establishing new or further strengthening the existing information sharing channels between the subsidiary companies is encouraged.

4.3 Limitations and suggestions for further research

This study certainly has limitations. First, the number of operational roles is emphasized in the study, since most of the interviewees represented those roles. There was only one interviewee who represented the strategic role in the company. The second limitation is that the network-level information sharing should be studied more, since in this study it couldn't be discussed sufficiently. We need to in addition to notice that the case company operates in the Finnish business environment, which is relatively small although the case company is a global actor.

As this study pointed out the key development areas in information sharing and assessed the risk of them, further studies about real-life applications on how to manage risk in complex scenarios are needed (Colicchia et al., 2019). The next step for further research would be to develop actionable plans on how to solve the information sharing issues. The research topic could be for example *“Adapting information sharing frameworks in intermodal supply chains”*. Therefore, providing insights from companies that utilize the best practices of information sharing in the supply chain. More studies about knowledge sharing should be considered, because it could have a positive effect on functional processes in organizations, there surely are studies in the topic, but it would be interesting to see the contribution to the operational performance.

References

- Chengalur-Smith, I., Duchessi, P., Gil-Garcia, J.R., 2012. Information sharing and business systems leveraging in supply chains: An empirical investigation of one web-based application. *Inf. Manage.* 49, 58–67. <https://doi.org/10.1016/j.im.2011.12.001>
- Colicchia, C., Creazza, A., Strozzi, F., Noè, C., 2019. Information sharing in supply chains: a review of risks and opportunities using the systematic literature network analysis (SLNA). *Supply Chain Manag. Int. J.* 24, 5–21. <https://doi.org/10.1108/SCM-01-2018-0003>
- Gwee, J., 2018. *The Case Writer's Toolkit*. Springer Nature, Singapore.
- Harland, C.M., 1996. Supply Chain Management: Relationships, Chains and Networks. *Br. J. Manag.* 7, S63–S80. <https://doi.org/10.1111/j.1467-8551.1996.tb00148.x>
- Hong, K.-K., Kim, Y.-G., 2002. The critical success factors for ERP implementation: an organizational fit perspective. *Inf. Manage.* 40, 25–40. [https://doi.org/10.1016/S0378-7206\(01\)00134-3](https://doi.org/10.1016/S0378-7206(01)00134-3)
- Kelle, P., Akbulut, A., 2005. The role of ERP tools in supply chain information sharing, cooperation, and cost optimization. *Int. J. Prod. Econ.* 93–94, 41–52. <https://doi.org/10.1016/j.ijpe.2004.06.004>
- Kembro, J., Selviaridis, K., 2015. Exploring information sharing in the extended supply chain: an interdependence perspective. *Supply Chain Manag. Int. J.* 20, 455–470. <https://doi.org/10.1108/SCM-07-2014-0252>
- Kembro, J., Näslund, D., 2014. Information sharing in supply chains, myth or reality? A critical analysis of empirical literature. *Int. J. Phys. Distrib. Logist. Manag.* 44, 179–200. <https://doi.org/10.1108/IJPDLM-09-2012-0287>
- Khan, S.A.R., Yu, Z., 2019. *Strategic supply chain management*. Springer Science+Business Media, New York, NY.
- Khurana, M., Mishra, P., Singh, A.R., 2011. Barriers to information sharing in supply chain of manufacturing industries. *Int. J. Manuf. Syst.* 1, 9–29. <https://doi.org/10.3923/ijmsaj.2011.9.29>
- Laudon, K.C., Laudon, J.P., 2014. *Management Information Systems: Managing the Digital Firm*, 13th ed.

- Li Gang, 2005. Comparative analysis on value of information sharing in supply chains. *Supply Chain Manag. Int. J.* 10, 34–46. <https://doi.org/10.1108/13598540510578360>
- Liquids | Bertschi [WWW Document], 2019. . Serv. - Liq. URL <https://www.bertschi.com/en/services/liquids> (accessed 10.10.19).
- Manuj, I., Mentzer, J.T., 2008. GLOBAL SUPPLY CHAIN RISK MANAGEMENT. *J. Bus. Logist.* 29, 133–155. <https://doi.org/10.1002/j.2158-1592.2008.tb00072.x>
- McCarter, M.W., Northcraft, G.B., 2006. Happy together? Insights and implications of viewing managed supply chains as a social dilemma. *J. Oper. Manag.* 25, 498–511.
- Mitchell, V.-W., 1995. Organizational Risk Perception and Reduction: A Literature Review. *Br. J. Manag.* 6, 115–133. <https://doi.org/10.1111/j.1467-8551.1995.tb00089.x>
- Montoya-Torres, J.R., Ortiz-Vargas, D.A., 2014. Collaboration and information sharing in dyadic supply chains: A literature review over the period 2000–2012. *Estud. Gerenciales* 30, 343–354. <https://doi.org/10.1016/j.estger.2014.05.006>
- Nahapiet, J., Ghoshal, S., 1998. Social capital, intellectual capital, and the organizational advantage. *Acad. Manage. Rev.* 23, 242–266. <https://doi.org/10.5465/AMR.1998.533225>
- Naylor, J.B., Naim, M.M., Berry, D., 1999. Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. *Int. J. Prod. Econ.* 62, 107–118. [https://doi.org/10.1016/S0925-5273\(98\)00223-0](https://doi.org/10.1016/S0925-5273(98)00223-0)
- Nurmilaakso, J.-M., 2008. Adoption of e-business functions and migration from EDI-based to XML-based e-business frameworks in supply chain integration. *Spec. Sect. Adv. Model. Innov. Des. Supply Chain* 113, 721–733. <https://doi.org/10.1016/j.ijpe.2007.11.001>
- Panahifar Farhad, 2018. Supply chain collaboration and firm's performance. *J. Enterp. Inf. Manag.* 31, 358–379. <https://doi.org/10.1108/JEIM-08-2017-0114>
- Pham, H.C., Nguyen, T.-T., Mcdonald, S., Tran-Kieu, N.Q., 2019. Information Sharing in Logistics Firms: An Exploratory Study of the Vietnamese Logistics Sector. *Asian J. Shipp. Logist.* 35, 87–95. <https://doi.org/10.1016/j.ajsl.2019.06.001>
- Porterfield, T.E., 2007. Supply chain strategy and the benefits of information exchange (Ph.D.). University of Maryland, College Park, Ann Arbor.

- Prajogo, D., Olhager, J., 2012. Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *Int. J. Prod. Econ.* 135, 514–522. <https://doi.org/10.1016/j.ijpe.2011.09.001>
- Sahin, F., Robinson, E.P., 2007. Flow Coordination and Information Sharing in Supply Chains: Review, Implications, and Directions for Future Research. *Decis. Sci.* 33, 505–536. <https://doi.org/10.1111/j.1540-5915.2002.tb01654.x>
- Seymour, L.F., Lambert-Porter, E., Willuweit, L., 2008. An RFID Adoption Framework: A Container Supply Chain Analysis, in: Avison, D., Kasper, G.M., Pernici, B., Ramos, I., Roode, D. (Eds.), *Advances in Information Systems Research, Education and Practice*. Springer US, pp. 175–188.
- Srinivasan, M., 2016. ROLE OF ERP IN SUPPLY CHAIN MANAGEMENT | LinkedIn [WWW Document]. URL <https://www.linkedin.com/pulse/role-erp-supply-chain-management-mohanapriya-srinivasan/> (accessed 11.7.19).
- Tan, K.H., Wong, W.P., Chung, L., 2016. Information and Knowledge Leakage in Supply Chain. *Inf. Syst. Front.* 18, 621–638. <https://doi.org/10.1007/s10796-015-9553-6>
- Tran, T.T.H., Childerhouse, P., Deakins, E., 2016. Supply chain information sharing: challenges and risk mitigation strategies. *J. Manuf. Technol. Manag.* 27, 1102–1126. <https://doi.org/10.1108/JMTM-03-2016-0033>
- Uusipaavalniemi, S., Juga, J., Sandhu, M., 2010. Information Sharing in Service Supply Chain. https://doi.org/10.1142/9789812836069_0030
- Yates, J.F., Stone, E.R., 1992. The risk construct. *Risk-Tak. Behav.*, Wiley series in human performance and cognition. 1–25.
- Yin, R.K., 2003. *Case study research: design and methods*, 3rd ed. ed. Sage, Thousand Oaks.
- Zijm, H., Klumpp, M., Regattieri, A., Heragu, S., 2019. *Operations, Logistics and Supply Chain Management*. Springer.

APPENDICES

APPENDIX 1: Interview questions

1. What is your role in the company
 - 1.1 How long have you been in the company
 - 1.2 What is your background in the industry
 - 1.3 How's your typical day

2. Information sharing process
 - 2.2 Why information is being shared?
 - 2.3 Why information is not being shared?
 - 2.4 What are the biggest challenges in information sharing?
 - 2.5 How do you see information sharing in the future?

3. About information
 - 3.1 What kind information is being shared in your work?
 - 3.2 What is good quality information?
 - 3.3 When is the right time to share information?

4. What are the biggest benefits of information sharing in supply chain?
 - 4.1 What opportunities are in information sharing with customers?
 - 4.2 What opportunities are in information sharing with the subsidiaries?

5. What are the threats in information sharing?
 - 5.1 Can you describe a worst-case scenario?

5. What are the barriers for information sharing?

APPENDIX 2: Survey questions to assess the problems

Survey questions	Impact (AVG)	Probability (AVG)	TOTAL
Information does not reach the correct recipient	3,9	3,3	12,7
Information is missing	3,9	2,6	9,9
Information is shattered into multiple places	3,6	3,6	12,8
Unnecessary work caused by missing information	4,1	3,7	15,4
Information is not being exchanged in time	3,3	3,4	11,3
Information is gathered in silos	3,4	3,1	10,8
Too much information	3,4	2,1	7,3