LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
School of Business and Management
Industrial Engineering and Management
Global Management of Innovation and Technology

MASTER'S THESIS

PERFORMANCE IMPROVEMENT IN MEDITERRANEAN OPERATIONS USING RISK MANAGEMENT ANALYSIS

Case study of Containerships Group Ltd

First supervisor: Professor Olli-Pekka Hilmola
Instructor: Mr. Antti Laukkanen

Date: 14th February 2016, Lappeenranta, Finland

Author: Amir Moslemi
Address: Teknologiapuistonkatu 2 B 25, 53850, Lappeenranta, Finland

Abstract

Author: Amir Moslemi

Title: Performance Improvement in Mediterranean Operations Using Risk Management Analysis: Case study of Containerships Group Ltd

Year: 2016

Place: Lappeenranta

Type: Master's Thesis. Lappeenranta University of Technology

Specification: 93 pages including 11 Figures, 13 Tables and 5 Appendices

First supervisor: Prof. Olli-Pekka Hilmola

Instructor: Mr. Antti Laukkanen

Keywords: Performance improvement, Risk identification, Container shipping, Logistics operations, Emerging markets

Emerging markets of Northern Africa and Turkey provide growth opportunities for logistics service companies in the middle of low growth environment of European Union. The purpose of this research is to explore and analyze the risk factors in container shipping industry and third party logistics (3PL) services. The research empirically examined the risk factors, which are related within the interaction between these two parties in emerging markets of Mediterranean area. The previous studies have provided a valuable insight into the operational risks faced by container shipping industries. However, most of these studies have focused on one or several operational risk factors from a single point of view, and no studies have inclusively examined the possible operational risks faced in the container shipping industry from dual perspective of 3PL provider and its customers. A questionnaire has been deployed to collect related data; and the impacts of the risks were then be assessed and ranked using the method of risk mapping. Respondents were located in Turkey, Algeria, Tunisia, and Libya. Research presents the most important risk factors identified, and compares them between 3PL provider and its customers. The research also provide some risk mitigation strategies for the key risk factors, and tried to figure out a common risk picture, which guides the managers in both sides to have a better decisions and as a result, improve the performance of the container shipping operations. Challenge during project execution time was that customers identified vast amount of more risks than what was the case with logistics service operator.

Acknowledgements

There are no proper words to convey my sincere gratitude and respect for my thesis and research advisor and supervisor Prof. Olli-Pekka Hilmola for the continuous support of my research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis.

In addition, I would like to express my profound gratitude and deep regards to my instructor and advisor in Containerships Group, Mr. Antti Laukkanen, Group Land Operations Director, for his exemplary guidance, monitoring and constant encouragement throughout the course of this thesis. I am also grateful to Mr. Janne Alava, Containerships HSEQ Manager for his advices and constructive discussions. I also want to thank the whole people of Containerships Group for their support and providing the exceptional opportunity of doing my master thesis in their company.

Moreover, I am grateful to Dr. Daria Podmetina for her encouragement and practical advice. Her detailed comments and instructions helped me to improve the structure of the thesis.

A very special thanks goes out to Mr. Aleksi Kukkarinen and Mr. Jani von Zansen from Logistics Forum, who have been always there to listen and give advice. I am deeply grateful to them for the discussions that helped me sort out the difficulties of my master thesis.

Furthermore, I would like to thank to my Professor from Global Management of Innovation and Technology program, Juha Väätänen and Dr. Ville Ojanen for their continuous support and providing the exceptional opportunity of doing an exchange study in Université catholique de Louvain in Belgium.

I thank with love to Elnaz Rezaei, my wife. Her support, encouragement, quiet patience and unwavering love were undeniably the bedrock upon, which the past four years of my life have been built.

Finally, and most importantly, I would like to thank my lovely family, my parents and my brothers Zoheir and Ali for their faith in me and allowing me to be as ambitious as I wanted. It was under their watchful eye that I gained so much courage and an ability to tackle challenges head on.

Table of Contents

List of figures

List of tables

Appendices

Abbreviations

3PL	Third Party Logistics
JIT	Just In Time
SCM	Supply Chain Management
SCRM	Supply Chain Risk Management
SCP	Supply Chain Performance
MED	Mediterranean Region
NPSA	National Patient Safety Agency
ARS	Average Risk Scale
ERM	Enterprise Risk Management
IT	Information Technology
NM	New Mexico
OEM	Original Equipment Manufacturer
DG	Dangerous Goods
LNG	Liquefied Natural Gas

1. Introduction

This chapter explains the objectives and the research questions of the thesis, and describes the gap between previous works and this research. The research methodology and the structure of the study are also presented in this section.

1.1 Background and research gap

The pursuit of improved efficiency performance in logistics operations is a constant business challenge (Bowersox et al. 2007). The outsourcing of the logistics function to partners is one of the popular strategies that is beneficial for businesses and allows them to focus on their core capabilities. This partners are known as third-party logistics (3PL) providers (Hong et al., 2004; Lieb & Bentz, 2005). 3PL companies, are very beneficial for businesses to improve customer service, respond to competition and eliminate assets (Handfield & Nichols, 1999). Many 3PL companies specifically in Europe have now broadened their activities to cover more services like, warehousing, distribution, and freight forwarding (Lieb & Randall, 1999).

Nowadays, every process and decision in business is likely to suffer from uncertainty. Uncertainties need to be continuously monitored and managed, due to the fact that wrong assessments and misjudgments may lead to unforeseen developments, which may have important consequences when detected (too) late. Due to the increasing number of uncertainties, the importance of risk considerations has grown (Heckmanna et al., 2014).

In supply chain management many authors considered the importance of risk. Because of the increasing level of complexity and interrelation of modern supply chains, the type and nature of uncertain developments or the impact of any action have become hard or even impossible to predict (Helbing et al., 2006). Furthermore, massive disruptions like Hurricane Katrina, global financial crisis, flooding in Thailand, European ash-cloud, Japanese earthquake and tsunami and many other disasters, displayed a lack of preparedness among supply chain managers towards uncertain developments in general (Risk Response Network, 2011).

The supply chain today, is much more risky than before. There are several reasons behind this. It is faster due to recent developments and innovations in logistics and transportation systems. It is stronger than before, because of strong competition in the market. It is cheaper, due to several strategies, like “Lean manufacturing”, which is decreasing the waste within a system. It is quicker, using strategies like “Just In Time or JIT” or short product life cycles. It is shorter, because of shorter lead times, which is an important part of lean manufacturing. It is wider, due to the increasing speed of globalization in this industry. It is changing quickly, because of high level of demand, and also developments in technology. And finally, it is heavier, because of the increasing amount of workload in the shipping companies. Most of them have already ordered or are going to order bigger vessels to have a more cost effective operations. All these factors, could lead us to the importance of risk management practices in supply chain systems.

Over the past decade in the container shipping business, the issue of risk has attracted considerable attention in academia. Previous studies addressed various types of risks in relation to container shipping, e.g., technical risk, market risk, business risk, and operational risk (Ewert, 2008). Technical risk refers generally to loss arising from activities such as ship or equipment design and engineering, manufacturing, technological processes, and test procedures. In the shipping industry, market risk includes revenue and investment risk (Kavussanos, Juell-Skielse, & Forrest, 2003); this refers to unforeseen and detrimental changes in demand and supply (Rodrigue, Notteboom, & Pallis, 2011). Business risk relates to the nature of the business and it “deals with such matters as future prices, sales or the cost of inputs” (Yip & Lun, 2009, p. 153).

In container shipping operation, the main business risk relates to the action of increasing capacity so as to take advantage of economies of scale (Yip & Lun, 2009). Operational risk is “the possibility of an event associated with the focal firm that may affect the firm’s internal ability to produce goods and services, quality and timeliness of production, and/or the profitability of the company” (Manuj & Mentzer, 2008, p. 139). Essentially, this arises from the logistics processes.

Within this complex picture of risk in container shipping, this research attempts to address a comprehensive risk picture of the container shipping operations. Container shipping involves multiple entities including shippers, forwarders, terminal operators, and shipping companies. The

complex operations within and between these entities and the long distance of physical process may give rise to various types of operational risks, which could negatively impact on the performance of container shipping companies.

In order to tackle these issues, it is important for shipping companies to know what these risks are and how they affect the shipping operations. Unless there is an unlimited resource, which could be employed to mitigate the risks, shipping companies will always have to prioritize their resources to mitigate those risks, which are most imminent and significant. This makes it important to analyze the extent to which each risk affects a shipping company's performance and to identify the relative importance of each risk factor.

The previous studies have provided a valuable insight into the operational risks faced by container shipping industries in their operations (e.g. Ewert, 2008; Manuj & Mentzer, 2008; Drewry, 2009; Talley, 1996; Husdal & Bråthen, 2010; Notteboom, 2006; Tummala & Schoenherr, 2011; Chang et al. 2015). These studies will be discussed later in Chapter 3 of this research. However, most of these studies have focused on one or several operational risk factors from a single point of view and no studies have inclusively examined the possible operational risks faced in the container shipping industry in a dual perspective of 3PL provider and its customer's, which are related to the contribution between these two parties. Indeed, such a study would be useful as when the attainable resources are limited, the shipping company and its customers will have to make a decision on how to mitigate their operational risks more strategically and efficiently. Obviously, more investment should be made on mitigating those risks that are of great significance and less investment on those of less significance.

Briefly, this research empirically investigates the key risk factors faced by the container shipping industry in a dual perspective of 3PL provider and its customers. As this research is about container shipping and the risks associated with 3PL providers and its customers, the research will examine the risk factors, which are related to the contribution between these two parties.

The purpose of research is to analyze the risk factors associated with operations for both 3PL provider and customer company perspectives. The outcome of the risk management analysis will

be the *performance improvement* according to Wieland & Wallenburg (2012). They have analyzed the impact of supply chain risk management (SCRM) on performance. In their research, it is found that SCRM is important for agility and robustness of a company. They emphasized that both of these indicators are important in improving performance.

Wieland & Wallenburg (2012) approved their hypotheses, about the importance of SCRM for both agility and robustness of a supply chain. Thus, the implementation of SCRM, which entails the identification, measurement, and controlling of risks, allows companies to better cope with changes both proactively and reactively and as a result will improve the performance of the supply chain, which is the purpose of this research.

This research is a *seminal study* in several ways. First, there are some studies about risk analysis in container shipping companies from 3PL provider perspective (e.g. Chang et al., 2015), but there does not exist any research, which includes the customer company perspective too. Furthermore, Chang et al. (2015) have studied the risk factors faced by the container shipping companies in Taiwan, which is an Asian country. But this research will empirically investigate the risk factors faced by the container shipping company and also, its customers in Mediterranean region, which has a lot of differences compared to Taiwan or eastern countries. In fact, the research will find the most important risk factors in customer side and in 3PL provider side and then will come up with a set of key risk factors and risk picture for each of them. Later in the discussion part the differences between these two regions will be discussed.

In addition, when it comes to performance measurement of the supply chain, clearly supply chain management (SCM) is associated with managing the upstream and downstream relationships with suppliers and customers to deliver the best customer value at the least cost (Christopher, 1998). Implementation of SCM requires the expanding of the internal perspective of performance measures to include both ‘‘inter-functional’’ and ‘‘partnership’’ perspectives and prevent inward-looking and self-focused attitudes in the management approach (Holmberg, 2000). Traditional performance measures such as profitability are less relevant for measuring supply chain performance (SCP), because they tend to have an ‘‘individual focus’’ and fail to consider chain-wide areas for performance improvement (Lai , Ngai, & Cheng , 2002).

There are several types of frameworks for SCP measurement, however many companies still managing their supply chain in a totally different way from what their partners in supply chain requested. The key reason behind this is that they lack agreement of goals and performance measures in their supply chain activities (Tan et al., 1999). Thus, by discussing the risk analysis results in this research, the 3PL providers and their customers can agree on a set of risk factors, which have significant risk scale in the both sides, and then try to improve them by agreed risk mitigation strategies. In this case the performance will be improved in a parallel manner and in a chain wide perspective.

According to the previous background, the research gap in this study has been presented in the figure below.

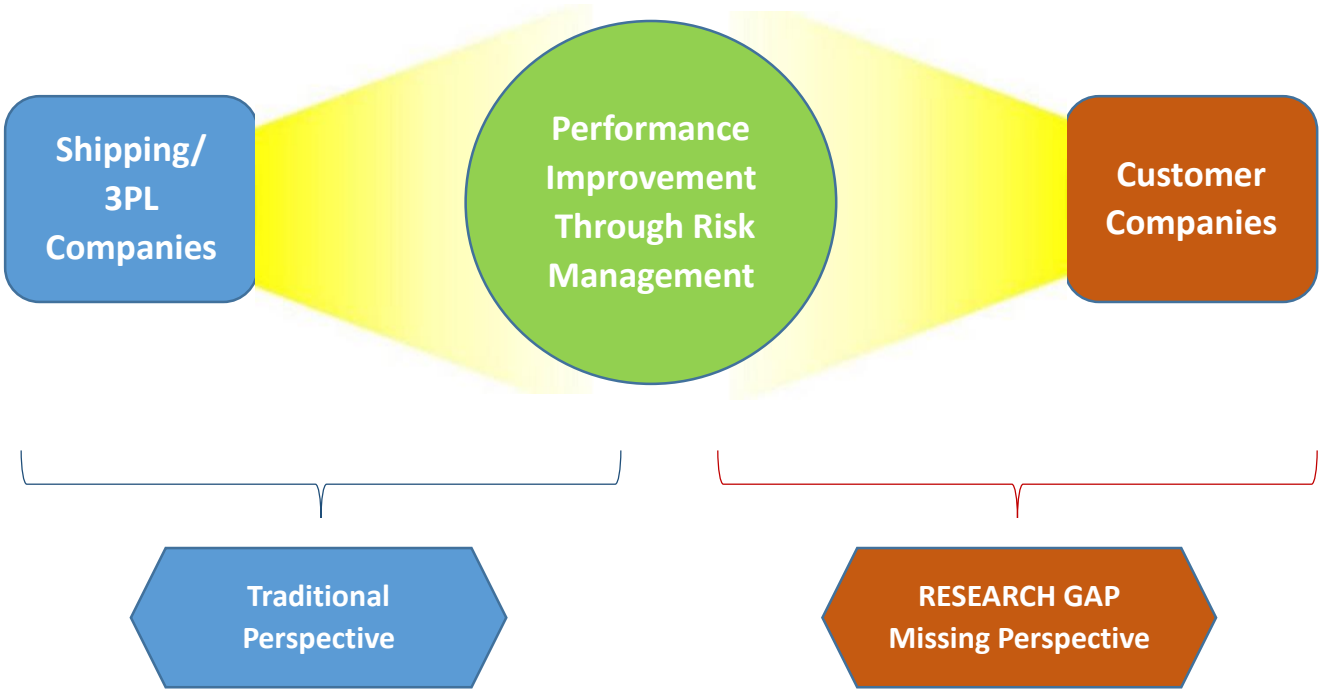

Figure 1. Research gap in risk management approach. Source: The Author

1.2 Research objectives and questions

According to what have been discussed about the research gap, the research will empirically investigate the risks of a container shipping company (Containerships Group Ltd) as a case study and its customers in Mediterranean (MED) region. The study aimed at answering these questions:
RQ1. What are the risk factors in container shipping operations from both 3PL provider and customer perspectives?
RQ2. Which risk factors are more important than the others in container shipping industry?
RQ3. How to reach the performance improvement using risk management analysis?

The research will answer the above mentioned research questions by three main steps, which will be explained in the methodology section with more details. The first question will be answered by the risk identification using the previous literature and also the risk verification using the qualitative interviews. The second question will be answered by risk measurement part and will be then continued by risk analysis section to answer the last question.

1.3 Structure of the thesis

The below diagram (Figure 2) gives broad overview of the structure of thesis by indicating the major input-output of each chapter. Considering each chapter as rectangle blue box the input and output of each chapter is illustrated in white rectangles.

In correspondence to Figure 2, research has been organized as follow: in Chapter 2, the previous literature about the research methodology will be reviewed and discussed. This chapter will explain the whole research methodology structure and will then summarize the key points.
In Chapter 3, the container shipping and logistics business will be reviewed and then the importance of 3PL companies will be emphasized. Later on the concept of risk will be defined from different perspectives and importance of risk management will be demonstrated. Furthermore the risk management as a key tool for performance improvement will be proposed. In addition, the historical development of the supply chain risk management will be described during the decades.

Chapter 4, will be allocated to detailed description of method and steps involved in the research methodology and also the interview structures, and data collection techniques. This chapter will be continued by verification of the collected data using the qualitative interviews.

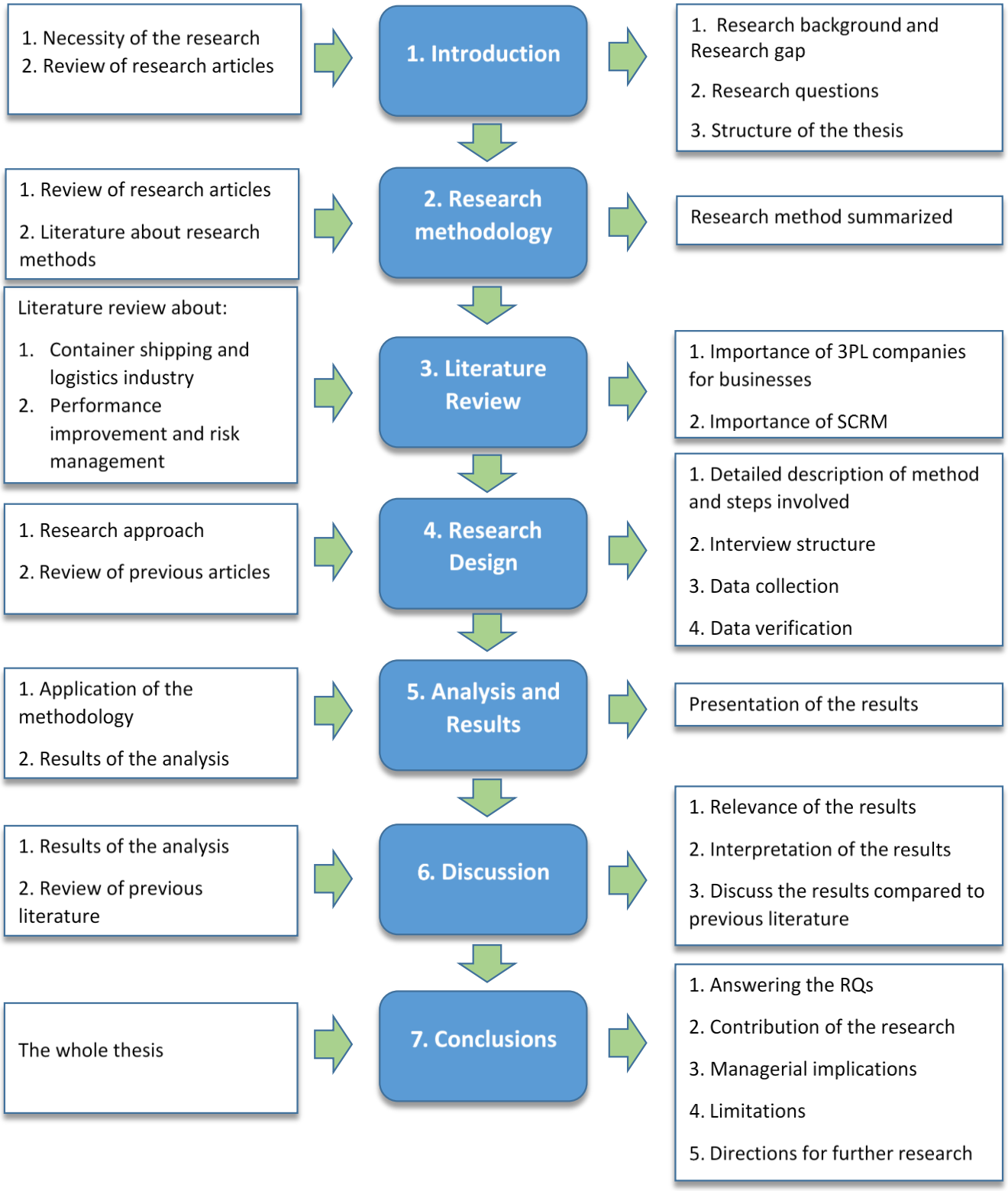

Figure 2. Structure of the thesis. Source: The Author

In Chapter 5, the data analysis phase will began and then the results will be presented. In Chapter 6, the presented results will be described and discussed. Then the results will be discussed compared to previous literature.

Finally, in conclusion chapter, main research questions will be answered and accordingly contribution of research will be illustrated. Some limitations and challenges for conducting the research will be discussed and areas for further research will be presented.

2. Research methodology

In this section the research will be implemented in three main steps, including risk identification, risk measurement, and risk analysis. These steps are described in the following.

2.1 Risk identification

In order to identify and analyze the risks faced by a container shipping company and its customers in an inclusive and integrated manner, first we should know that there are three major flows in maritime logistics operations - information flow, physical flow, and payment flow. Information flow refers to large collection and transfer of information/knowledge between manufacturers, transportation companies, and retailers and customers (Paixão & Marlow, 2003; Spekman & Davis, 2004; Creazza, Dallari, & Melacini, 2010). Physical flow refers to the transfer of goods including raw materials, finished goods, and return/recycle products from the business sector to the customer sector (Paixão and Marlow, 2003; Spekman and Davis, 2004; Creazza et al., 2010). Payment flow refers to monetary payments from the customer sector to the business sector (Lambert et al., 1998; Spekman & Davis, 2004).

In Figure 3 Chang et al. (2015) illustrate how logistics flows are distributed amongst the relevant entities in container shipping business whereby are included the three flows and multiple entities such as shipping company, other transport companies, agency-related companies, consigner, consignee, and bank.

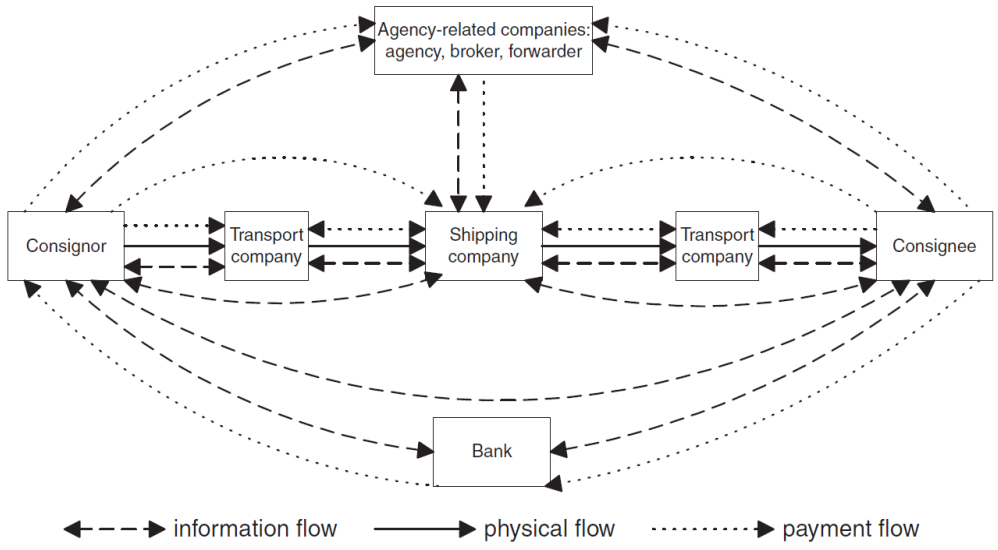

Figure 3.The three flows in container shipping services. Source: Chang et al. (2015)

In addition, there is another typology in supply chain risk management, which was developed by Rao & Goldsby (2009). They have reviewed a wide range of literature to cover all the possible risk factors in supply chain. Their typology consists five different sources of risk in supply chain including environmental risk, industry risk, organizational risk, problem specific risk and finally, decision maker risk.

This typology (Figure 4) is more comprehensive and includes all approaches in the supply chain risk management, thus the research will use this classification to identify the risk factors.

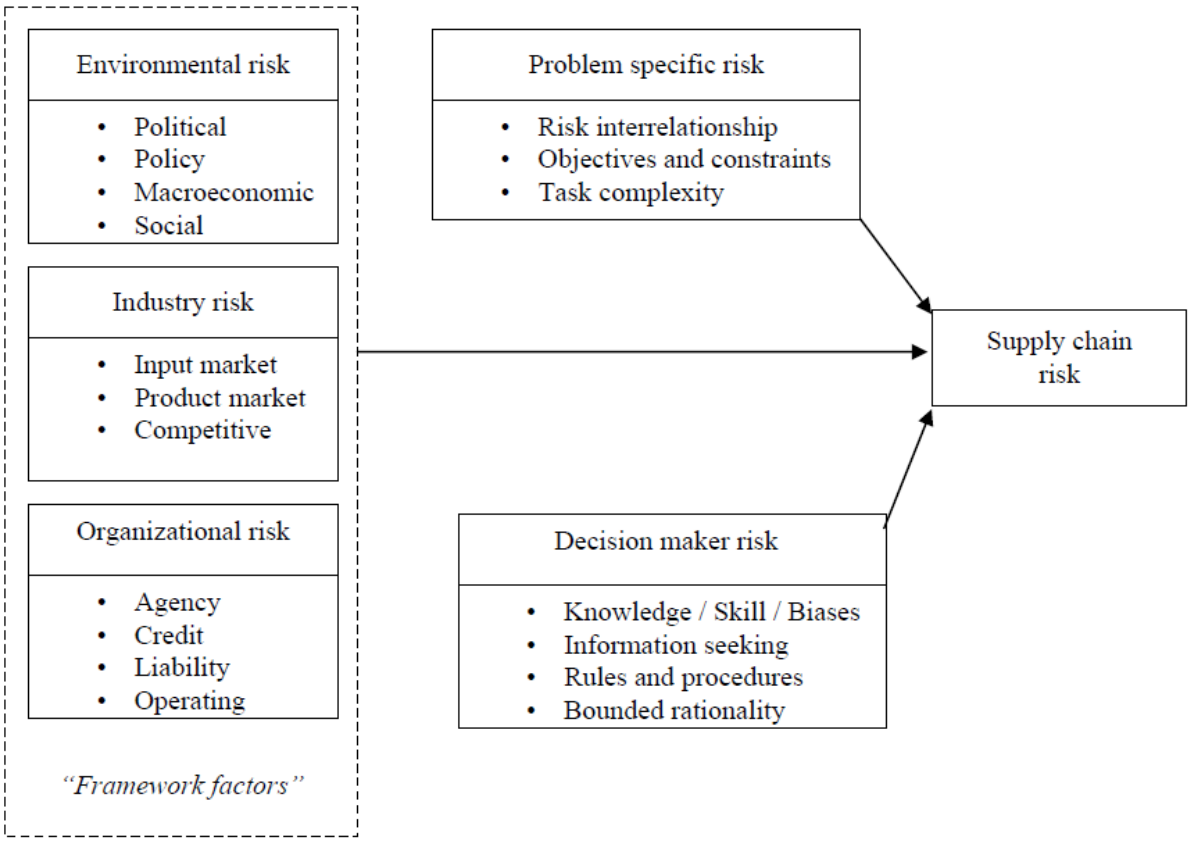

Figure 4. Sources of supply chain risk. Source: Rao & Goldsby (2009).

Environmental risk factors are those that affect the overall business context across industries. Industry risk factors include those that may not affect all sectors of the economy as a whole, but rather specific industry segments (Ritchie & Marshall, 1993).

As suggested by Ritchie & Marshall (1993) the third category of uncertainties facing the supply chain is at the firm level (i.e. organizational uncertainties). Bettis & Hall (1982) argued that to some extent, risk is endogenous to an organization in that organizations will have at least some influence on how they want to internally manage these risks. Rao & Goldsby (2009) named these risks as problem specific risks. In addition they have defined decision-maker related risks, which could be related to an individual or to a decision making group within an organization.
For risk identification, in order to be inclusive, the research first identified all the risk factors addressed in previous studies through an extensive literature review. Review of previous studies, data and documents to identify risk is a common method used in risk analysis studies (Waters, 2007).

Following the above step, in order to verify whether the risks addressed in the broad range of literature are applicable to container shipping and whether there are any other risks that have not been addressed in literature, but exist in practice and should therefore be included in the study, the research has used face-to-face interviews in "Containerships" company with six senior managers from different departments in two regions, MED and Finland's head office. These interviews were conducted on February 2015 in Helsinki and Istanbul. In addition, for the customer perspective part, the research conducted three more interviews from three customers (different industries) in MED region to verify the risk factors identified by literature review and probably add some other risk factors, which are not mentioned.

2.2 Risk measurement

Generally, risk measurement is conducted quantitatively using two factors – risk likelihood and risk consequences (Mitchell, 1995; Waters, 2007; Cox, 2008; Beretta & Bozzolan, 2008). Risk likelihood is the probability that a risk caused by a risk-source will occur, and risk consequence is the outcome or the potential outcome of a risk event. By multiplying the risk likelihood with the relevant risk consequence, the risk scale will be obtained (Cox, 2008; Tummala & Schoenherr, 2011).

Several researchers (e.g. NPSA, 2008) used five abstractive classification to describe the likelihood and probability of an event. These were: very low (or impossible; rare), low (or

unlikely), medium (or occasional; possible), high (or frequent; likely), and very high (or almost certain). This research was used numbers 1, 2, 3, 4, and 5 to represent “rare”, “unlikely”, “possible”, “likely”, and “almost certain”, (e.g. Yang, 2010).

The level of risk consequence is described in different ways. In this study, “insignificant, minor, moderate, major, and catastrophic” represented by 1 to 5, are used to describe the level of risk consequence (e.g. Chang et al., 2015). In order to identify and measure the level of likelihood and consequence of the risk factors, the research will conduct a questionnaire survey using a five-point Likert scale. There will be two types of questionnaires. One for 3PL provider and one for Customer Companies.

As it is mentioned before, the case company in this research is Containerships Group Ltd, headquartered in Helsinki, Finland. The company is active in 21 countries around the globe. The service regions of the company are presented in Figure 5. The service map for Containerships Group has been provided in Figure 6.

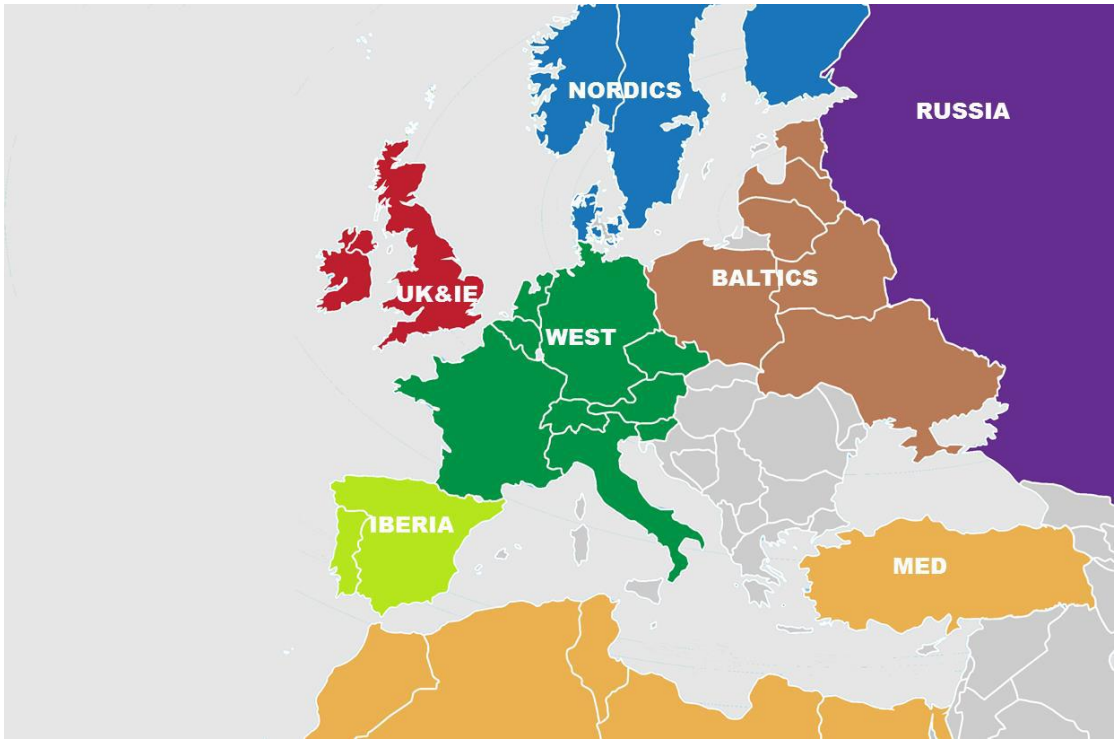

Figure 5. Service Regions. Source: Containerships. (2015)

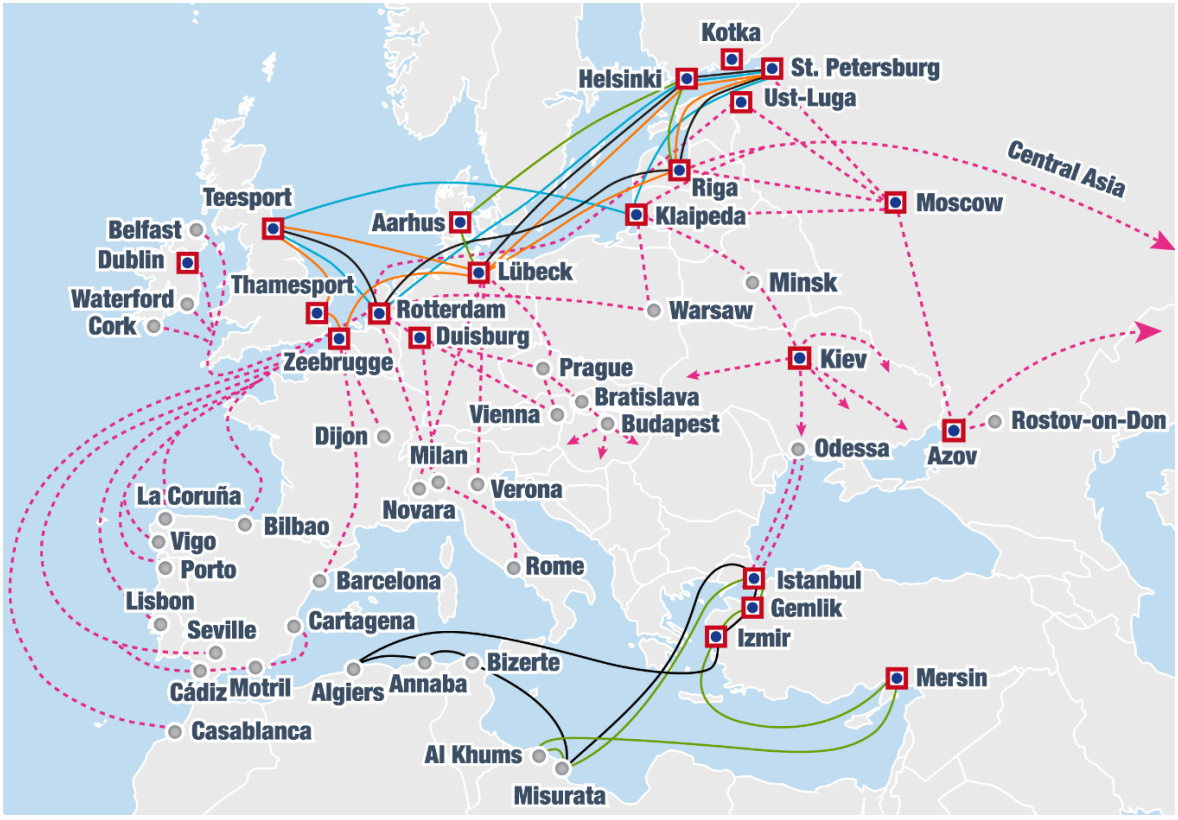

Figure 6. Service Map. Source: Containerships. (2015)

Figure 7Mediterranean countries. Source:Openstreetmap (2015) ©OpenStreetMap contributors

The main research areas in this research are Turkey, Algeria, Tunisia, and Libya. As it is clear from the map in Figure 7, all these countries have access to Mediterranean Sea and are linked to each other by the shipping transport.

In addition, regarding the case company in this research several fact need to be mentioned. “Your cargo in our hands” as stated in the company web page is one of the main slogans for Containerships Group. The company provides every service that customers need to ensure safe and rapid container shipping between Russia and the Baltic, Europe, UK, Ireland and the North Sea, as well as between North Africa and the Mediterranean. They offer customers a choice of all standard and special container sorts and complete coverage using sea, road, and rail container transportation. Containerships has built up a team of dedicated and professional staff who really understand the international shipping business, and who are able to translate this knowledge into a complete range of high-quality shipping services. The company has been building and expanding its international shipping network for 45 years. Where possible they use their own fleet and services, with owned fleet of ships, trucks and containers, and owned terminals in many European countries. They have 19 offices around Europe. In countries where they do not have offices, the company have built up a network of professional and reliable partners. (Containerships, 2015). Table 1 presents the financial data about Containerships Group.

Table 1. Key financial data for Containerships Group Ltd

Containerships Ltd Oy	2010/12	2011/12	2012/12	2013/12	2014/12
The company's net sales (EUR 1000)	174067	184767	170403	162880	174806
Change in net sales%	20.00	6.10	-7.80	-4.40	7.30
The operating result (1000 EUR)	6880	-6682	2468	-2130	1064

Source: Asiakastieto (2016)

The online questionnaire has been sent to the shipping company managers and customer companies located in Turkey, Algeria, Tunisia and Libya. For each of these four countries, the questionnaire has been sent to four senior managers, and four employees in related departments. In addition, for the customer perspective part, the same questionnaire has been sent to eight customer companies (different industries) in each of these four countries. It is worth to mention

that, the questionnaires has been sent at the end of the February 2015 and the analysis part has been started at the end of November 2015.

2.3 Risk analysis

In this section the research will analyze the results of the risk measurement and will propose a risk picture for the 3PL provider and for the customer perspective. The research will use the method used by Chang et al. (2015) for risk analysis. They have calculated the risk scale of each risk factor by multiplying risk likelihood and risk consequences and then created a risk map to compare their relative importance. In this method the following characters were defined as follows:

- N: the total number of respondents;
- l_{ri}: the likelihood of risk factor r by the respondent, i;
- c_{ri} : the consequence of risk factor r by the respondent, i;

Note that the risk scale is the product of the likelihood and the consequence of a risk factor. The method is to first obtain the risk scale for each individual respondent on each risk factor, and then calculate the average of those risk scales over all respondents. Chang et al. (2015) referred this method as Average Risk Scale (ARS) in their paper. The formula is as follows:

$$ARS_r = \frac{1}{N} \sum_{i=1}^{N} (l_{ri} \times c_{ri})$$

The summary of research methodology steps including number of respondents for each location are explained with more details in Appendix A.

Regarding the research validity, several highlights need to be mentioned. Firstly, the risk identification has been done by the author using the previous studies in this area. As mentioned before, review of previous studies, data and documents to identify risk is a common method used

in risk analysis studies (Waters, 2007). The data collection process was started with literature review on August 2015 and finished on October 2015.

Secondly, in order to verify these risk factors, the research has used face-to-face interviews with a number of “Containerships” company managers and customer company managers in two regions of Finland’s head office and Local MED offices. It is worth to mention that the structure of these interviews has been tested before in a pilot test among 3 company managers.

Third, the online questionnaires has been created according to the results from the interviews and again tested through a pilot test among several respondents in the target region. Then the questionnaires has been sent to the respondents on November 2015. The respondents for the questionnaires has been aimed to cover all of the four target countries (Turkey, Algeria, Tunisia and Libya). Thus eight company managers in each countries have been chosen to answer the online questionnaire. And on the other side eight customers in each countries have been chosen to answer the questionnaire to have a dual perspective on the topic. The deadline for answering the survey was aimed on mid-November. In the first deadline a reminder email have been sent to the respondents, including a short explanation about the research objectives, and also the new deadline, which was the end of November 2015. Then the analysis part started to analyze the data gathered. Due to the research included the customers’ perspective in the results so the research is in a good level in terms of validity.

Finally, it is worth to mention that there are several approaches in measuring the risk factors, but as most of the key literature used the approach of using risk likelihood and risk consequence, so the research tried to use this approach as a dominant way to measure and rank the risk factors (Mitchell, 1995; Waters, 2007; Cox, 2008; Beretta & Bozzolan, 2008; Cox, 2008; Tummala & Schoenherr, 2011; Yang, 2010, Chang et al., 2015).

3. Literature review

3.1 Container shipping and logistics industry

In this section the research will study the general concepts in container shipping and logistics industry and the current situation along with the recent developments in this area.

Over the last 30 years of the history of supply chain management, which is started by an article from Houlihan (1985), it has been started from an initial focus on improving relatively simple, but very labor-intensive processes to the present day engineering and managing of extraordinarily complicated global chains and networks. Logistics as the main path connecting the producers and the consumers of the goods in the world has become more important in the recent years.

In the recent years, more importantly, the demand for a comprehensive logistics services is extremely increasing, specifically in the European countries. Turkey, likewise is not an exception. Istanbul as a hub for the air passenger transport revealed a big potential to become a cargo transport hub too. Its geographical location, which is connecting the Europe to the great Asia, and its access to both Black and Mediterranean Seas, has made Istanbul to be a strategic point for most of the international companies (being active in the region). The case study in this research is MED operations.

Lambert & Stock (1982) describe that transportation is moving the products to markets that are often geographically separated by great distances. This way, it can help to increase the customer's general level of satisfaction, because he or she has an access to the products.

As mentioned in Chapter 1, many 3PL providers have broadened their activities to provide a range of services that include warehousing, distribution, freight forwarding and manufacturing (Lieb & Randall, 1999). In this contest, intermodal services felt to be more important, which logistics services should be able to answer all these needs to be successful in the market and reliable for their customers.

In recent years, there has been an increase in shipping products using more than one transportation mode in the process of logistics. Beyond obvious economic benefits, increased international

shipping has been a driving force. The major feature of “intermodalism” is the free exchange of equipment between modes. For example, the container portion of a truck trailer is carried abroad an airplane, or a railcar is hauled by a water carrier. Such equipment interchange creates transportation services that are not available to a shipper using a single-transportation mode. Coordinated services are usually a compromise between the services individually offered by the cooperating carriers. That is, cost and performance characteristics rank between those of the carriers separately (Ballou, 2004).

According to Ballou (2004) there are ten possible intermodal service combinations: (1) rail-truck; (2) rail-water; (3) rail-air; (4) rail-pipeline; (5) truck-air; (6) truck-water; (7) truck-pipeline; (8) water-pipeline; (9) water-air; and (10) air-pipeline. Not all of these combinations are practical. Some that are feasible have gained little acceptance. Only rail-truck, called piggyback, has seen widespread use. Truck-water combinations, referred to as fishy back, are gaining acceptance, especially in the international movement of high valued goods. To a much lesser extent, truck-air and rail-water combinations are feasible, but they have seen limited use.

Regarding the case study of this research, the Containerships Group Ltd is using an intermodal service to provide door to door services for its customers from producer to consumer including secure warehousing and storage, cargo transshipment between trailers and containers, labelling and re-packing. In short, the company is one reliable partner focused on delivering its customers supply chain (Containerships Group, 2015). In this regard, the case study is well matched to the main research purpose, which is analyzing the risk factors in a comprehensive logistics services.

3.2 Performance improvement and risk management

Firstly, regarding the definition of the word “Risk” in supply chain literature, Mitchell (1999) defined risk as a subjectively determined expectation of loss; the greater the probability of this loss, the greater is the risk. Accordingly, Yates & Stone (1992) claimed that risk is an inherently subjective construct that deals with the possibility of loss.

Tang (2006, p. 453) defined supply chain risk management (SCRM) as “the management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity”.

Growth in world trade and corresponding movements has led companies to capitalize on global sourcing opportunities in supply chain and going global means adding frequently risks. Collaboration in the supply chain is a process change. The result of this change was influenced by the new challenges of supply chain network leaders. The recent emergence of this field forced business enterprises to invest and focus attention on creating a profitable and lasting supply chain network. Oftentimes, companies cannot see many risks that are emerging and changing. Thus, risks will be forgotten until somebody realize the impact. Improving supply chain risk management creates an opportunity to win market share (Norrman & Jansson, 2004).

Nowadays, Supply chain risk management (SCRM) is a fast growing area in logistics research. McKinsey (2010) stated that in a supply chain survey among executives, more than two-thirds of the respondents reported increasing risk over the years of 2007 until 2010, and nearly as many expect that risk will continue rise.

Sometimes, supply chains have been simplified as linear and static chains reaching from source to sink including the suppliers’ suppliers and the customers’ customers. Anyhow, we should describe the supply chain as a complex web of changes, coupled with the adaptive capability of organizations to respond to such changes (Choi et al., 2001). Wieland & Wallenburg (2012) indicated that, because of this very nature of supply chains, both proactive (= preventive) and reactive strategies need to be implemented.
As mentioned in the first chapter, Wieland & Wallenburg (2012) have analyzed the impact of SCRM on performance and found that SCRM is important for agility and robustness of a company.

In addition, De Souza et al. (2012) studied the relationship between Enterprise Risk Management (ERM) and performance improvement. They implemented a questionnaire as a tool for data collection and they sent the questionnaire to managers of nonfinancial companies listed among the 500 largest and best firms in Brazil. At the end, they have reached to the conclusion that the

maturity level of risk management and the level of stakeholders' involvement in risk management is an undeniable factor in the performance improvement.

Furthermore, the ineffective management of supply chain risks could result in cost overruns, production delays, quality failures, and program cancellations. The efforts to increase the international partners and customers could also create more complicated risks. Many organizations tried to use technology as a tool for connecting with other organizations to develop a very complex network of affiliations. These connections have created a new set of risks that are not faced previously in the business environment and they are defined as inter-organizational framework of risks (Sutton et al. 2008).

Most supply chain members have already established internal crisis policy now, but before it happens they were faced with some serious crises that caused real damages, like loss of profit and customers trust. After that companies decided that, it is better to develop relationships to work together for improving their performances. The conclusion was that companies are not alone in the competitive environment, working together can be more profitable.

It is insufficient for companies to rely on themselves to resist crisis. If a company in a supply chain will have a serious problem then other companies in the chain will therefore suffer impacts of different levels. So the collaboration and cooperation will be the best way to solve the issue. Thus, an integrated application of risk management is a must, where all the supply chain partners interact with each other to tackle this issue.

Oftentimes a multitude of decision criteria needs to be considered, determining the risk factors that can help organization to evaluate the negative impact in the chain. Badea et al. (2014) presents an integrated and structured approach of how risks among collaborative supply chain can be assessed, facilitating the choice of a profitable collaboration for future business partnership in the supply chain. More specifically their study, reports the process of choosing the right collaborative concept for future business opportunities based on five essential alternatives for a good collaboration: Information sharing collaboration, Decision synchronization collaboration, Incentive alignment

collaboration, Resource and skill sharing collaboration and Knowledge Management collaboration.

The crisis in supply chain can happen at any time. The fact that no one in the supply chain has all the necessary information to identify and control the risks comprehensively is a real issue. The need for interactive cooperation will be more obvious when a company wants to consider the individual risks. The development for a quick reaction depends on the risk management initiative that enable a business to respond quickly to the changes of the market and also the consideration of potential and present disconnection in supply chain (Rajabinasr et.al 2013).

4. Research design

As described in Chapter 2, the data collection for this research will be conducted in two steps; the first one is identification of risks through review of existing literature, and the second is verification of data through interviews. Manuj & Mentzer (2008) suggest that identifying risks is the first step in developing a risk management process. As mentioned earlier the verification part will be conducted by qualitative interviews with number of shipping company managers and also the customer company managers in the four target countries. As mentioned in the research methodology chapter, later on the online questionnaires will be deployed to collect the relevant scale of the verified risk factors.

4.1 Risk identification through a review of previous literature

With regard to the operational risk in container shipping, a number of studies need to be mentioned. Drewry (2009) identified a list of business process risks and asset risks in container transport and logistics. These included documentation, booking and invoicing errors, errors in customs regulatory compliance and in security compliance, strikes and transport congestions, theft and cargo loss or damage, piracy, and terrorist attacks (Drewry, 2009).

The risk factors associated with information flow, which have been addressed in previous studies, may be grouped into three categorizations: information delay, information inaccuracy, and information technology (IT) problem. According to Ramayah & Omar (2010), information delay and inaccurate information means poor information quality. They also pointed out that lack of advanced IT may be a cause of poor information quality.

Angulo et al. (2004, p. 102) stated that information delay was an important risk element in information flow; they defined it as “the wait time that shared information experiences before it is used by an internal supply chain functions”. Metters (1997, p. 99) explained that “lack of inter-company communication combined with large time-lags between receipt and transmission of information are the root cause of information delay”.

With regard to information inaccuracy, DeLone & McLean (1992) mentioned that it might lead to wrong decision making. Sharma & Gupta (2002) suggested that lack of information security might

affect information accuracy, since it could lead to the transferring data being tampered with or leaked.

Angulo et al. (2004) stated that using inaccurate information might lead to costly investment and work inefficiencies and it might be caused by customer's poor inventory integrity. Forrester (1961) and Lee et al. (1997) found that information asymmetry or lack of communication could lead to inaccurate or distorted information flow in a supply chain.

Husdal & Bråthen (2010) identified several risks relating to information flow in the context of Norwegian freight transport; these risks are: disregard of rules and regulations, wrong or erroneous lading permits, wrong or erroneous documents (e.g. customs declaration), and wrong or erroneous information from or to other players in the supply chain.

A number of studies addressed the importance of IT. Tummala & Schoenherr (2011) suggested that lack of necessary IT, or IT failure, ought to be considered as an important risk element associated with information flow, since they might disrupt the process of information transmission. They stated that the triggers that might cause system risks include information infrastructure breakdowns, lack of effective system integration or extensive system networking, and lack of compatibility in IT platforms amongst supply chain partners. Swabey (2009) stated that IT infrastructure breakdown is a risk factor. Millman (2007) pointed out that human error is the biggest risk to an organization's network security.

Tseng et al. (2012) analyzed the risks of cargo damage for aquatic products of refrigerated containers based on a questionnaire survey in various maritime communities in Taiwan, including container carriers, ocean freight forwarders, and container terminal operators. They found that "container data setting errors" is the top factor of both perceived risk and severity of risk.

The service schedule's unreliability is also a risk factor in container shipping, since it could lead to transportation delays and affect shipping companies' reputations. Notteboom (2006) investigated the sources of schedule unreliability on the East Asia-Europe route and identified several sources, which led to the service schedule's unreliability, including waiting time and delays

caused by port strikes, unstable weather and sea conditions, port/terminal/transport congestion, and port/terminal productivity being below expectations. Qi & Song (2012) pointed out that the lack of appropriately designed flexible liner service schedules would lead to service unreliability.

Clearly the relationships between suppliers and their immediate buyers have evolved from fragmented, scattered links to today's integrated, interdependent supply chain networks. It has been witnessed that, this update could increase the level of benefits related to efficiency and productivity, but on the other hand it could also result in severe problems, like supply chain disruptions that has been effected the entire world during the past few years. For instance, the fire at the Philips microchip plant in Albuquerque, NM, in March 2000, caused a big turbulence in their major buyers, Nokia and Ericsson. Nokia had a more reliable supply strategy and because they found out about the chip shortage in just three days, thus they took advantage of its multi-tiered supplier strategy to obtain chips from other sources. On the other hand, because Ericsson was sourcing only from that plant, thus they had a major production shutdown and as a result, the company suffered $400 million in lost sales (Latour, 2001).

It is becoming increasingly clear to the business world, specifically after the tragedies of 9-11 and many subsequent disastrous events that risks exist in every link of a supply chain, thus an effective risk management approach should be on priority for each management team.

As mentioned in the final report on "supply chain vulnerability" obtained by Cranfield Management School (2002), supply chain risks and disruptions can be caused by a number of sources, which may include: (1) natural disasters; e.g. the Kobe earthquake, SARS, foot and mouth disease, birds' flu, and others; (2) terrorist incidents, e.g. the attack on September 11, 2001; (3) industrial or direct action; e.g. the fuel price protest in September 2000 that rapidly affected almost every supply chain in the UK; (4) unexpected accidents; e.g. a fire at a component supplier can have such a serious impact on the original equipment manufacturers (OEMs) that they are forced to shut down operations; and, (5) operational difficulties; e.g. if one supplier experiences a production or supply related problem, then every downstream organization will be affected.

Against this background, Tang (2006) divided supply chain risks into two classification of operational risks and disruption risks. As Tang stated, an operational risk refers to those inherent uncertainties that inevitably exist in supply chains; for example, an uncertain customer demand, an uncertain supply, and an uncertain cost. Tang also proposed that, a disruption risk is referred to as the major disruptions caused by natural and man-made disasters such as earthquakes, floods, hurricanes, and terrorist attacks, or economic crises such as currency fluctuations or employee strikes.

In their study, Chopra & Sodhi (2004) discuss several supply chain risks that a manager must account for when planning suitable mitigation strategies. As this research is about container shipping and the risks associated with 3PL providers and its customers, it will examine only the risk factors, which are related to the contribution between these two parties.

Based on a large-scale survey, Vernimmen et al. (2007) reported that over 40 per cent of the vessels deployed on worldwide liner services arrive one or more than one day behind schedule. They found several risk factors that might cause transportation delay including bad weather at sea, congestion or labor strikes at the different ports of call, and knock-on effects of delays suffered at previous ports.

Notteboom (2006) stated that transportation delay might incur extra logistics costs to the shippers and damage the liners' reputation. Husdal & Bråthen (2010) identified several risk factors; those are relevant to this context include unstable weather and road conditions, lack of fuel supply, and strike and other work-related issues. Tummala & Schoenherr (2011) classified several risk factors into transportation delay, including port capacity and congestion, port strikes, and delay at ports due to port capacity.

In relation to cargo/company asset loss or damage, Husdal & Bråthen (2010) suggested that supply chains might be affected by accidents, engine/vehicle breakdowns, theft, and errors in loading (e.g. mixing hazardous and non-hazardous goods might cause explosion accidents).

Compared to other general supply chains, dangerous goods (DG) transportation is a special risk factor in transportation industry supply chains, because a DG explosion may cause huge damage to the cargo, the ship, and the nearby port. Tummala & Schoenherr (2011) stated that terrorism and wars also might lead to disruption risk. This issue is more critical in Middle East countries and also in Africa.

Based on the micro-data of individual vessel accidents, which occurred in America from 1981 to 1989, Talley (1996) found that unlicensed operators (vs licensed operators) and smaller ship size (vs large ship size) contributed to the increase of risk and severity of cargo damage in container shipping. He also suggested that the risks and severity of damage are greater in collision and fire/explosion incidents than in groundings.

Moreover, inappropriate empty container repositioning could incur significant costs to shipping lines (Song & Dong, 2011) so it could be mentioned as a risk in container shipping industry. Song et al. (2005) stated that empty container transportation incurred approximately 15 billion USD for the world containership fleet in 2002. Drewry (2006) reported that empty containers have accounted for at least 20 per cent of global port handling activity ever since 1998.

Notteboom & Vernimmen (2009) used a cost model to simulate the impact of bunker cost changes on the operational costs of liner services. The results showed that oil price rise may force shipping lines to reduce speed, which may increase their operational costs and operational risks.

Fu et al. (2010) reported that piracy threat is a big issue in some regions, which as a result several major container liners decided to change their service routes.

In summary, there are 38 risk factors, which were identified through literature review. Thus the research classified all of them into five categories of environmental risk, industry risk, organizational risk, problem specific risk and finally decision maker risk according to typology developed by Rao & Goldsby (2009). Tables 2 to 6 explain them in 5 different groups.

Table 2. Environmental risk factors

Risk factors	**Authors**
Natural disasters and Fire	Miller (1991) and Chopra & Sodhi (2004)
War, terrorism and political uncertainty	Tang (2006) and Shubik (1983)
Processing documents being detained by government departments (e.g. customs)	Husdal & Bråthen (2010) and Yang (2010)
Port congestion (unexpected waiting times before berthing or before starting loading/discharging)	Notteboom (2006); Drewry (2009) and Tummala & Schoenherr (2011)
Unstable weather	Notteboom (2006) and Husdal & Bråthen (2010)
Oil price rise	Rao & Goldsby (2009) and Notteboom & Vernimmen (2009) and Husdal & Bråthen (2010)
Cargo being stolen from sealed containers	Drewry (2009) and Husdal & Bråthen (2010)
Attack from pirates	Drewry (2009), Fu et al. (2010) and Tummala & Schoenherr (2011)
Excessive handling due to border crossings or to change in transportation modes	Chopra & Sodhi (2004)

Table 3. Industry risk factors

Risk factors	**Authors**
Industrywide capacity utilization	Miller (1991) and Chopra & Sodhi (2004)
Number of customers	Chopra & Sodhi (2004)
Competitive uncertainty	Miller (1991)
Product value	Chopra & Sodhi (2004)
Demand and supply uncertainty	Miller (1991) and Chopra & Sodhi (2004)

Table 4. Organizational risk factors

Risk factors	**Authors**
Labor productivity being below expectations. Due to e.g. unsafe work place, dispute, strikes	Notteboom (2006); Drewry (2009) , Husdal & Bråthen (2010) and Tummala & Schoenherr (2011) and Chopra & Sodhi (2004) and Miller (1991)
Using different communication channels in the supply chain and consequently increasing the time of information transmission (e.g. telephone, e-mail, EDI)	Metters (1997)
Lack of information security during the information flow	Sharma & Gupta (2002), Finch (2004) and Qi & Zhang (2008)
Information asymmetry/incompleteness	Forrester (1961), Lee et al. (1997), Angulo et al. (2004) and Husdal & Bråthen (2010)

Lack of information standardization and compatibility	Tummala & Schoenherr (2011)
IT infrastructure breakdown or crash	Qi & Zhang (2008), Swabey (2009) and Tummala & Schoenherr (2011) and Chopra & Sodhi (2004)
Unsuitable human operation on IT infrastructure	Millman (2007)
Unsuitable human operation on application software	Millman (2007)
Supply chain partners not transmitting essential information on time	Angulo et al. (2004) and Yang (2010, 2011)
Port/terminal productivity being below expectations (loading/discharging)	Notteboom (2006) and Tummala & Schoenherr (2011)
Inappropriate empty container transportation	Song et al. (2005) , Drewry (2006) and (Song & Dong (2011)
Lack of flexibility of fleet size and designed schedules	Song et al. (2005) ; Qi & Song (2012)
Damage to containers or cargo due to terminal operators' improper loading/unloading operations	Husdal & Bråthen (2010)
Damage to ship or quay due to improper berth operations	Talley (1996) and Husdal & Bråthen (2010)
Change of currency exchange rate during payment process	Tummala & Schoenherr (2011)
Payment delay from partners or shippers	Seyoum (2009)
Suppliers or Shippers bankruptcy	Husdal & Bråthen (2010) and Tummala & Schoenherr (2011) And Chopra & Sodhi (2004)
Financial strength and Liquidity of 3PL provider/customers	Tummala & Schoenherr (2011)

Table 5. Problem specific risk factors

Risk factors	**Authors**
Outsourcing activities	Kotabe et al (2008)
Damage caused by transporting dangerous goods	Talley (1996) and Husdal & Bråthen (2010)

Table 6. Decision making risk factors

Risk factors	**Authors**
Dependency on a single source of supply as well as capacity and responsiveness of alternative suppliers	Chopra & Sodhi (2004)

Business risk from shipping cycles, decisions about buying, selling or chartering ships	Stopford (1997)
The decision maker's detailed knowledge/skill/experience/biases of the overall risk framework and issues involved therein	Ritchie & Marshall (1993)
Miss-investments or over-investments (if investments completed in inadequately in wrong moment)	Stopford (1997)

Even though the research tried to mention all the possible risk factors in the area of container shipping business, but there are some other risk factors, which cannot be determined in the literature. These risk factors should be discovered in the real life practices, which in this research the qualitative interviews from the case study managers tried to answer this goal. The following section will discuss about these risk factors.

4.2 Verification of identified risk factors

As mentioned earlier, the risks identified based on the literature review have been verified by qualitative interviews (Appendix B) with a number of container shipping managers and also the customer companies. During the interviews, the interviewees have been invited to suggest additional risks that had not been identified. Detailed results of the interviews will be presented in this section.

As mentioned earlier, three senior managers from Containerships office in Helsinki, three other senior managers from Containerships office in Istanbul office and three customers from MED region were interviewed. The purpose for this stage of the research is to only verify the identified risk factors and maybe to add some new risk factors to the list using the expert's opinions in this field.

During this verification process, almost all the risk factors identified in the literature review were confirmed by the interviewees. The only risk factor, which has not been confirmed as a risk by the interviewees was "Attack from pirates". All respondents agreed that it is not a risk in MED region and it has not happened before, so it was removed from the list. Furthermore, one of the shipping company managers in Turkey mentioned that, the issue of labor strike and in general labor

productivity is one of the main risk factor in the MED region and specifically in North Africa. For instance he explained that:

> […] Recently, there was a strike in a port located in one of the North African countries. The problem was that the port did inform the shipping company only six hours before the strikes, which was too late and the result was two days of delay in delivering the service.

Clearly this issue is not a big problem for Baltic or West Europe region, because in case of any strikes, the governments and related organizations are able to inform the companies at least a week before it happens. Thus, the shipping companies and the customers could be informed about the delays.

In addition to the previous risk factors, a number of other risk factors were suggested. Pricing procedures and the risks associated with them was suggested as a risk factor that could happen during the decision making process. For instance, if the market is very competitive and there are lots of competitors in the service area, sometimes the companies need to decrease the regular prices to win the market, or in some cases to survive. An operation manager of the shipping company in MED region mentioned:

> […] If we need to survive in a competitive market like this, we need to be more flexible with our customers and offer the best price to take the order. Unless, due to huge amount of competitors, which some of them are big companies, we cannot have a good market share.

This risk factor has also been suggested by another manager of 3PL provider in Finland and he had the similar opinion about it.

Another risk factor suggested by the interviewees was “Lack of innovation and innovative culture inside the organization”. The idea of being innovative and having entrepreneurial intentions inside the organizations have been widely discussed in innovation management literature. Gailly (2011) in his book “Developing innovative organizations” describes that the innovativeness of an

organization can also be improved by raising its ability to identify and capture new opportunities, outside its current scope of activity.

This means building the capability to pursue somewhat high risk, but also high-potential projects (play poker, not chess), often through dedicated teams and people. It implies that, innovation will be ready to develop new product ranges, enter new markets or build new value chains, as long as the firm can leverage its scale, unique assets or reactivity. This kind of innovation is more related to radical innovation, which is not always a good strategy to boost the performance. As a shipping company manager explained:

> […] In the current situation of growing technology and growing market, the need for being innovative is a key factor to have a better performance and as a result a bigger market. Being innovative in the transportation industry means to always have a new and flexible offer to your customers, so that they can choose your offer instead of others. […] For instance, offering a new route of shipping, which is more time and cost efficient could be the game changer in this business.

In fact, the risk factors in decision making process, which have mentioned above, need to be taken to be successful in the market. However, there could be a big consequence behind them. In this regard, these risk factors have been added to previous risk factors identified by literature review.

Table 7. Classification of risks in container shipping industry

Environmental risk factors (Env)	
Natural disasters and Fire	Env_1
War, terrorism and political uncertainty	Env_2
Processing documents being detained by government departments (e.g. customs)	Env_3
Port congestion (unexpected waiting times before berthing or before starting loading/discharging)	Env_4
Unstable weather	Env_5
Oil price rise	Env_6
Cargo being stolen from sealed containers	Env_7
Excessive handling due to border crossings or to change in transportation modes	Env_8
Industry risk factors (Ind)	

Industrywide capacity utilization	Ind_1
Number of customers	Ind_2
Competitive uncertainty	Ind_3
Product value	Ind_4
Demand and supply uncertainty	Ind_5
Organizational risk factors (Org)	
Labor productivity being below expectations. Due to e.g. unsafe work place, dispute, strikes	Org_1
Using different communication channels in the supply chain and consequently increasing the time of information transmission (e.g. telephone, e-mail, EDI)	Org_2
Lack of information security during the information flow	Org_3
Information asymmetry/incompleteness	Org_4
Lack of information standardization and compatibility	Org_5
IT infrastructure breakdown or crash	Org_6
Unsuitable human operation on IT infrastructure	Org_7
Unsuitable human operation on application software	Org_8
Supply chain partners not transmitting essential information on time	Org_9
Port/terminal productivity being below expectations (loading/discharging)	Org_10
Inappropriate empty container transportation	Org_11
Lack of flexibility of fleet size and designed schedules	Org_12
Damage to containers or cargo due to terminal operators' improper loading/unloading operations	Org_13
Damage to ship or quay due to improper berth operations	Org_14
Change of currency exchange rate during payment process	Org_15
Payment delay from partners or shippers	Org_16
Suppliers or Shippers bankruptcy	Org_17
Financial strength and Liquidity of 3PL provider/customers	Org_18
Problem specific risk factors (Pro)	
Outsourcing activities	Pro_1
Damage caused by transporting dangerous goods	Pro_2
Decision making risk factors (Dec)	
Dependency on a single source of supply as well as capacity and responsiveness of alternative suppliers	Dec_1
Business risk from shipping cycles, decisions about buying, selling or chartering ships	Dec_2
The decision maker's detailed knowledge/skill/experience/biases of the overall risk framework and issues involved therein	Dec_3
Miss-investments or over-investments (if investments completed in inadequately in wrong moment)	Dec_4
Pricing Procedures and the risks associated with them	*Dec_5*
Lack of innovation and innovative culture inside the organization	*Dec_6*

Source: The Author

Based on the literature review and the interview results, this research identified a total of 39 risk factors under the various sub-categories of environmental risks, industry risks, organizational risks, problem specific risks and finally, decision making risks. These are summarized in Table 7. The additional risk factors suggested by the interviewees are Dec_5 and Dec_6. They are highlighted with Italic font. In order to facilitate the narrative, the research used short names to code the risk elements (sub-categories).

5. Analysis and results

This section is divided into three parts. First part will describe the risk scales and the second part will be the risk mapping. The last part will be the correlation analysis and t-testing. Once again, as explained in the Chapter 2, by multiplying the risk likelihood with the relevant risk consequence, the risk scale will be obtained. This research was used numbers 1, 2, 3, 4, and 5 to represent “rare”, “unlikely”, “possible”, “likely”, and “almost certain”. On the other hand, “insignificant, minor, moderate, major, and catastrophic” represented by 1 to 5, are used to describe the level of risk consequence.

5.1 Results of risk scaling

As explained in Chapter 2 of this report, the process of risk measurement has been done through an online questionnaire using Google forms (Appendix C). First, a preliminary questionnaire was created and then it is piloted by 3 respondents. Because this project is divided into two different point of views, thus two separate questionnaires has been created. The first one, has been sent to 32 respondents from the shipping company located in MED region.

Four different regions of Turkey, Algeria, Tunisia, and Libya were the countries that have been tested through the company network. The other questionnaire has been aimed to measure the risk factors by the customer companies in those countries. Firstly, the period of data collection has been defined for two weeks of time and after that, a reminder email has been sent to the respondents who did not fill the forms. The second period of data collection, lasted for one more week and then the data analysis stage started.

The overall respondents for the shipping company side and the customer company side, has been defined 32 respondents for each of them and equally divided by the different regions. Thus the total amount of respondents was 64. For the shipping company side, some 25 replies were returned, so the response rate is 78.12 per cent. On the other hand, for the customer company side, 6 replies were returned, so the response rate is 18.75 per cent. It is worth to mention that although the number of respondents in customers were low, but considering the difficulty of extracting information from the customers and also the importance of their perspective, the current amount could be a good response rate. In addition, there was at least one response or more from each

country in the target group so that we can conclude that the responses were collected from all of these countries.

Total amount of replies for both sides were 31 replies from overall 64 respondents, so the overall response rate is 48.43 per cent, which is usually considered as a good response rate. The risk scales of the 39 risk factors were calculated using the ARS function mentioned in Chapter 2; Table 8 details their mean values, standard deviations, and the rankings (according to risk scale) amongst all risk factors.

In terms of shipping company perspective, the top three high-level risk factors are "Change of currency exchange rate during payment process" (Org_15: 8.92), "Number of customers" (Ind_2: 8.72), and "Product value" (Ind_4: 8.40).

Table 8. Risk scale of all risk factors

	Shipping company perspective			Customer company perspective		
Risk Factor	Risk Scale	SD	Rank	Risk Scale	SD	Rank
Env_1	5,44	5,15	22	9,83	8,06	3
Env_2	4,24	4,27	34	10,00	8,34	2
Env_3	6,00	4,89	15	5,50	3,99	36
Env_4	6,36	4,29	14	5,83	3,06	31
Env_5	5,40	4,03	24	6,50	4,14	26
Env_6	8,16	5,99	4	10,33	5,43	1
Env_7	4,08	3,49	36	6,50	3,51	26
Env_8	2,84	2,93	39	6,33	6,06	28
Mean of environmental risk factors	5,31			7,60		
Ind_1	5,96	4,25	16	5,50	3,99	36
Ind_2	8,72	5,87	2	7,50	3,21	13
Ind_3	7,72	5,79	6	7,50	4,93	13
Ind_4	8,40	6,17	3	6,67	5,82	24
Ind_5	6,72	3,92	9	6,83	5,64	19
Mean of industry risk factors	7,50			6,80		
Org_1	5,88	5,89	17	7,33	5,43	16
Org_2	4,68	3,92	31	7,33	5,09	16
Org_3	4,72	3,72	29	5,17	6,15	39
Org_4	6,52	5,10	12	5,67	6,06	33

Org_5	5,28	4,60	25	6,83	5,74	19
Org_6	6,48	5,43	13	8,33	9,03	10
Org_7	5,68	6,09	19	6,83	9,43	19
Org_8	4,72	5,32	29	8,17	9,00	11
Org_9	5,76	5,32	18	5,67	5,85	33
Org_10	5,68	2,91	19	8,17	9,52	11
Org_11	4,52	4,17	32	6,00	6,13	29
Org_12	4,96	5,15	26	5,67	6,06	33
Org_13	7,20	4,51	7	9,17	9,68	7
Org_14	3,92	3,37	38	7,50	9,12	13
Org_15	8,92	7,40	1	9,50	8,85	5
Org_16	7,84	6,08	5	9,50	8,85	5
Org_17	4,48	4,22	33	9,67	8,07	4
Org_18	6,60	5,62	10	9,17	6,11	7
Mean of organizational risk factors	5,76			7,54		
Pro_1	4,76	3,92	28	6,67	3,67	24
Pro_2	4,16	2,77	35	8,83	6,74	9
Mean of problem specific risk factors	4,46			7,75		
Dec_1	4,80	4,28	27	7,00	9,32	18
Dec_2	6,84	5,53	8	5,83	3,31	31
Dec_3	4,04	3,43	37	6,83	4,67	19
Dec_4	6,56	5,71	11	6,83	3,49	19
Dec_5	5,44	4,35	22	6,00	4,65	29
Dec_6	5,56	4,52	21	5,33	4,08	38
Mean of decision making risk factors	5,54			6,30		
Total average	5,79			7,28		

Source: The Author

Moreover, although their respective risk scales are lower than the top three, there are several risk factors, which are also quite high (>7). These are “Oil price rise” (Env_6: 8.16), “Payment delay from partners or shippers” (Org_16: 7.84), “Competitive uncertainty” (Ind_3: 7.72), and “Damage to containers or cargo due to terminal operators’ improper loading/unloading operations” (Org_13: 7.20).

The factor, “Excessive handling due to border crossings or to change in transportation modes” (Env_8: 2.84), has the least impact on shipping companies’ risk losses. In terms of shipping company perspective, industry risk is the most significant one (the mean is 7.50) amongst the five categories of risks and environmental risk is the least significant one (the mean value is 5.31).

In respect of customer company perspective, the top three risk factors are “Oil price rise” (Env_6: 10.33), “War, terrorism and political uncertainty” (Env_2: 10.00), and “Natural disasters and Fire” (Env_1: 9.83).

Moreover, although their respective risk scales are lower than the top three, there are several risk factors, which are also quite high (>9). These are “Suppliers or Shippers bankruptcy” (Org_17: 9.67), “Change of currency exchange rate during payment process” (Org_15: 9.50), “Payment delay from partners or shippers” (Org_16: 9.50), “Damage to containers or cargo due to terminal operators’ improper loading/unloading operations” (Org_13: 9.17), and “Financial strength and Liquidity of 3PL provider/customers” (Org_18: 9.17).

The least significant risk factor from the customer point of view is “Lack of information security during the information flow (Org_3: 5.17). In terms of customer company perspective, the most significant risk categories are problem specific risks (the mean value is 7.75) and environmental risks (the mean value is 7.60). Decision making risks, with the mean being 6.30 has the least impact on customer companies’ risk losses.

Remarkably, amongst all the risk factors, “Oil price rise” (Env_6) ranks as the first in respect of customer company perspective; and the forth in respect of shipping company perspective. This suggests that this factor is in effect the most serious risk factor in container shipping operations. It may be worth mentioning that in relation to “Oil price rise”, a head manager in shipping company during the interview survey stated:

> […] The oil price rise is the major risk in this business. Everything is linked to oil price and energy prices and it triggers even the economy, as we are serving to oil based countries like Algeria and Libya. They are actually using petrol dollars and if the oil price will decrease, as a result the buy power will decrease and it will automatically effect the business.

Clearly, the issue of increasing or decreasing oil price has two different side effects in MED region and especially for oil export dependent countries. In one hand, for the shipping companies, if it is decreasing, it would be good in terms of less expenses for the oil costs of the vessels, but on the hand, it could have a significant negative effect on the economy and the buy power of the oil based countries like Algeria and Libya.

Furthermore, the risk factor of, "Change of currency exchange rate during payment process" (Org_15) ranks as the first in respect of shipping company perspective; and the fifth in respect of customer company perspective. This suggests that this factor is also one of the most serious risk factors in container shipping operations. Again, in relation to the importance of "Change of currency exchange rate during payment process" a shipping company manager explained:

> […] This is one of the main risks specifically in Turkey. For, instance we had more than 40 per cent change of rates in Turkish Lira to USD in the last 6 months. Thus it is affecting the market behavior and most investors are waiting for a more stable market, which is less risky.

Averaging over all risk factors in terms of their impact on shipping company and customer companies, the result as shown in Table 8 reveals that customer companies are the most affected (the total average is 7.28), which means that they are more concern about the risks exists in this industry. This is an important point, in which the shipping managers should consider it as an opportunity to improve their consideration about risk management and to show their customers that they do care about these risks and they are implementing a good and effective strategies in order to mitigate those risks.

5.2 Results of risk mapping

Risk mapping is a common method to analyze the relative importance of different risk factors (Waters, 2007). In a risk map, the horizontal axis represents the risk likelihood and the vertical axis represents the risk consequence. Each risk factor can be located in the risk map.

As explained in Chapter 2, the research used the average risk likelihood and average risk consequence to derive a risk factor's likelihood and consequence over all respondents. Appendices D and E are the results of this averages. Based on the risk scales, the risk map has been divided into four regions: low risk region (corresponding to risk scale <3), moderate risk region (3< risk scale <6), high risk region (6< risk scale <9), and extremely high risk region (9< risk scale).

5.2.1 Risk mapping for shipping company perspective

As shown in the risk map for shipping company (Figure 8), the majority of the risk factors (27 out of 39) fall within the moderate risk region and one of the risk factors fall within the low risk region, which is "Excessive handling due to border crossings or to change in transportation modes" (Env_8).

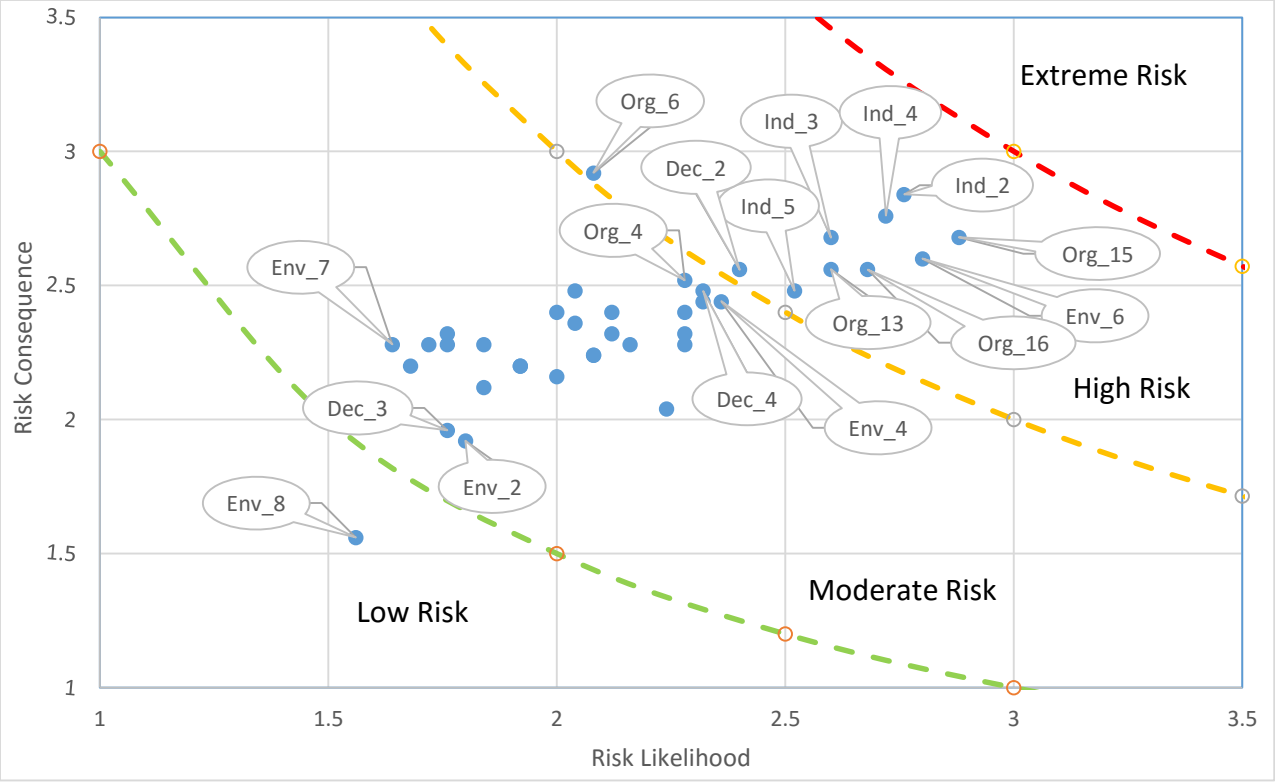

Figure 8. Risk map for shipping company over the all respondents. Source: The Author

In the extremely high risk region there does not exist any risk factor. A total of ten risk factors fall within the high risk region including Org_6, Dec_2, Ind_5, Ind_3, Ind_4, Ind_2, Org_15, Env_6, Org_16, and Org_13. In particular, Org_4, Dec_4 and Env_4, although they are in the moderate risk region, are very close to the boundary of the high risk region. Most of these factors belong to

the categories of industry risk and organizational risk; this coincides with the earlier presented finding that, in respect of shipping company risks, the industry risk is more significant than the other four categories of risk due its higher mean value of risk scale. It is also worth mentioning that the risk factor Org_15 (Change of currency exchange rate during payment process) has the highest risk scale and is quite close to the extreme risk region.

In terms of the risk factors with high consequence and low likelihood, for instance, Org_6, which is the risk of "IT infrastructure breakdown or crash", the backup system is of course an option for reducing the risk. In addition, the companies can use cloud services to recover their systems in terms of any IT crash.

5.2.2 Risk mapping for Customer Company perspective

In the risk map for customer companies (Figure 9), two risk factors, Env_6 and Org_17, are located in the extremely high risk region. Env_6, or "Oil price rise" has been discussed already in the previous part. Org_17, or "Suppliers or Shippers bankruptcy" is another risk factor, which fall within the extremely high risk region. 17 risk factors fall within the high risk region. These include Org_5, Env_7, Org_6, Org_1, Pro_1, Pro_2, Org_13, Ind_2, Org_16, Org_2, Org_8, Dec_4, Org_18, Env_1, Env_2, Org_15, and Ind_3.

Twenty risk factors fall within the moderate risk region, but six of them (Org_14, Ind_4, Org_10, Dec_3, Ind_5, and Env_5) are close to the high risk region. Nine risk factors from 17 risk factors located in high risk region, belong to organizational risks. This suggests that, in container shipping operations, the organizational risks have the most serious impact for the customer companies.

In terms of the risk factors with high consequence and low likelihood, Org_5 and Env_7, which are the risks of "Lack of information standardization and compatibility", and "Cargo being stolen from sealed containers", the insurance is of course an option for reducing the risk consequence in En_7. In addition, the shipping companies can increase the security level in the ports and inform their customers that they are protecting the cargo in a most secure level. Thus, the customers could be sure that, this kind of problems will never happen.

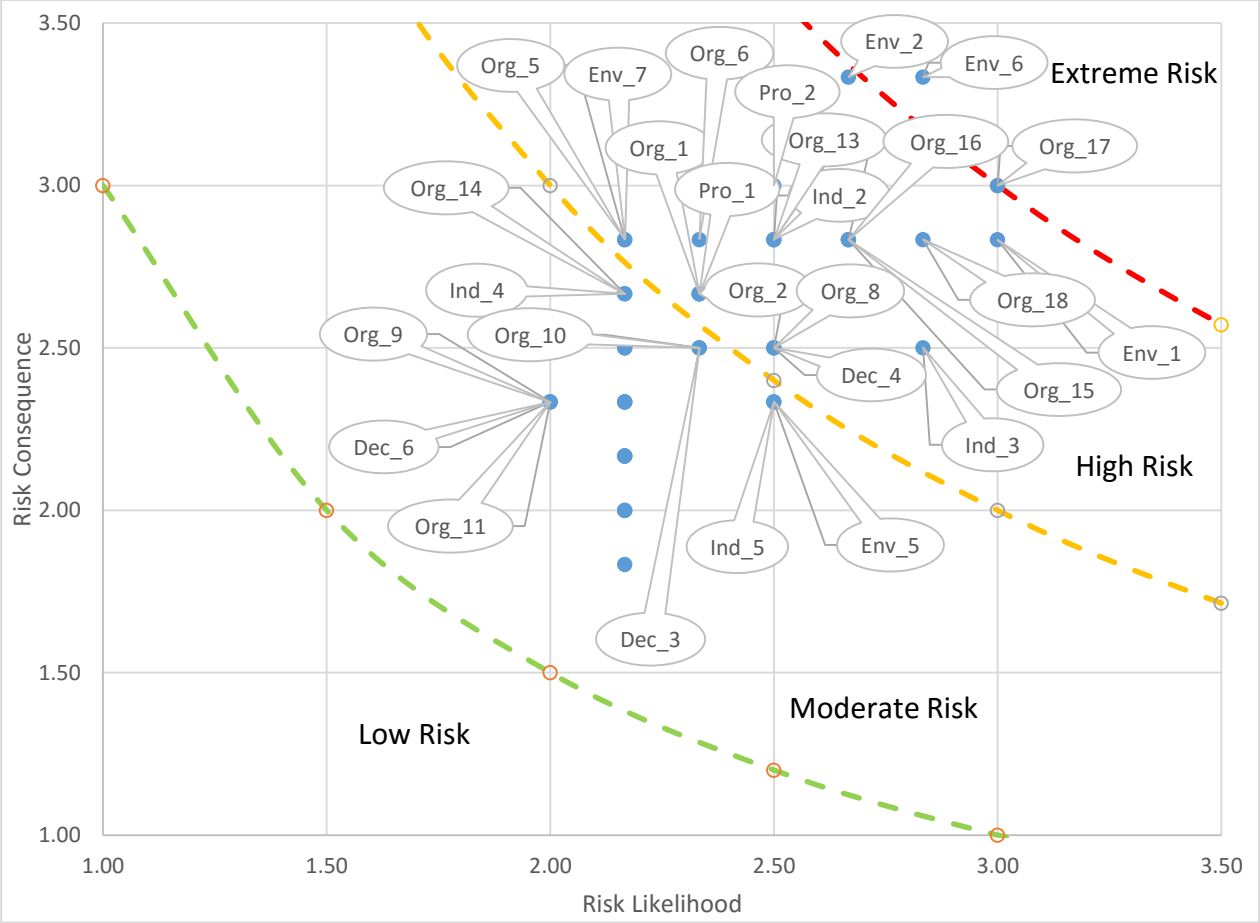

Figure 9. Risk map for Customer Company over the all respondents. Source: The Author

According to the results of risk mapping from a dual perspective, Figure 10 describes the results of risk mapping over all respondents and combines the two perspectives.

As it is clear from the figure, the blue spots, represents the risk factors from the shipping company point of view, and the red spots, represents them from the customer company point of view. The trend line for both group of respondents, displays that there is a positive relationship between the risk likelihood and risk consequence. When the risk likelihood increases, the risk consequence will be increase too, and vice versa. The correlation between these variables will be discussed in the next part.

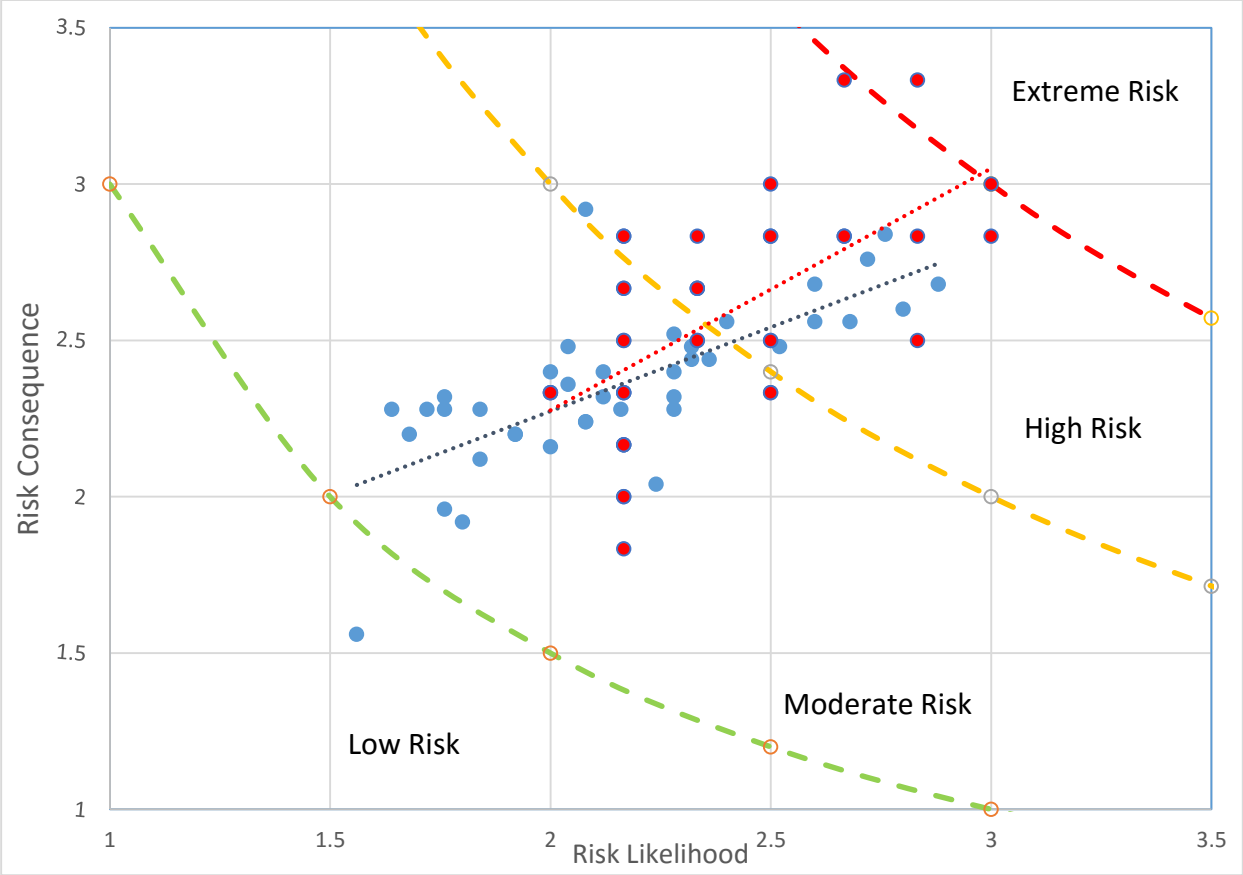

Figure 10. Risk mapping. Dual perspective. Source: The Author

5.3 Correlation coefficient and regression analysis

In order to find out the exact correlation between the two variables of risk likelihood and risk consequence from a dual perspective, the research tried to figure out these correlations using excel correlation tool. In this analysis the two groups of data sets were used, which are average risk likelihood and average risk consequence for two groups of respondents and can be found in Appendices D and E. Table 9 explains the results of correlation coefficient analysis.

Table 9. Correlation coefficient table for dual perspective.

	Shipping company-Risk Likelihood	Shipping company-Risk Consequence	Customer Companies-Risk Likelihood	Customer Companies-Risk Consequence
Shipping company-Risk Likelihood	1			
Shipping company-Risk Consequence	0,73	1		
Customer Companies-Risk Likelihood	0,30	0,20	1	
Customer Companies-Risk Consequence	0,17	0,15	0,62	1

Source: The Author

There are several highlights need to be mentioned in respect of the correlation coefficient analysis. First, there is a positive relationship between the risk likelihood and risk consequence in general and from both perspectives, because all the coefficients in the table are positive numbers. However, these relationships are different in terms of strength.

The relationship between the shipping company risk likelihood and shipping company risk consequence is positive and strong, as the related correlation is 0.7, which means, when the likelihood of the risks is increasing the consequence will be increase dramatically. Thus, we can conclude that, when the consequence of a risk factor cannot be controlled, then by decreasing the relative likelihood we can also decrease the consequence level of the risk factor. However, the correlation between the shipping company risk likelihood and customer company risk likelihood is positive with a medium strengths.

On the other hand the correlation between the shipping company risk likelihood and customer company risk consequence is positive, but low. Relatively, the correlation between the shipping company risk consequence and customer company risk likelihood is again positive and low.

The same situation is valid for the correlation between shipping company risk consequence and customer company risk consequence, which means that, both sides of the party will be effected if

a risk happens. The correlation between the customer company risk likelihood and customer company risk consequence is also positive, but very low.

When it comes to the regression analysis and t-testing, the results shows that the correlation between the Shipping Company and customer company risk likelihood is positive and similar in statistical terms. As it is displayed in Table 10, the P-value of the risk likelihood between two parties is 0.06, which is very close to our alpha value (alpha = 0.05). In this regression, the dependent variables are the average risk likelihood for shipping company and the independent variables are average risk likelihood for customer companies.

On the other hand, the correlation between the Shipping Company and Customer Company risk consequence, is again positive, but not significant in statistical terms. As it is displayed in Table 11, the P-value of the risk consequence between two parties is 0.35, which is bigger than our alpha value (alpha = 0.05). In this regression, the dependent variables are the average risk consequence for shipping company and the independent variables are average risk consequence for customer companies.

Table 10. T-testing for risk likelihood in dual perspective.

Regression Statistics			
Multiple R	0.30	r = 0.30	
R Square	0.09		alpha = 0.05
Adjusted R Square	0.06		0.06 > 0.05
			Most likely the
Standard Error	0.33		same
Observations	39		

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.42	0.42	3.72	0.06
Residual	37	4.25	0.11		
Total	38	4.68			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	1.24	0.47	2.59	0.01	0.271
Customer Companies-Average Risk Likelihood	0.38	0.20	1.92	0.06	-0.01

Source: The Author

Table 11. T-testing for risk consequence in dual perspective.

Regression Statistics			
Multiple R	0.15	r = 0.15	
R Square	0.02		
Adjusted R Square	-0.003		alpha = 0.05
Standard Error	0.25		0.35 > 0.05
			NOT
Observations	39		SIGNIFICANT

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.05	0.058	0.88	0.35
Residual	37	2.45	0.06		
Total	38	2.51			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	2.06	0.31	6.46	1.45	1.41
Customer Companies-Average Risk Consequence	0.11	0.12	0.94	0.35	-0.13

Source: The Author

According to these results, we can conclude that the shipping company and customer companies do not share the same point of view about the risks. This could be the major finding of this research and emphasize that the customers see risks and consequences totally different from the shipping company.

6. Discussion

This part is devoted to discuss the most important risk factors identified in the previous section. In fact the discussion part will discuss the comparison of main risk factors between 3PL provider and its customers. The research has used empirical data to analyze the risks faced by container shipping industry from a parallel perspective in relation to five different types of risk categories: Environmental risks, Industry risks, Organizational risks, Problem specific risks and finally Decision making risks.

It was aimed at providing a comprehensive view on the risks in container shipping industry. The first and second research questions have been answered: a total of 39 risk factors have been identified and classified into five categories mentioned earlier. Moreover, the relative importance of each factor was calculated.

To answer the third research question, which is about performance improvement using the risk management analysis, the research is focused on the previous theory proven by Wieland & Wallenburg (2012). They have studied the relationship between the risk management practices and performance improvement and had concluded that the results of such practices will make the companies reactive in facing the risks by improving the agility, and also proactive by improving the robustness of the companies.

In this respect, it is worth mentioning several highlights. One is that the “Industry risk” for shipping company and the “Problem specific risk” and “Environmental risk” for the customer companies, are the most important risk categories among the others. It is recommendable that the managers, if the available resources are rather limited, could perhaps give priority to these categories in designing risk control policies. This finding is indeed consistent with some of the previous studies in this field as mentioned in the Introduction.

The other highlight is that, amongst the 39 risk factors, Env_6 or “oil price rise” is the most serious risk factor with the highest risk scale. This emphasizes the importance of energy resources in every business specifically in transportation and logistics. However, Org_17, or “Suppliers or Shippers bankruptcy” is the other risk factor, which has the second biggest risk scale. The best way to

control this issue, is continuously monitoring the supply chain partners and specifically their financial situation. This applies for both the shipping company and customer companies.

6.1 Common risk management approach

According to the risk mapping results from both shipping company and the customer companies, the majority of risk factors, which fall within the high risk and extremely high risk region, belongs to the category of organizational risks. This includes 10 risk factors from customer company analysis and 4 risk factors from shipping company analysis. Thus, when it comes to a common risk approach, the organizational risk factors are most dominant risks in this industry, and it should be considered with more attention.

Another important approach, which could be drawn out from the risk mapping results, is to find the common key risk factors between the supply chain partners and in this research shipping company and its customers. For this purpose, the research has identified seven risk factors with high value of risk scale, which are common between the shipping company and the customer companies.

As mentioned earlier in the risk mapping analysis, there are 17 high risk factors plus 2 extremely high risk factors in the customer company side and for the shipping company side, there are 10 high risk factors. The common high value risk factors between the shipping company and its customers include: Env_6, Ind_2, Ind_3, Org_6, Org_13, Org_15 and Org_16. Table 12 and Figure 11 describes these factors.

As it is shown in Table 12, the common risk factors between shipping company and customer companies has been listed and ranked using the average risk scale in both perspectives. Clearly, the number one priority goes to the risk factor of “oil price rise”. The second priority is “change of currency exchange rate during payment process”, and the third one is “payment delay from partners or shippers”. It is worth mentioning that, almost all of these seven risk factors should be considered as an important issue for the both sides.

Table 12. Common key risk factors

Risk Code	Risk Description	Average Risk Scale	Rank
Env_6	Oil price rise	9.24	1
Ind_2	Number of customers	8.11	5
Ind_3	Competitive uncertainty	7.61	6
Org_6	IT infrastructure breakdown or crash	7.40	7
Org_13	Damage to containers or cargo due to terminal operators' improper loading/unloading operations	8.18	4
Org_15	Change of currency exchange rate during payment process	9.21	2
Org_16	Payment delay from partners or shippers	8.67	3

Source: The Author

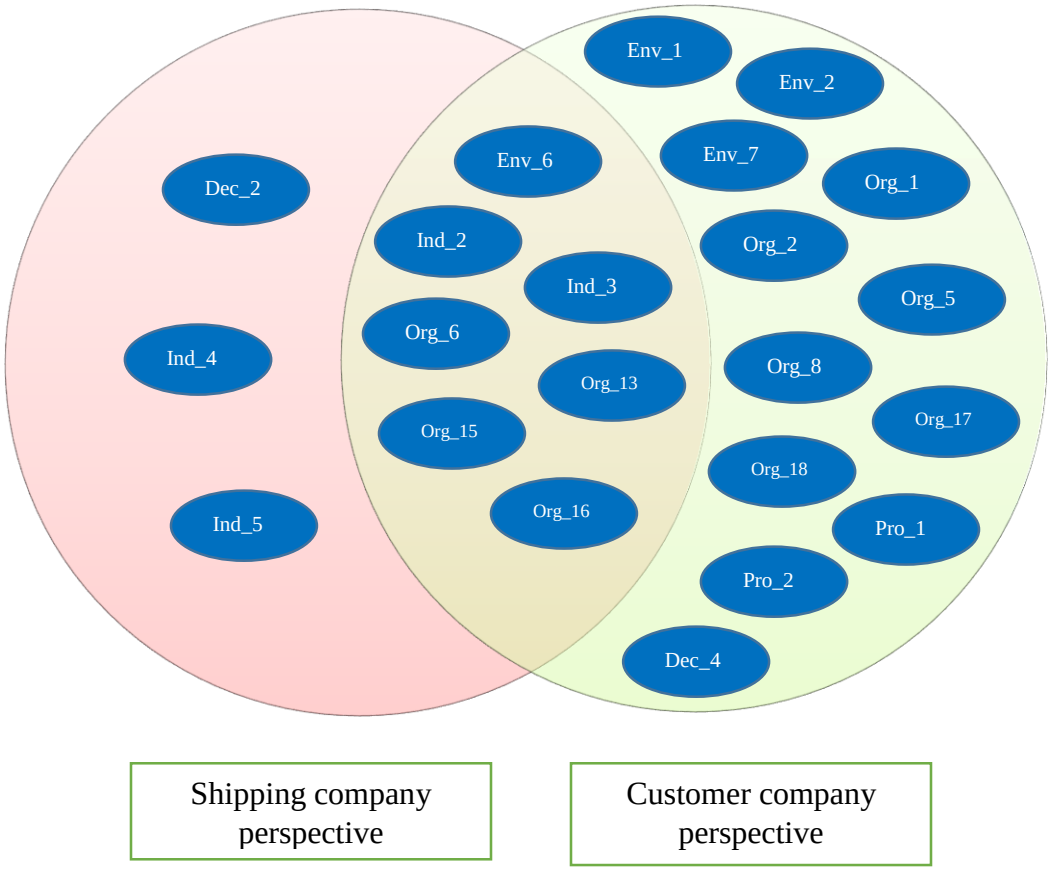

Figure 11.The common key risk factors. Source: The Author.

In relation to the previous findings in t-testing analysis, here we can see the difference between the shipping company and the customer's opinion in a better way. As it is clear from the Figure 11 the most of the high value risk factors have been identified by the customers. This emphasize the big difference and shows that customers see risks in everywhere.

6.2 Risk mitigation strategies

Regarding the common risk factors, it is worth to mention that, oil price and currency exchange rate are both related to the economical fluctuations in the global market. Clearly, the best strategy to face this issue is the continuous monitoring of the global market fluctuations. On the other hand, as forecasting the fluctuations is not an easy task and sometimes impossible to do, thus the companies could focus on decreasing the consequence level of these issues. In this respect, there are several strategies need to be mentioned.

In respect of oil price fluctuations, the companies can make partnerships with 3rd party market analysis companies, which can help them to better cope with the market changes and control the financial loss from these fluctuations.

Liquefied Natural Gas (LNG) is another solution for this risk factor. Nowadays a few shipping companies around the globe, are planning to use LNG for their vessels. Containerships Group could be a good example for this subject. On the 24th of November 2015 Containerships signed an LNG supply agreement with Shell confirming earlier announced plans of bringing LNG fuel technology to European shortsea container logistics. Containerships is preparing to receive the first of 6 new built dual-fuel engine-technology container vessels to its fleet in 2017. All vessels will use LNG as their main fuel and are able to burn conventional marine diesel oil/heavy fuel if necessary. "I am delighted to announce that Containerships has signed a partnership agreement with Shell, which secures the supply of LNG for our first four vessels. This is a vital component of our LNG strategy. The process of evaluating the many different alternatives has been lengthy and extensive, and we believe the solution we have found together with Shell will be mutually rewarding." said Containerships CEO Kari-Pekka Laaksonen (Containerships Group, 2015).

With continued uncertainty about currency fluctuations, businesses must act now to mitigate risks and increase the agility of their supply chains to secure a profitable future. When currency valuations fluctuate, there are several problems, which could affect specifically the exporters, when they want to buy in a currency with a relatively high valuation, and selling product or services in a much weaker currency. This situation is much more observable in, for instance, Turkish currency, Lira.

To solve this issue, Phil Bulman (2015), a managing consultant at "Vendigital Ltd", explains that, the business should try to match the currencies it is buying and selling in. For instance, if a business want to have the majority of its sales revenue in Euros, they should try to balance this with a similar level of goods and services bought in euros. This is called 'natural hedge'. By implementing this strategy, businesses could reduce the effects resulted from currency fluctuations. Companies can also naturally hedge in a way that future payments in certain currency are saved to account in foreign currency. In addition, if company is about to receive payments from foreign currency, then taking loans in this currency is one way of completing natural hedging.

In addition, there could be another solution for fighting against the currency fluctuations. It is called "traditional hedging", and it is implemented where the firms with major commodity spends in areas such as plastics, metals, currencies or fuel. This way they can secure a proportion of their requirements via futures, with the aim of utilizing these resources when their market price has inflated (Bulman, 2015).

In terms of "payment delay from partners or shippers", several highlights need to be mentioned. Firstly, there is a huge difference in the business culture between MED region and Europe. The differences are coming from the several factors like, economical differences, market condition, cultural differences and even the differences in the quality of shipping services. In MED region, when you are talking about the payment delays, most of the managers in both sides, consider it as a usual and daily routine, as in one of the interviews a shipping manager explained:

> […] Some of our customers are paying for our services with a usual delays, which are happening all the time. The payment delays are very usual in this region, and if we wanted to push the customers to pay earlier, there is a chance to lose those customers due to the strong competition in the market.

In order to reduce the consequence level of this risk factor, it is suggested that, the company managers in MED region, try to adapt themselves to a more reliable business culture like European business culture, where the payments should be made in a predefined manner between the supply chain partners, so that no one will be affected in the future relationships.

Damage to containers or cargo due to terminal operators' improper loading/unloading operations, is the forth ranked factor in the common key risk factors. Clearly, the best option to decrease the consequence of this risk, is having the liability insurances, that could cover the financial losses from these issues.

As Newtek (2012) emphasizes in Forbes magazine, every business, even if home-based, needs to have liability insurance. This policy provides both defense and damages if you, your employees or your products or services cause or are alleged to have caused Bodily Injury or Property Damage to a third party. Clearly there are several types of liability insurance coverage offers by the insurance companies. It is important to purchase the most suitable liability insurance according to the company needs.

Number of customers, by the way, is a quite sensitive risk. Clearly, every business should consider the amount of its customers in a risk management perspective. More importantly, in supply chain and logistics, having less amount of customers could even cause the risk of bankruptcy for the companies. In this regard, the companies should pay more attention to this risk.

Competitive uncertainty, is another common risk factor between the shipping company and its customers. The best risk mitigation strategy for this issue is again the continuous monitoring of the major competitors in the market. The last common risk factor is the IT infrastructure

breakdown or crash. As explained before, the backup systems and cloud services are the best solutions to this issue.

As explained before in the risk measurement part, an online questionnaire (Appendix C) sent to the respondents from both sides to measure the risk scales. Although the questionnaire was a quantitative data collection, however the last question was aimed to extract the individual qualitative answers from the respondents regarding the solutions, comments or strategies to mitigate the risks and improve the performance in related functional area.

In the correlation analysis part, the research has calculated the correlation coefficient and it is find that there is a positive relationship between the risk likelihood and risk consequence in general and from both perspectives, because all the coefficients in the table are positive numbers. However, these relationships are different in terms of strength.

All of the above mentioned mitigation strategies are listed in the Table 13. It is worth to mention that, the mentioned strategies are suggestions to control the key risk factors. However, the company managers could use the list of key risk factors and try to find several other solutions to control them, which is the main purpose of the research.

Table 13. Risk mitigation strategies

Code	Risk Factor	Recommended Strategy
Env_6	Oil price rise	✓ Continuous monitoring of the global market fluctuations ✓ Active risk management system ✓ Inventory holding (traditional hedging) ✓ 3rd party consulting companies (Market analysis) ✓ LNG fuel
Org_15	Change of currency exchange rate during payment process	✓ Continuous monitoring of the global market fluctuations ✓ Try to match the currencies it is buying and selling in (Bulman, 2015) ✓ Currency hedging

Org_16	Payment delay from partners or shippers	✓ Difference in business culture is the key reason ✓ MED region should try to adapt themselves to a more reliable business culture like European business culture, where the payments should be made in a predefined manner between the supply chain partners. ✓ Not to push the customers, but try to educate them to adapt in the new system
Org_13	Damage to containers or cargo due to terminal operators' improper loading/unloading operations	✓ Having the liability insurances, that could cover the financial losses from these issues ✓ Invest on educating the vessel crew and terminal operators to decrease the likelihood ✓ Important to get the suitable liability insurance as per the company needs ✓ To understand the basics of liability coverage as per the company needs
Ind_2	Number of customers	✓ Consider the amount of its customers in a risk management perspective ✓ Follow the number of customers in a regular periods of time
Ind_3	Competitive uncertainty	✓ Continuous monitoring of the major competitors in the market ✓ Investing on competitive advantage of the company (e.g. improved quality, new routes) ✓ Advertisement
Org_6	IT infrastructure breakdown or crash	✓ Backup systems ✓ Cloud services ✓ Professional IT maintenance ✓ Liability insurances

Source: The Author

It is worth to mention that, this research tried to discuss most of the possible risks in container shipping separately. However, most of the mentioned risk factors are related to each other and can probably be effective to each other in terms of their impact. For instance, as mentioned in Chapter 4 of this research, most likely everything in the market now is linked to oil price and energy prices and it triggers even the economy, specifically if we are serving to oil based countries like Algeria and Libya. Thus the low price of oil may lead to low consumption power and in return payment problems from the customers.

Another example could be the robberies and stealing of containers, which could increase due to low price of oil to. Another effect of the oil price decrease is that, it may lead to devaluate the currencies specifically in the oil producing counties. Big examples for this issue could be about Russia or Brazil today. Also political uncertainty could increase due to oil price fluctuation, and in addition capacity utilization (dedicated to the region) would decrease, leading to lower prices etc.

Outsourcing activities are also very popular, when everything falls apart and the market is unstable, thus owning something does not benefit that much. Some risks are more important than the others, and could lead to causal chains of events taking place, which are very destructive, especially for businesses. These risks should be identified and controlled through a chain effective analysis to insure that every aspects of the risks have been clarified and controlled. This could be discussed in the further researches.

Finally, regarding the comparison of the research findings with previous literature, several highlights need to be mentioned. First of all, this research provided a comprehensive risk picture of all possible risk factors in the container shipping business in a dual perspective approach. It is worth to mention that in the previous literature (e.g. Chang et al., 2015) the risk factors has been measured only for shipping company perspective. In addition, the research has been conducted on MED region where in the previous literature, another regions (e.g. Taiwan in Chang et al., 2015) were the target for risk management analysis. And finally, the research conducted correlation and t-testing analysis to improve the insights on the risk management practices.

7. Conclusions

This study presents a hierarchical classification of risks in container shipping industry from a parallel perspective. Risks are classified into five categories: environmental risks, industry risks, organizational risks, problem specific risks, and finally decision making risks. Each category consists of a number of risk factors and this research considered a total of 39 risk factors. The risk scales are measured by multiplying risk likelihood and risk consequence in terms of two different perspectives. First, from the shipping company point of view and second, from the customer companies point of view. Thus the first research question has been answered via identification of relevant risk factors.

The research has been answered the second research question in a very comprehensive way using the data measurement part. The question was about the importance of risk factors. In this respect, several highlights need to be mentioned. Among the five categories of risks, and for the both perspectives, it is found that organizational risks are generally more significant than others. However, “Oil price rise”, that is a risk factor from environmental risk category, is the most serious risk factor amongst all the others in respect of two types of perspectives.

In respect of shipping company view, “Change of currency exchange rate during payment process”, “Number of customers”, and “Product value”, are the top three risk factors. It is thus suggested that if a shipping company aims to minimize its losses caused by risk incidents, consideration about these factors should be prioritized. If, however, the customer companies wants to focus on their losses caused by the risk elements, they needs to pay more attention to “Oil price rise”, “War, terrorism and political uncertainty”, and “Natural disasters and Fire” as they are the top three risk factors in respective of customer company view.

In total, two risk maps are created to identify the importance of each risk factor in respect of the two types of perspectives. The risk maps offer an intuitive view of the level (low, moderate, high, and extreme) of each risk factor and their likelihood and consequence. In addition the third risk map provided to gather all the risk factors in a dual perspective in one figure.

The last research question was about performance improvement using risk management analysis. To answer this question, the research has discovered several important findings. One of the important findings from the risk mapping results, is the list of common key risk factors between the supply chain partners and in this research shipping company and its customers. For this purpose, the research has identified seven risk factors with high value of risk scale, which are common between the shipping company and the customer companies and are located in the high and extremely high risk regions in the risk maps. The common high value risk factors between the shipping company and its customers include seven key risk factors namely: oil price rise, change of currency exchange rate during payment process, payment delay from partners or shippers, damage to containers or cargo due to terminal operators' improper loading/unloading operations, number of customers, competitive uncertainty, and IT infrastructure breakdown or crash. It has been suggested twenty-four risk mitigation strategies for these factors in the discussion part. It is worth to mention that, with careful implementation of these mitigation strategies the companies can reach in a good level of performance improvement.

Another interesting finding of this research was the difference in the opinions of two parties, the shipping company and the customer companies. According to the correlation analysis and t-testing analysis, we can conclude that the shipping company and customer companies do not share the same point of view about the risks. This could be the major finding of this research and emphasize that the customers see risks and consequences totally different from the shipping company.

7.1 Academic implications

This study makes empirical contribution to the literature as a few studies so far have approached the risks in container shipping industry from a dual perspective including all five supply chain risk categories (environmental, industry, organizational, problem specific and decision making risks) based on the empirical data from industrial experts.

7.2 Managerial implications

The research provides an inclusive and comprehensive analysis of the risks in container shipping operations, which is of importance to the shipping companies and their customers in the supply

chain. The research as stated earlier, tried to identify all the risks, along with exploring and analyzing the relative importance of each factor in respect of two different point of views. This could provide useful insight for container shipping company managers and the supply chain companies, and can assist them in better understanding the risks in their operations and in differentiating their efforts on mitigating risks.

In addition, it has been suggested twenty-four risk mitigation strategies for common risk factors in the discussion part. It is worth to mention that, with careful implementation of these mitigation strategies the companies can reach in a good level of performance improvement.

The research recommends to the managers of shipping companies and the customer companies to have a continuous monitoring and controlling on the common risk factors in a contribution strategy. In this respect, participation in the annual meetings with the customers and more importantly, the continuous risk management analysis system could be the best solutions to this issue. These practices will help the managers in both sides of the party to have better decision making approaches, increasing the agility and robustness of the companies and as a result improve the performance as a whole.

This study, could help the shipping company to educate the top management team, which are involved in this practice to better understand the customers and also the cultural differences among the regions. The research could have several other contributions. For instance, finding the weak signals from the risk analysis results, which can improve the operations of container shipping.

In addition, developing a new valuable tool could be an important result of this research. A tool which has value added as a service to customers to show that the shipping company possess this kind of risk management tools, when selling the services to customers.

7.3 Limitations

There are three main limitations to this research. Firstly, the language differences. Although, the majority of respondents in both interviews and the questionnaires were able to understand and speak English language, but we should keep in mind that the research is done in four non-English

speaking countries of Turkey, Algeria, Tunisia and Libya. This could cause some miss-understandings about each risk factor and even the whole project of risk management.

The second limitation, could be the geographical location. As explained before in Chapter 1, the research was aimed to analyze the risk factors in four MED countries. Thus the generalization of the results for other regions like Europe could not be a good choice to do, as the business cultures are totally different.

The last but not the least is the number of respondents for the questionnaires and also the case company. As explained in the methodology part, the total amount of respondents aimed at 64, in which 32 of them were in the shipping company and the other 32 respondents were from the customer companies. The total response rate was 48.43 per cent, which is usually considered as a good response rate. The important point in this matter is that, the research was focused on a single case company in this industry, which is a weak point of the research. However, there could be some similarities between the shipping companies, but the complete generalization of this research to other shipping or supply chain companies is not recommended.

7.4 Directions for further research

Further research may focus on evaluating the relative performance of appropriate risk mitigation strategies in managing container shipping operations, through the implementation of empirical practices in several different regions. Also developing a risk management tool, which can monitor the key risks in a continuous manner and regular periods of time could be another direction for the further research.

In addition, there are some risks that are more important than the others, and could lead to causal chains of events. These risks should be identified and controlled through a chain effective analysis to insure that every aspects of the risks have been clarified and controlled. This could be discussed in the further researches.

References

Angulo, A., Nachtmann, H., & Waller, M. A. (2004). Supply chain information sharing in a vendor managed inventory partnership. *Journal of Business Logistics, 25*(1), 101-120.

Arroyo, P., Gaytan, J., & de Boer, L. (2006). A survey of third party logistics in Mexico and a comparison with reports on Europe and USA. *International Journal of Operations & Production Management, 26*(5-6), 639–667.

Asiakastieto. (2016). *Containerships Ltd Oy*. Retrieved January 21, 2016, from Asiakastieto: https://www.asiakastieto.fi

Badea, A., Prostean, G., Goncalves, G., & Allaoui, H. (2014). Assessing Risk Factors in Collaborative Supply Chain with the Analytic Hierarchy Process (AHP). *Procedia - Social and Behavioral Sciences, 124*, 114–123.

Ballou., R. H. (2004). *Buisness logistics/ Supply chain management* (5th ed.). Upper Saddle River, New Jersey. USA: Pearson Education Inc.

Beretta, S., & Bozzolan, S. (2008). Quality versus quantity: the case of forward-looking disclosure. *Journal of Accounting, Auditing and Finance, 23*(3), 333-376.

Bettis, R. A., & Hall, W. K. (1982). Accounting determined risk and accounting determined return. *Academy of Management Journal, 25*(2), 254-264.

Bowersox, D. J., Closs, D. J., & Cooper, M. B. (2007). *Supply Chain Logistics Management* (2nd ed.). New York: McGraw-Hill/Irwin.

Bulman, P. (2015, March 2). *How can firms reduce the effects of currency fluctuations?* Retrieved November 28, 2015, from Strategic Risk: http://www.strategic-risk-global.com/how-can-firms-reduce-the-effects-of-currency-fluctuations/1411969.article

Chang, C. H., Jingjing , X., & Dong-Ping, S. (2015). Risk analysis for container shipping: from a logistics perspective. *The International Journal of Logistics Management, 26*(1), 147 - 171.

Chen, Y. (2008). Research on trust among supply chain partners. In H. Zhang, R. M. Zhao, & Z. Xie (Ed.), *International conference on industry cluster development and management* (pp. 742-745). China: Orient Academic Forum.

Choi, T. Y., Dooley, K. J., & Rungtusanatham, M. (2001). Supply networks and complex adaptive systems: control versus emergence. *Journal of Operations Management, 19*(3), 351-366.

Chopra, S., & Sodhi, M. (2004). Managing risk to avoid supply chain breakdown. *MIT-Sloan Management Review, 46*(1), 53-61.

Christopher, M. (1998). *Logistics and Supply Chain Management: Strategies for Reducing Costs and Improving Services* (2nd ed.). London: In: Financial Times, Pitman Publishing.

Containerships. (2015). *FROM DOOR-TO-DOOR AND BEYOND*. Retrieved September 27, 2015, from Containerships Group Ltd: http://www.containershipsgroup.com/our-services

Containerships Group. (2015, December 7). *Containerships and Shell sign LNG supply contract*. Retrieved January 17, 2016, from containerships group: http://www.containershipsgroup.com/about-us/news/290-containerships-and-shell-sign-lng-supply-contract

Cox, L. A. (2008). What's wrong with risk matrices? *Risk Analysis, 28*(2), 497-512.

Cranfield Management School. (2002). *Supply chain vulnerability.* New York (NY): Cranfield University Press.

Creazza, A., Dallari, F., & Melacini, M. (2010). Evaluating logistics network configurations for a global supply chain. *Supply Chain Management: An International Journal, 15*(2), 154-164.

De Souza, R. S., Gomes, S. D., Bruni, A. L., De Oliveira, G. G., Sampaio, M. S., & De Faria, J. A. (2012). *Studies in Managerial and Financial Accounting. Enterprise Risk Management and Performance Improvement: A Study with Brazilian Nonfinancial Firms* (Vol. 25). (M. J.-F. Antonio Davila, Ed.) Emerald Group Publishing Limited.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: the quest for the dependent variable. *Information Systems Research, 3*(1), 60-95.

Drewry. (2006). *Annual Container Market Review & Forecast 2006/07.* London: Drewry Shipping Consultants Ltd.

Drewry. (2009). *Risk Management in International Transport and Logistics.* London: Drewry Shipping Consultants Ltd.

Ewert, K. (2008). "Risk management", . *Handbook of Container Shipping Management, 2*(33), 71-85.

Finch, P. (2004). Supply chain risk management. *Supply Chain Management: An International Journal, 9*(2), 183-196.

Forrester, J. W. (1961). *Industrial Dynamics.* Boston, MA.: MIT Press.

Fu, X., Ng, A. K., & Lau, Y. Y. (2010). The impacts of maritime piracy on global economic development: the case of Somalia. *Maritime Policy andManagement, 37*(7), 677-697.

Gailly, B. (2011). *Developing innovative organizations; A roadmap to boost your innovation potential.* London: PALGRAVE MACMILLAN.

Handfield, R. B., & Nichols, J. E. (1999). *Introduction to Supply Chain Management.* Upper Saddle River. NJ: Prentice Hall.

Heckmanna, I., Comesb, T., & Nickela, S. (2014). A critical review on supply chain risk – Definition, measure and modeling. *Omega, 52,* 119–132.

Helbing, D., Ammoser, H., & Kühnert, C. (2006). Disasters as Extreme Events and the Importance of Network Interactions for Disaster Response Management. In A. Sergio, J. Volker, & K. Holger, *Extreme Events in Nature and Society* (pp. 319–48). Berlin, Heidelberg: Springer.

Holmberg, S. (2000). A systems perspective on supply chain measurements. *International Journal of Physical Distribution and Logistics Management, 30*(10), 847–868.

Hong, J. J., Chin, A. H., & Liu, B. L. (2004). Logistics outsourcing by manufacturers in China: a survey of the industry. *Transportation Journal, 43*(1), 17–25.

Houlihan, J. B. (1985). International supply chain management. *nternational Journal of Physical Distribution and Materials Management, 15*(1), 22–38.

Husdal, J., & Bråthen, S. (2010). Bad locations, bad logistics? How Norwegian freight carriers handle transportation disruptions. *The World Conference for Transportation Research 2010.* Lisbon, 11-15 July.

Kavussanos, M. G., Juell-Skielse, A., & Forrest, M. (2003). International comparison of market risks across shipping-related industries. *Maritime Policy and Management, 30*(2), 107-122.

Kotabe, M., Riege, A., Griffiths, K., Noble, G., Ang , S. H., Pecotich, A., & Helsen, K. (2008). *International Marketing: Second Asia-Pacific Edition.* Brisbane: Wiley.

Lai , K. H., Ngai, E., & Cheng , T. (2002). Measures for evaluating supply chain performance in transport logistics. *Transportation Research Part E, 38*, 439–456.

Lambert , D. M., & Stock, J. R. (1982). *Strategic Logistics Management* (3rd ed.). Homewood IL. USA: IRWIN INC.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: implementation issues and research opportunities. *International Journal of Logistics Management, 9*(2), 1-20.

Latour, A. (2001). *Trial by fire: a blaze in albuquerque sets off major crisis for cell-phone giants.* January 29: The Wall Street Journal ; Eastern Edition.

Lee, H. L., Padmanabhan, V., & Whang, S. (1997). Information distortion in a supply chain: the bullwhip effect. *Management Science, 43*(4), 546-558.

Lieb, R. C., & Randall, H. L. (1999). 1997 CEO perspectives on the current status and future prospects of the third party logistics industry in the United States. *Transportation Journal, 38*(3), 28–41.

Lieb, R., & Bentz, B. A. (2005). The North American third party logistics industry in 2004: the provider CEO perspective. *International Journal of Physical Distribution & Logistics Management, 35*, 595–611.

Luo, W., van Hoek, R. I., & Roos, H. H. (2001). Cross-cultural logistics research: a literature review and propositions. *International Journal of Logistics: Research and Applications, 4*(1), 57–78.

Manuj, I., & Mentzer, J. T. (2008). Global supply chain risk management. *Journal of Business Logistics, 29*(1), 133-155.

McKinsey. (2010). *The challenges ahead for supply chains.* November: McKinsey Quarterly.

Metters, R. (1997). Quantifying the bullwhip effect in supply chains. *Journal of Operations Management, 15*(2), 89-100.

Miller, K. (1991). A framework for integrated risk management in international business. *Journal of International Business Studies, 23*(2), 311-331.

Millman, R. (2007, June 19). *Human error biggest threat to computer security*. Retrieved August 23, 2015, from ITPRO: www.itpro.co.uk/115920/human-error-biggest-threat-to-computer-security

Mitchell, V. W. (1995). Organizational risk perception and reduction: a literature review. *British Journal of Management, 6*(2), 115-133.

Mitchell, V. W. (1999). Consumer perceived risk: conceptualizations and models. *European Journal of Marketing, 33*(1/2), 163-195.

National Patient Safety Agency (NPSA). (2008). *A Risk Matrix for Risk Managers.* NHS, London.: National Patient Safety Agency.

Newtek - The Small Business Authority. (2012, January 19). *13 Types of Insurance a Business Owner Should Have*. Retrieved November 28, 2015, from Forbes:

http://www.forbes.com/sites/thesba/2012/01/19/13-types-of-insurance-a-small-business-owner-should-have/

Norrman, A., & Jansson, U. (2004). Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident, The Emerald Research Register. *International Journal of Physical Distribution & Logistics Management, 5*, 434-456.

Notteboom, T. E. (2006). The time factor in liner shipping services. *Maritime Economics and Logistics, 8*(1), 19-39.

Notteboom, T. E., & Vernimmen, B. (2009). The effect of high fuel costs on liner service configuration in container shipping. *Journal of Transport Geography*, *17*(5), 325-337.

Openstreetmap. (2015, January 21). Retrieved January 21, 2015, from Open street map service webpage and application: https://www.openstreetmap.org

Paixão, A. C., & Marlow, P. B. (2003). Fourth generation ports – a question of agility? *International Journal of Physical Distribution and Logistics Management, 33*(4), 355-376.

Qi, X. T., & Song, D. P. (2012). Minimizing fuel emissions by optimizing vessel schedules in liner shipping with uncertain port times. *Transportation Research Part E, 48*(4), 863-880.

Qi, Y., & Zhang, Q. (2008). Research on information sharing risk in supply chain management. *2008 International Conference on Wireless Communications, Networking and Mobile Computing*, (pp. 1-6). Dalian.

Rajabinasr, A., Nourbakhshian, M., Hooman, A., & Seyedabrishami, S. Z. (2013). The Main Tools Used in Supply Chain Risk Management. *Interdisciplinary Journal of Contemporary Research in Business, 4*(9), 969-974.

Ramayah, T., & Omar, R. (2010). Information exchange and supply chain performance. *International Journal of Information Technology and Decision Making, 9*(1), 35-52.

Rao, S., & Goldsby, T. J. (2009). Supply chain risks: a review and typology. *The International Journal of Logistics Management, 20*(1), 97-123.

Risk Response Network. (2011). *New models for addressing supply chain and transport risk.* The World Economic Forum.

Ritchie, B., & Marshall, D. (1993). *Business Risk Management.* London: Chapman & Hall.

Rodrigue, J. P., Notteboom, T., & Pallis, A. A. (2011). The financialization of the port and terminal industry: revisiting risk and embeddedness. *Maritime Policy and Management, 38*(2), 191-213.

Seyoum, B. (2009). *Export-Import Theory, Practices, and Procedures.* Oxon: Routledge.

Shang, K. C., & Marlow, P. B. (2005). Logistics capability and performance in Taiwan's major manufacturing firms. *Transportation Research Part E – Logistics and Transportation Review, 41*(3), 217–234.

Sharma, S., & Gupta, J. N. (2002). Securing information infrastructure from information warfare. *Logistics Information Management, 15*(5), 414-422.

Shubik, M. (1983). Political risk: analysis, process, and purpose. In R. J. Herring, *Managing International Risk.* New York, NY: Cambridge University Press.

Song, D. P., & Dong, J. X. (2011). Flow balancing-based empty container repositioning in typical shipping service routes. *Maritime Economics and Logistics, 13*(1), 61-77.

Song, D. P., Zhang, J., Carter, J., Field, T., Marshall, J., Polak, J., . . . Woods, J. (2005). On cost-efficiency of the global container shipping network. *Maritime Policy and Management, 32*(1), 15-30.

Spekman, R. E., & Davis, E. W. (2004). Risky business: expanding the discussion on risk and the extended enterprise. *International Journal of Physical Distribution & Logistics Management, 34*(5), 414-433.

Stopford, M. (1997). *Maritime Economics* (2nd ed.). London: Routledge.

Sutton, S. G., Smedley, G., & Arnold, V. (2008). Accounting for Collaborative Supply Chain Relationships: Issues and Strategies. *The International Journal of Digital Accounting Research, 8*, 1-22.

Swabey, P. (2009, December 10). *European firms at risk of technological breakdown*. Retrieved August 26, 2015, from Information-Age: http://www.information-age.com/it-management/skills-training-and-leadership/1101952/european-firms-at-risk-of-technological-breakdown

Talley, W. K. (1996). Determinants of cargo damage risk and severity: the case of containership accidents. *Logistics and Transportation Review, 32*(4), 377-388.

Tan, K. C., Kannan, V. R., Handfield, R. B., & Ghosh, S. (1999). Supply chain management: an empirical study of its impact on performance. *International Journal of Operations and Production Management, 19*(10), 1034–1052.

Tang, C. S. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics, 103*(2), 451-488.

Tseng, W. J., Ding, J. F., Chou, C. C., Hsu, F. T., Wang, Y. W., Liu, Y. N., . . . Wu, W. Y. (2012). Risk analysis of cargos damages for aquatic products of refrigerated containers:shipping operators' perspective in Taiwan. *Information Management and Business Review, 4*(2), 86-94.

Tummala, R., & Schoenherr, T. (2011). Assessing and managing risks using the supply chain risk management process (SCRMP). *Supply Chain Management: An International Journal, 16*(6), 474-483.

Vernimmen, B., Dullaert, W., & Engelen, S. (2007). Schedule unreliability in liner shipping: origins and consequences for the hinterland supply chain. *Maritime Economics and Logistics, 9*(3), 193-213.

Waters, C. D. (2007). *Supply Chain Risk Management – Vulnerability and Resilience in Logistics.* King's Lynn, Norfolk, VA: Biddles Ltd.

Wieland, A., & Wallenburg, C. M. (2012). Dealing with supply chain risks: Linking risk management practices and strategies to performance. *International Journal of Physical Distribution & Logistics Management, 42*(10), 887-905.

Yang, Y. C. (2010). Impact of the container security initiative on Taiwan's shipping industry. *Maritime Policy and Management, 37*(7), 699-722.

Yang, Y. C. (2011). Risk management of Taiwan's maritime supply chain security. *Safety Science, 49*(3), 382-393.

Yates, J. F., & Stone, E. R. (1992). Risk appraisal. In *Risk-taking Behavior* (pp. 49-85). Wiley, Chichester,UK.

Yip, T. L., & Lun, Y. V. (2009). *"Business risk in container shipping", in Wagner, S.M. and Bode, C. (Eds), Managing Risk and Security: The Safeguard of Long-Term Success for Logistics Service Providers.* Berne: Haupt Publisher.

Appendices

Appendix A: Methodology in brief

In this part the structure of the methodology part is described briefly in three main steps for two groups of respondents.

- Steps for 3PL provider's perspective:
  1. Risk identification
     a. Literature review
     b. Interview from 6 senior managers in 2 regions, MED and Finland's head office to verify the risk factors identified by literature review and probably add some other risk factors, which are not mentioned
  2. Risk measurement
     a. A questionnaire survey using a five-point Likert scale for MED region
        i. Turkey: 4 senior managers, and 4 employees in related departments
        ii. Algeria: 4 senior managers, and 4 employees in related departments
        iii. Libya: 4 senior managers, and 4 employees in related departments
        iv. Tunis: 4 senior managers, and 4 employees in related departments

        (Overall 32 respondents)
  3. Risk analysis (which risks are most important), risk mapping and risk picture for 3PL provider perspective.
- Steps for customer perspective:
  1. Risk identification
     a. Literature review
     b. Interview from 3 customers (different industries) in MED region to verify the risk factors identified by literature review and probably add some other risk factors, which are not mentioned
  2. Risk measurement
     a. A questionnaire survey using a five-point Likert scale for MED region
        i. Turkey: 8 customers
        ii. Algeria: 8 customers
        iii. Libya: 8 customers
        iv. Tunis: 8 customers

        (Overall 32 respondents)
  3. Risk analysis (which risks are most important), risk mapping and risk picture for customer perspective.

Note that the number of respondents in the risk measurement part have been selected equally both for 3PL provider and its customers side (32 respondents) to have a better comparison between two sides of 3PL provider and its customers.

Appendix B: Semi-structured interview form

CONTAINERSHIPS

Respondent: **Function:**

Question. Please express your opinion about the following risk factors in the container shipping operations and explain whether each of them are a risk factor in your region or not.

Table 14. Environmental risk factors

Risk factors	Answer
Natural disasters and Fire/ Doğal afetler ve yangın	
War, terrorism and political uncertainty/ Savaş, terör ve siyasi belirsizlik	
Processing documents being detained by government departments (e.g. customs)/ İşleme belgeler devlet daireleri tarafından gözaltına alındıktan (örneğin gümrük)	
Port congestion (unexpected waiting times before berthing or before starting loading/discharging)/ Liman tıkanıklığı (beklenmeyen bekleme süreleri yanaşma önce veya başlangıç yükleme / boşaltma öncesi)	
Unstable weather/ kararsız hava	
Oil price rise/ Petrol fiyat artışı	
Cargo being stolen from unsealed containers/ Kargo ağzı açık kaplarda çalınmasını	
Attack from pirates/ Korsanlardan Saldırı	
Excessive handling due to border crossings or to change in transportation modes/ Nedeniyle sınır kapıları veya ulaştırma modları değiştirmek için aşırı kullanım	

Table 15. Industry risk factors

Risk factors	Answer
Industry wide capacity utilization/ Sanayi Geniş kapasite kullanım	
Number of customers/ Müşteri sayısı	
Competitive uncertainty/ Rekabetçi belirsizlik	
Product value/ Ürün değer	
Demand and supply uncertainty/ Arz ve talep belirsizliği	

Table 16. Organizational risk factors

Risk factors	Answer
Labor productivity being below expectations. Due to e.g. unsafe work place, dispute, strikes/ Beklentilerin altında olmak emek verimliliği. Ötürü, örneğin, güvensiz iş yeri, anlaşmazlık, grev	
Using different communication channels in the supply chain and consequently increasing the time of	

information transmission (e.g. telephone, e-mail, EDI)/ Tedarik zincirinde farklı iletişim kanallarını kullanarak ve dolayısıyla bilgi iletim süresini arttırmak (örneğin telefon, e-posta, EDI)	
Lack of information security during the information flow/ Bilgi akışı sırasında bilgi güvenliği eksikliği	
Information asymmetry or incompleteness/ Bilgi asimetrisi veya eksiklik	
Lack of information standardization and compatibility/ Bilgi standardizasyon ve uyumluluk eksikliği	
IT infrastructure breakdown or crash/ IT altyapısı arıza veya kilitlenme	
Unsuitable human operation on IT infrastructure/ IT altyapısına uygun olmayan insan operasyon	
Unsuitable human operation on application software/ Uygulama yazılımına uygun olmayan insan operasyon	
Supply chain partners not transmitting essential information on time/ Tedarik zinciri ortakları zamanında gerekli bilgi aktarımı değil	
Port or terminal productivity being below expectations (loading and discharging)/ Liman veya terminal verimlilik beklentilerin altında olmak (yükleme ve boşaltma)	
Inappropriate empty container transportation/ Sakıncalı boş konteyner taşımacılığı	
Lack of flexibility of fleet size and designed schedules/ Filo büyüklüğü esneklik ve dizayn programları eksikliği	
Damage to containers or cargo due to terminal operators' improper loading/unloading operations/ Nedeniyle, terminal operatörlerinin yanlış yükleme / boşaltma operasyonları için konteyner veya kargo hasar	
Damage to ship or quay due to improper berth operations/ Nedeniyle yanlış yataklı operasyonları gemi hasar veya iskele	
Change of currency exchange rate during payment process/ Ödeme işlemi sırasında döviz kurunun Değişim	
Payment delay from partners or shippers/ Ortakları veya nakliyatçılar gelen ödeme gecikmesi	
Suppliers or Shippers bankruptcy/ Tedarikçiler ve Shippers iflas	
Financial strength and Liquidity of 3PL provider or customers/ Mali gücü ve 3PL sağlayıcı veya müşteri Likidite	

Table 17. Problem specific risk factors

Risk factors	**Answer**
Outsourcing activities/ Outsourcing faaliyetleri	
Damage caused by transporting dangerous goods/ Tehlikeli malların taşınmasında kaynaklanan hasarlar	

Table 18. Decision making risk factors

Risk factors	**Answer**
Dependency on a single source of supply as well as capacity and responsiveness of alternative suppliers/ Arz tek bir kaynak üzerinde bağımlılık yanı sıra kapasite ve alternatif tedarikçilerin yanıt	
Business risk from shipping cycles, decisions about buying, selling or chartering ships/ Nakliye döngüleri, gemi, satın alma satış veya kiralama konusunda kararlar İşletme riski	
The decision maker's detailed knowledge/skill/experience/biases of the overall risk framework and issues involved therein/ Karar vericinin detaylı bilgi / beceri / deneyim / genel risk çerçevesi önyargıları ve sorunlar burada yer	
Miss-investments or over-investments (if investments completed inadequately in wrong moment)/ Miss-yatırımlar veya aşırı yatırımların (yatırımlar yanlış anda yetersiz tamamlandı ise)	

Thank you for your response!

Appendix C: Questionnaire survey forms (Quantitative data collection)

Containerships Group Ltd

Questionnaire Survey for Employees

* Required

1. **First name, last name (optional):**

_____

2. **Main operational region:** *
   Mark only one oval.

   - ◯ Algeria
   - ◯ Libya
   - ◯ Tunisia
   - ◯ Turkey

Page 2 - Environmental and Industry risk factors

How do you rate the likelihood and consequence level of the following risk factors? Please Note that:
In Likelihood level: 1= Rare, 2= Unlikely, 3= Possible, 4= Likely, 5= Almost Certain.
In Consequence level: 1= Insignificant, 2= Minor, 3= Moderate , 4= Major, 5= Catastrophic.

3. **Env_1. Natural disasters and Fire** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood	◯	◯	◯	◯	◯
Risk Consequence	◯	◯	◯	◯	◯

4. **Env_2. War, terrorism and political uncertainty** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood	◯	◯	◯	◯	◯
Risk Consequence	◯	◯	◯	◯	◯

5. **Env_3. Processing documents being detained by government departments (e.g. customs)** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood	◯	◯	◯	◯	◯
Risk Consequence	◯	◯	◯	◯	◯

6. **Env_4. Port congestion (unexpected waiting times before berthing or before starting loading/discharging)** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

7. **Env_5. Unstable weather** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

8. **Env_6. Oil price rise** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

9. **Env_7. Cargo being stolen from sealed containers** *
   Scale is
   Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

10. **Env_8. Excessive handling due to border crossings or to change in transportation modes** *
    Scale is
    Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

11. **Ind_1. Industrywide capacity utilization** *
    Scale is
    Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

12. **Ind_2. Number of customers** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

13. **Ind_3. Competitive uncertainty** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

14. **Ind_4. Product value** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

15. **Ind_5. Demand and supply uncertainty** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

Page 3 - Organizational risk factors

How do you rate the likelihood and consequence level of the following risk factors?

16. **Org_1. Labor productivity being below expectations. Due to e.g. unsafe work place, dispute, strikes** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

17. **Org_2. Using different communication channels in the supply chain and consequently increasing the time of information transmission (e.g. telephone, e-mail, EDI)** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

18. **Org_3. Lack of information security during the information flow** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

19. **Org_4. Information asymmetry/incompleteness** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

20. **Org_5. Lack of information standardization and compatibility** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

21. **Org_6. IT infrastructure breakdown or crash** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

22. **Org_7. Unsuitable human operation on IT infrastructure** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

23. **Org_8. Unsuitable human operation on application software** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

24. **Org_9. Supply chain partners not transmitting essential information on time** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

25. **Org_10. Port/terminal productivity being below expectations (loading/discharging)** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

26. **Org_11. Inappropriate empty container transportation** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

27. **Org_12. Lack of flexibility of fleet size and designed schedules** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

28. **Org_13. Damage to containers or cargo due to terminal operators' improper loading/unloading operations** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

29. **Org_14. Damage to ship or quay due to improper berth operations** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

30. **Org_15. Change of currency exchange rate during payment process** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

31. **Org_16. Payment delay from partners or shippers** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

32. **Org_17. Suppliers or Shippers bankruptcy** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

33. **Org_18. Financial strength and Liquidity of shipping company/customers** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

Page 4 - Problem specific and Decision making risk factors

How do you rate the likelihood and consequence level of the following risk factors?

34. **Pro_1. Outsourcing activities** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

35. **Pro_2. Damage caused by transporting dangerous goods** *
Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

36. **Dec_1. Dependency on a single source of supply as well as capacity and responsiveness of alternative suppliers** *

Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

37. **Dec_2. Business risk from shipping cycles, decisions about buying, selling or chartering ships** *

Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

38. **Dec_3. The decision maker's detailed knowledge/skill/experience/biases of the overall risk framework and issues involved therein** *

Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

39. **Dec_4. Miss-investments or over-investments (if investments completed in inadequately in wrong moment)** *

Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

40. **Dec_5. Pricing Procedures and the risks associated with them** *

Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

41. **Dec_6. Lack of innovation and innovative culture inside the organization** *

Scale is
Mark only one oval per row.

	1	2	3	4	5
Risk Likelihood					
Risk Consequence					

42. **Please describe shortly if you have any solution, comment or strategy to mitigate the risks and improve the performance in your functional area.**

_____

_____

_____

_____

_____

Appendix D: Average risk likelihood and consequence for shipping company

Risk Factor	Average Risk Likelihood	Average Risk Consequence	Risk Factor	Average Risk Likelihood	Average Risk Consequence
Env_1	2.08	2.24	Org_8	1.76	2.28
Env_2	1.8	1.92	Org_9	2.04	2.48
Env_3	2.28	2.28	Org_10	2.28	2.4
Env_4	2.36	2.44	Org_11	1.84	2.12
Env_5	2.16	2.28	Org_12	1.92	2.2
Env_6	2.8	2.6	Org_13	2.6	2.56
Env_7	1.64	2.28	Org_14	1.68	2.2
Env_8	1.56	1.56	Org_15	2.88	2.68
Ind_1	2.28	2.32	Org_16	2.68	2.56
Ind_2	2.76	2.84	Org_17	1.76	2.32
Ind_3	2.6	2.68	Org_18	2.32	2.44
Ind_4	2.72	2.76	Pro_1	2	2.16
Ind_5	2.52	2.48	Pro_2	1.72	2.28
Org_1	2.12	2.4	Dec_1	1.92	2.2
Org_2	2.24	2.04	Dec_2	2.4	2.56
Org_3	1.84	2.28	Dec_3	1.76	1.96
Org_4	2.28	2.52	Dec_4	2.32	2.48
Org_5	2.08	2.24	Dec_5	2	2.4
Org_6	2.08	2.92	Dec_6	2.12	2.32
Org_7	2.04	2.36			

Appendix E: Average risk likelihood and consequence for customer companies

Risk Factor	Average Risk Likelihood	Average Risk Consequence	Risk Factor	Average Risk Likelihood	Average Risk Consequence
Env_1	3.00	2.83	Org_8	2.50	2.50
Env_2	2.67	3.33	Org_9	2.00	2.33
Env_3	2.17	2.17	Org_10	2.33	2.50
Env_4	2.17	2.50	Org_11	2.00	2.33
Env_5	2.50	2.33	Org_12	2.17	2.00
Env_6	2.83	3.33	Org_13	2.50	2.83
Env_7	2.17	2.83	Org_14	2.17	2.67
Env_8	2.17	2.33	Org_15	2.67	2.83
Ind_1	2.17	2.17	Org_16	2.67	2.83
Ind_2	2.50	2.83	Org_17	3.00	3.00
Ind_3	2.83	2.50	Org_18	2.83	2.83
Ind_4	2.17	2.67	Pro_1	2.33	2.67
Ind_5	2.50	2.33	Pro_2	2.50	3.00
Org_1	2.33	2.67	Dec_1	2.17	2.33
Org_2	2.33	2.67	Dec_2	2.17	2.50
Org_3	2.17	1.83	Dec_3	2.33	2.50
Org_4	2.17	2.00	Dec_4	2.50	2.50
Org_5	2.17	2.83	Dec_5	2.17	2.33
Org_6	2.33	2.83	Dec_6	2.00	2.33
Org_7	2.17	2.17			