Risk and risk management in the shipping industry

An exploratory study of the Danish shipping industry and the perception of risk

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EXECUTIVE SUMMARY

The shipping industry is a major part of global trade, and an essential factor for people and economies around the world. The industry is moving the majority of goods in the world, and is thus a foundation for global trade and the value created from this trade.
As a consequence, the industry is inherently international, and as a result exposed to a wide variety of risks that include both threats and opportunities to the companies involved in shipping.

On the basis of this importance, the purpose of this research is to examine the present situation in the shipping industry in regard to these risks and the handling of them.
The industry is investigated to determine the most important risk factors shipping companies are facing today, and to understand the tools and strategies that are used in the handling of these risks. Furthermore, the purpose is to outline the perception of risk and risk management in order to develop the understanding of risk in the shipping industry.
This is done through the use of several methodic strategies, to enhance the empirical basis and generalizability of the study, and by comparing findings from literature with findings from companies involved in daily operations within the industry.

The research highlights the general approach to risk as being traditional and in accordance to the literature on the topic. However, it is also highlighted that the variation in perception and approach to both risk and risk management within the industry is immense. This is signified by the identification of a need for development in the field of risk management, and how this development can be cultivated by a heightened focus on supply chain risk management.

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1 INTRODUCTION

1.1 Problem formulation

Since the first cargo was moved by sea more than 5000 years ago (Stopford, 2009), much has happened in international trade. With the industrialization and later the increased globalization, international trade has risen to new heights. As shipping has always been a major player in trade, this development has also meant that the industry has grown significantly and become a crucial aspect of the world economy. 85 percent of the international trade carried out in the world today is estimated to be done by the means of a shipping service (Yercan & Yildiz, 2015) and therefore the industry as a whole is massively important to people, states and economies around the world. At the same time, this importance for global trade, and thus for everyone in the world, shipping is able to seriously affect the development of the world today. This can be in positive ways, by bringing opportunities and goods to distant regions, enriching everyone participating in trade. However, it can also be negative impacts for example through pollution from ships and accidents resulting in for example the Exxon Valdez oil spill in 1989 where more than 40 million liters of oil was released into an Alaskan bay, influencing the environment to this day (The Atlantic, 2014).

For Denmark, the shipping industry, entitled “The Blue Denmark”, is an essential part of the economy with a production of around 330 billion DKK a year and employment of more than 60.000 people in Denmark as of 2015. The majority of employees and revenue is generated through exports, and the industry has since the peak of the financial crisis in 2009 outperformed the overall Danish economy in terms of growth (The Danish Maritime Authority, 2016). Evident from these numbers, shipping as an industry is a major contributor to the Danish economy as both companies and employees pay taxes of the earnings and personal income generated through operations and production. This also means that, despite small size of the country, it is one of the world’s 10 biggest shipping nations (Marine Insight, 2017) and shipping has long been an integrated and important part of the Danish business environment especially symbolized by Maersk, the biggest shipping company in the world (Alphaliner, 2017). Shipping is thus a massively important industry to Denmark and the Danish economy, and because the country boasts a wide

variety of shipping companies it is a market that represents many of the same issues that are dealt with on a global scale.

As a result of this major role shipping plays in trade worldwide, companies engaged in shipping are inherently multinational. When companies become multinational and engage in global business, this also means an increased vulnerability towards various risks since a global company is exposed to more unknowns than one only doing business in a limited geographical area (Andersen, 2006). At the same time, shipping is considered to be a very capital intensive industry and companies require large capital in order to manage and develop their business. Shipping companies are thereby exposed to risks stemming from the global business environment they are a part of, and the capital requirements derived from the nature of the industry. Therefore, the high volatility of the shipping industry brings vast amount of risks to all actors involved in the supply chain of the shipping industry.

Due to the importance shipping has to global trade and the world, mismanagement of these risks could have immense consequences and risk management initiatives can be a way to address, mitigate and utilize the various risks any given organization faces. However, despite the many risks in the shipping industry and the importance shipping holds to the global market, the literature on the risk behavior of shipping companies is very limited (Wang, et al., 2014). This is despite the fact that risk management has evolved to become an integral part of most larger organizations and spans from focusing on specific risks or hazards and the insurance against these, to focusing on specific types of risks such as financial risks. Risk management has even developed into frameworks that include entire organizations or even supply chain networks (Andersen, et al., 2014).

The development in risk management has been exponential, just as the development in trade and shipping has developed to become bigger and more complex. Shipping has become an industry faced with a multitude of risks and therefore it is essential to address the literature gap identified and develop an overview of the risks shipping companies face today as well as an insight into how shipping organizations approach and deal with the risks they face.

1.2 Research questions

Because of the importance shipping holds to Denmark, and the world in general, identifying and managing risks is essential for both the companies involved, the industry as a whole, the supply chains of the shipping companies, and the economies of trading nations around the globe.
Hence, research on the risks in shipping and the management of these risks is essential and this study will focus on investigating the perception and approach to risk and risk management in the shipping industry to map the current situation and reflect on potential improvements.
Based on this purpose, the following research questions have been formulated:

RQ1: What are the most important risk factors present in the shipping industry today?

RQ2: How are shipping companies approaching and dealing with the risks they are facing today?

2 METHODOLOGY

This chapter will be focused on the methodology of the study as a whole, as well as the literature and theoretical basis on which the study is based. The goal of this chapter is to develop the theoretical basis through a review of the literature and to develop the research design of the project whereby explaining the methodological choices and the research structure. The chapter will start with developing the research philosophy and approach, to create the basis for the empirical study. The methodological approach is based on the "Research Onion Model" developed by Saunders et al. (2009) as this provides a comprehensive framework for all steps in the development of a research design.

After the development of the research design, will follow a review of the literature on risk management, on risk management in shipping and on supply chain risk management in order to cover three perspectives of risk management and create the theoretical basis for the further research.

2.1 Research design

According to Saunders et al. (2009), research philosophy is an *"over-arching term that relates to the development of the knowledge and the nature of that knowledge".* The chosen research philosophy thus defines the general principles through which researchers view the world and approach a given study. This philosophy is also what underpins the approach to method and strategy throughout the study and the techniques used in both data collection and analysis.

The framework for methodology presented in figure 1 illustrates how the philosophy helps identify the appropriate research approach which in turn is deciding on the strategy chosen and onwards. This part of the chapter will follow the same approach and begin with research philosophy, hereafter research approach, strategy, time horizons, choices and techniques.

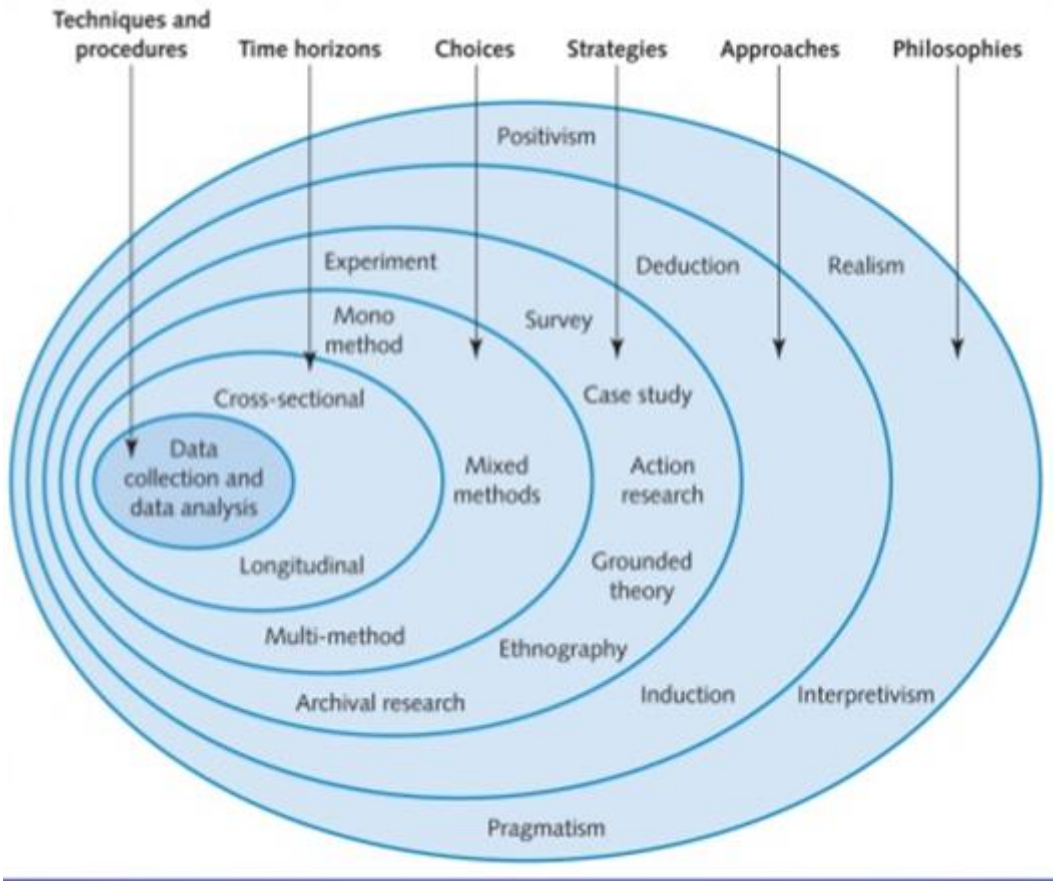

Figure 1 - Research Onion Model (Saunders, et al., 2009)

2.1.1 Research philosophy

Saunders et al. (2009) distinguish between four research philosophies in the field of business management: positivism, realism, interpretivism and pragmatism paradigms.

The research in this study will be performed through the pragmatic paradigm, which instead of choosing between polar philosophies of positivism and interpretivism, perceives reality as external and multiple and intents to make choices focusing on what would best enable answering a research question. The ontological standpoint taken in this study is that of a subjectivist view, since all findings will undoubtedly be influenced by subjective views in either respondent of analysist, perhaps even both. However, by using a pragmatic epistemology, it will be possible to obtain knowledge from either, or from both, observable phenomena and subjective meanings. Through this combination of subjectivity and pragmatism it thus becomes possible to gain valuable insights from both angles, while also explaining a certain degree of potential variance to the reliability of the study since subjective opinions are influencing any findings.

By integrating different perspectives in this study, namely an organization perspective, industry perspective and supply chain perspective, the phenomena observed can be interpreted through several perspectives and thus several subjective realities that will add to the value of the observations. By utilizing the pragmatic paradigm it is possible to adopt both objective and subjective points of view and use these in further analysis, and this is thought to be the most appropriate approach to this study as perceptions throughout the field of risk management and the industry of shipping are diverse.

2.1.2 Research approach

In regard to research approaches, the "Research Onion Model" advises that there are two types of approaches: the inductive and the deductive approach.

In the deductive approach, established theories and laws form the basis and the desired outcome of the research is reached through available facts. This approach is usually named as a "top down" approach (Saunders et al., 2009).

On the other hand, the inductive or the so-called "bottom-up" approach appeals to the *"development of a theory as a result of the observation of the empirical data"* (Saunders, et al., 2009).

Considering the above information, it is natural that the approach chosen here is the deductive approach since the starting point of the research is within the theory established in the fields of risk management and shipping. Already established theories from the literature and facts from the shipping companies will form the basis of the research.

However, part of the analysis will heavily rely on empirical data and this argues for a more inductive approach. The findings from the empirical study will however act as a test of the initial deductive findings from the literature and the established approaches by shipping companies to obtain reliable answers to the research questions, and as such the approach must be defined as a deductive research approach.

2.1.3 Research strategy and method

The research strategy is the approach or approaches taken towards collecting data. Research strategies are not mutually exclusive but can rather add several advantages such as the possibility

for triangulation, improved generalizability and improved interpretation of results. When several research strategies are applied, a multi-method is being used. This can be either solely within qualitative strategies, solely quantitative strategies, or it can mix both qualitative and quantitative strategies.
Further, studies can have three different purposes that must be determined initially in order to further develop the strategy and method used. The three forms are exploratory, descriptive and explanatory. However, also the purpose can take on multiple hybrid forms and include more than one of the three purposes (Saunders , et al., 2009).

When considering the purpose of this study, it is expected that the findings will be exploratory and descriptive as this is the purpose illustrated by the research questions as well as the motivation behind them.
The research will be exploratory, because the literature available on the risk factors influencing the shipping industry and their strategies for handling them is very scarce. The research will further be descriptive because the aim is to provide a thorough description of the risk management phenomenon within the general business, shipping industry field and supply chain.

Based on the purpose of the research and the exploratory and descriptive nature of it, it was decided that three out of seven available research strategies should ensure the procurement of the necessary information to answer the research questions.
First, the archival research strategy will be used to gather and analyze the available risk management and shipping literature, as well as secondary data on the Danish shipping companies in order to perform a literature review and a preliminary shipping risks screening.
Secondly, the survey strategy will be used in the form of an online questionnaire, which will be constructed on the basis of the preliminary shipping risks screening and then discussed with one of the companies to see if it is understandable from a working professional's point of view.
Finally, the case study strategy will be applied through in-depth semi-structured interviews with several Danish shipping companies. Furthermore, multiple case studies should help to understand different cases and contexts in regard to attitude towards various risk factors and the application and use of risk management practices within the Danish shipping industry.
All three strategies will assist in delivering the purpose of the research and thus the answering of

the research questions. Further, the strategies will all help through; data triangulation to arrive at a more general and reliable result, facilitating the use of another research strategy and complimentary use of several strategies to include various aspects and thereby increase understanding of the topic.

This means that the study will be based on a mixed-model which is defined by Saunders et al. (2009) as being the combination of both quantitative and qualitative data collection strategies while also using both quantitative and qualitative data analysis to analyze all data collected. The research design thus becomes one with both an exploratory and a descriptive purpose, which also uses several research strategies that complement each other and mix both quantitative and qualitative collection and analysis tools to best answer the research questions. This method fits well into the overall philosophy of pragmatism as this allows for use of the relevant data collection and data analysis tool based on the situation rather than a preliminary decision.
Furthermore, this study can function as a test of how well a combination of a secondary data desk research, an online questionnaire and semi-structured interviews would serve for the purpose of studying Danish shipping industry. This could in turn serve as a pre-test for future studies within the field, ideally on a global scale and thus help the future research in more than one way. The findings from the use of this method will be discussed later in the paper.

2.1.4 Research time horizon

The next step is to define the time horizon of the research and this would be a straightforward choice towards a cross-sectional type of studies, meaning *"the study of a particular phenomenon or phenomena at a particular time"* (Saunders, et al., 2009).
This is because longitudinal studies of the risk management within the Danish shipping industry would require more time than available in order to document any changes in the field and hence to be able to add value to the research. Further, more extensive agreements with shipping companies would be needed as several interviews would have to be undertaken to document any movements within the research topic. This would require a higher investment from the companies as well, and this was not a possibility for all included either.
Consequently, a cross-sectional time horizon is selected as the appropriate time horizon for this

investigation. With this, most of the "research onion" is in place, and only the final layer, data collection and data analysis remains.

2.1.5 Data collection and data analysis

Different kind of secondary data will form the basis of the theoretical framework and the preliminary shipping risks screening. The following key words are going to be used during the literature search in order to find appropriate books, articles and research papers:
risk management, shipping, risk management in shipping, supply chain, supply chain risk management.
The preliminary shipping risks screening will be based on companies that are part of the Danish maritime organization; Danish Shipowners Association. The members of this organization will be researched and screened to identify which include risks and risk management within either annual report or company website. The screening will reveal the risks that are mentioned most often and this will in combination with the literature reviews form the basis of the further empirical data collection.

Both quantitative and qualitative methods will be used for the primary data collection as well as data analysis in the study, as previously mentioned with the use of the mixed-model method. The quantitative method is an online questionnaire, while semi-structured interviews are perceived as the qualitative method. Two methods are used to get primary data in order to increase practical value of the research, while also to serve for the purpose of data triangulation, facilitation and complementarity of one another.
The analysis of the empirical findings will be using both quantitative and qualitative tools without accounting for what data is being analyzed as the purpose of the research is to develop an understanding of the industry and the perception of risk by using all available information. Thus a limitation in data analysis methods are thought to be inhibiting rather than valuable, and will not be restrained regardless of the data being analyzed.

2.2 Data and research quality

The main concerns regarding credibility of both method and findings are reliability, validity and generalizability. These aspects of quality will be covered in this section, on after the other, focusing on the purpose of each, potential threats to each aspect, and means to ensure quality in this study.

Relevance of the collected secondary data will be ensured by testing each literature item to be supportive towards covering one or more research topics. While data triangulation approach will be applied in order to ensure validity and credibility. Further, credibility of the research findings will be assessed in terms of reliability, validity and generalizability.

Reliability is related to the consistency of results and data collection methods. It is the questions of being able to verify results and whether other researchers with the same basis and starting point would have found similar results.
Reliability can be affected by three threats: participant error, participant bias and observer bias (Saunders, et al., 2009).
Participant error could happen in case of an employee answering for example a questionnaire, is very busy and does not have enough time to evaluate the questions properly. Because of this threat, it has been attempted to reduce this specific threat by providing a one month time frame for shipping companies to fill in the questionnaire.
Continuing, participant bias could influence research findings in case of interviewees striving to signal what the company and potential manager expects due to various reasons. Therefore, according to a request of some of the companies and in order to prevent this specific threat, it was decided to ensure anonymity of all of the respondents taking part in the questionnaire and interviews, except the company named Unifeeder, that has agreed to participate in the pre-test and had no issues of publicity.
Finally, the observer bias might affect findings of the research as interpretation of the findings will be subjective to the authors' personal views and experience. This is a real aspect of any research, especially when incorporating qualitative means of data collection and analysis. This is also considered in the research design and taken into account throughout the analysis as subjectivity plays a substantial role in the results. The research design has accordingly been constructed so

that both subjectivity from respondents and authors are considered, as well as objective analysis of the data and thus the industry. This is done in order to increase credibility while also mitigating the threat of bias by accounting for the bias that inevitably will be present.

Validity is concerned with the accuracy of the study. That is, if and to what extent the findings are about what they appear to be about, and if what is investigated is what is intended to be investigated. As such this is about the conclusion and whether this is answering the questions asked and is thus valid.
According to Saunders et al. (2009), relevant threats to validity of research findings could be: a major accident or policy changes prior beginning of the study, which might influence responses; opportunistic behavior of the respondents, who may provide false information in order to gain potential benefits for own company; and ambiguity about causal direction, when cause and effect relationships are hard to identify and specify in terms of direction.
The first threat would be reduced by asking appropriate questions before the interviews. Yet, it may still affect online questionnaire responses.
Mitigation of the second threat would be mainly ensured through data triangulation and guaranteed anonymity of the respondent companies.
The last threat appears the most challenging to mitigate due to a substantial number of subjective opinions which might have different causal direction. This is a threat to this study as well since there may be many individual subjectivities that are influencing respondents within each company, just as the direction of causal relationships may be varying in different organizations.

Generalizability is the concern about the applicability of the study and the findings, and whether these are able to be projected to other cases in similar situations.
As the purpose of this study is to state something general about the shipping industry based on a sample of Danish shipping companies, generalizability is a quality concern that must be addressed. Due to the relatively small sample size and the inherent subjectivity of the findings, the generalizability of this study is not complete. Thus it will be difficult to argue for complete generalizability in the Danish shipping industry, even more so in the global industry, based on a study of only some Danish shipping companies. Because of this it is suggested that the results and

the applied method should be further tested for generalizability and robustness through future studies that may be able to validate findings and as such enhance the generalizability of the study.

2.3 Literature review

Any company in today's competitive world, whether a big multinational or a smaller national company, cannot ignore the global business environment as this has macro and micro effects that can affect the environment in which a company operates. Thus all companies must be aware of the risks stemming from the global business environment regardless of size. In the global business environment there are many risks stemming from various uncertainties such as political and social, to economic and natural (Miller, 1992). Risk management comes in many forms and can be more or less extensive and integrated, and cover one or more of these types of uncertainties.

In supply chains, the management of various forms of risk becomes even more complex than in one organization. Suddenly there are many different companies and various agendas to account for and an even bigger exposure to external factors. The need for risk management becomes especially apparent in an industry that is international by definition such as the shipping industry. Here international trade and dealings happen every day, and thus the exposure to the global business environment is more direct and frequent than in many other industries.

This section is dedicated to a focus on the existing literature on risk management which is going to act as the basis of the research project. It will start with a focus on the literature on general risk management and the development over time. The section will since turn to the literature focused especially on risk management in the shipping industry and finish with a risk management of a supply chain where the craft becomes more complex.

2.3.1 Risk management

Risk management has evolved a lot through time, and in many different directions. Certain aspects have grown to become institutionalized as both a tool and an approach to risk management. Namely, this is what is categorized as traditional risk management and the accompanying tool of risk mapping (Power, 2007). This can be a weakness as the approach may become superficial and lack targetability. Other approaches to risk management are more specific and aimed towards a specific issue in the company, for example project risk management as touched upon later (Andersen, et al., 2014). Many versions of risk management have thus developed, but risk management in some form has become an integral part of any bigger company, and a necessary

consideration for any organization.
These variations occur because different companies encounter different types of risk based on factors such as industry, strategy, environment, organization and more, and even the same types of risk can affect companies in very different ways, and as such the variations in both focus and perception of risk management is seen in the literature as well (Borghesi & Gaudenzi, 2013). For the purpose of this project, there are several concepts that are required to be defined, and this section is focusing on this particular task.

Traditionally, risk is perceived as being the risk of downside losses, something which is reflected by both dictionaries and several technical definitions according to (Hillson, 2001). This view of risk is what has created the risk matrix seen in figure 2, which is a common tool in risk management used to assess risks based on their probability and impact on an organization (Olsen & Wu, 2008). By using this framework of risk assessment, it becomes easier for managers to distinguish and analyze risks and it is thereby helpful in the prioritization that is necessary for any organization with limited resources and no possibility of addressing all risks (Olsen & Wu, 2008).

Naturally, much of the literature on risk management has a similar traditional view on risk. Risk is defined as the chance of any undesired consequence by Harland, et al. (2003) as one example of the traditional definition and view of risk. Before that Mitchell (1995) describes risk as containing different types of losses and adds that the risk of any loss is a combination of the likelihood and impact of that particular loss, a definition very much in line with the traditional view and the risk matrix. Manuj and Mentzer (2008) use the same view and builds on this definition by adding the aspect of qualitative losses as part of their definition of risk.

As such the traditional view of risk management is that risk is the risk of losses or other consequences and that it is best assessed by a function of probability and impact.

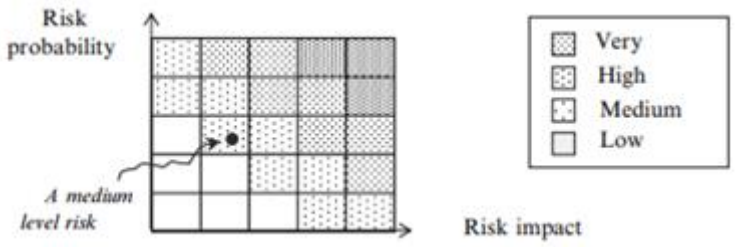

Figure 2 - Traditional risk management (Olsen & Wu, 2008)

However, other authors have different views on risk and are including upside potential as well as downside threats when defining risk (Hillson, 2001). March and Shapira (1987) argue that risk is measured by the variance of the probability of possible gains and losses connected to a particular outcome and they thus include all outcomes, positive and negative in their perception of risk. This definition is backed by theory on decision-making in which risk is defined as: "*a measure of the range of possible outcomes from a single totally rational decision and their values, in terms of upside gains and downside losses*" (Mangan & Lalwani, 2016)

As argued by Andersen, et al., (2014) a definition of risk solely focused on the downside potential reduces risk management to risk mitigation, and as the researchers believe risk management entails the management of both threats and opportunities. Hence it was decided to include the upside potential, as well as the downside threats, in the risk definition of the project. Because of this, the definition of risk used in this paper will be the same as that by Mangan and Lalwani (2016), which was stated above.

At the same time this gives us the opportunity to dwell on the difference between risk and uncertainty, and thus define uncertainty as well. For this purpose, a classic description of the difference between uncertainty and risk is still relevant and satisfactory, since Knight (1921) distinguishes between these two by defining risk as random outcomes with knowable probabilities and uncertainty as random outcomes with unknowable probabilities. This means that risk is something that can be measured and attempted to manage, whereas uncertainty is something that is uncontrollable. The objective here is not to determine the truth in Knight's objectivistic approach, or to discuss if risk and measurement of risk is inherently subjective as others argue (Holton, 2004), but simply to use the definition of uncertainty put forward by Knight as random

outcomes that cannot be measured or managed. Another highly useful description of uncertainty comes from former United States Secretary of Defense Donald Rumsfeld who said:

"*There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns – the ones don't know we don't know.*"

(The Atlantic, 2014)

This makes a similar distinction between risk and uncertainty, as risk being known unknowns and uncertainty being unknown unknowns.

When moving on to the definition of risk management itself, it becomes necessary to include the previous definition of risk, but also to consider the development of risk management as a field. Risk management as a field developed in the 1950's as a tool for managing industrial risks that entailed all events capable of interfering with production activities (Borghesi & Gaudenzi, 2013, pp. 26-27). This original view on risk management is similar to what is labeled traditional risk management by Andersen et al. (2014) and Power (2007) and attempts to broadly cover generic risks threatening the overall company. Risks that are usually covered by traditional risk management are accidents and incidents such as fires, floods, personal accidents and the like. Traditional risk management does however not insure a company against exchange rate risk, commodity risk, interest rate risk and other financial risks. For this purpose, financial risk management developed; with a focus on covering an organization against the financial risks it encounters, often through hedging with the use of financial instruments (Andersen, et al., 2014), as well as the buying and selling of insurances, and thus the finance function of an organization became the first center of risk management (Borghesi & Gaudenzi, 2013, pp. 26-27). Further, individual projects required their own form of risk management and project risk management developed from this need. This focuses on limiting the downside risks of a given project, and is used to deal with specific risks for investment projects such as takeovers for example (Andersen, et al., 2014).

The above mentioned forms of risk management were the basis of early risk management, and all focused on certain types of risk so that organizations could choose which to protect against and to

focus risk management efforts. In the 1970's and 1980's however, a focus on integrated risk management developed as some authors argued for the importance of a centralized approach to risk management, where the responsibility for managing all risks faced by the company would be placed (Greene & Serbein, 1983). This new approach to risk management gave rise to the enterprise risk management (ERM) as a way of operating with a more holistic and comprehensive risk management strategy, in order to capture the risks that lay hidden within the company's operations (Andersen & Schrøder, 2010). The aim of ERM was to create an overview of risks and respond with a coordinated effort to limit the risk exposure of the company and thereby cover against both internal and external risks (Andersen, et al., 2014). The rationale behind ERM, as argued by (Nocco & Stulz, 2006) was to manage risk on an executive level and incorporate risk management into the strategy of the company, and to use effective ERM as a source of competitive advantage.

However, ERM also has some limitations and drawbacks since there is not only a need for risk management to be organization-wide, but it must also be effective and for this ERM is not sufficient (Andersen & Læssøe, 2014). By focusing solely on ERM, organizations may be missing weaker signals, or signals that are not searched for, and as such it is essential to utilize multiple perspectives, since such approach will likely reveal "a bigger picture" (Schoemaker & Day, 2009). This becomes especially important in a dynamic and developing world defined by tough competition and continuous innovation and disruption.

As an answer to the limitations of ERM, strategic risk management (SRM) has evolved and taken on a central role in modern risk management. SRM is an extension of ERM to also cover strategic risks. These entail technological changes, competitor moves, political changes, changes in consumer behavior and other changes that are also changing the strategic foundation of the company or even the industry (Andersen & Schrøder, 2010). SRM evolved as a response to ERM not being able to cover the uncertainty in today's world and offered a focus on strategic responsiveness. This strategic responsiveness is truly what creates value, according to Andersen and Læssøe (2014), by identifying and mitigating more risks, and by uncovering and utilizing new opportunities. Thus, SRM is the most extensive form of risk management, attempting to cover the whole spectrum of risks a company faces, from natural disasters to disruptive technologies or

competitors, and viewing risks as not something to solely evade but to embrace and use to create value. Despite the emergence of SRM to cover some of the flaws of ERM, the idea of risk management and being able to identify the risks as well as evaluate and address them is a tall task, and one influenced by many factors such as overconfidence, groupthink and anchoring (Kaplan & Mikes, 2012). Especially anchoring and the influence it has on managers' and organizations' perception of risk, which in turn can also affect the ability to manage various risks due to the implications this is shown to have on the basic decision-making process (Furnham & Boo, 2011).

Despite the potential limitations of risk management and the inability to identify any and address all risks, as well as putting aside subjective views and influences, it is believed that risk management is a vital part of any competitive organization operating in the globalized world of today. Because of this, and because of conviction that risk management entails the management of both upside and downside potential, this paper uses the risk management definition suggested by Stulz (1996):

> "*The main goal of corporate risk management is to protect a company's ability to carry out its business plan and exploit its comparative advantages in risk-bearing by limiting the possibility (consequences) of catastrophic 'lower tail' outcomes*".

2.3.2 Risk management in shipping

Shipping is a very volatile and inelastic industry that requires skilled management to maximize profits during upturns and to minimize losses during downturns. For instance, in the period from 2003 to mid-2008, freight rates have increased tremendously by almost 300 per cent. However, this was followed by a rough drop of 95 per cent over the last quarter of 2008 (Alizadeh & Nomikos, 2009). Such extreme changes in revenues, operating cash flows, and asset values create vast amount of risks for shipping companies. Therefore, it is surprising that the literature on risk management in shipping, and specifically on the risk-taking behavior of shipping companies is very limited (Wang, et al., 2014). The risk management could increase control and minimize exposure to those risks and Alizadeh and Nomikos (2009) have identified four reasons, which could justify the use of risk-management strategies.

The first reason is capital structure and the cost of capital, as inability of a company to serve its debt is considered to be the main cause for insolvencies. We will discuss financial risks and tools to manage those risks in more details later in this chapter.
The second reason is defined as benefits of public listed companies. There is practical proof that risk management initiatives decrease variability of share prices and that companies actively employing risk management strategies tend to outperform relative companies who do not manage their risks.
Going further, Alizadeh and Nomikos (2009) state taxes as the third reason to use risk management. The argument is that by reducing volatility of pre-taxed income (expected earnings), the company will also reduce volatility of the expected tax position, which in turn should result in higher expected after-tax income.
The last reason is bankruptcy costs. Administration costs associated with bankruptcy, loss of customers and employees and restrictions imposed on the operations of the company are all among direct and indirect costs of bankruptcy. Furthermore, as stated above, risk management reduces volatility of expected earnings, meaning that it also decreases the probability of a company going bankrupt. Therefore, the use of risk management could increase the value of a firm.

Being too optimistic and neglecting contingency plans could easily lead shipping companies to bankruptcy as happened with Danish company named Copenship in 2015 (Reuters, 2015) and the biggest global case lately – bankruptcy of Hanjin Shipping (South-Korean container-shipping company operating globally) after creditors were unable to agree on how to reschedule company's debts in 2016 (Porter, 2016).
Furthermore, big shipping companies are by definition multinational, and often operate on a global scale where they are facing a multitude of pressures from various regulators and stakeholders in every country in which they operate. In this way they face many of the same risks as other global operators and must attempt to manage these risks. Examples are financial risk, market risk and hazards in the form of natural events. At the same time the shipping industry is a highly capital intensive one, and therefore the need for risk management becomes even bigger since multinationalism in capital-intensive industries often create more risk (Andersen, 2012).
All these factors are aspects of the shipping industry that encourages management and

consciousness about the various risks present in the industry that may influence any given company in a positive or negative way.

Shipping risk classifications

As the necessity of risk management in shipping has been made clear, the next step is to identify and classify risks inherent to the shipping industry. Hence, for the purpose of risks identification and categorization it has been decided to analyze available secondary data sources and to speak with industry professionals. As the outcome, two shipping risks classifications were found in the literature, and for comparison two shipping risks classifications are presented from the annual reports of Danish shipping companies.

In this way, the literature and the industry is combined in the initial creation of a list of risk factors in the shipping industry.

RISK TO OPERATING CASH FLOWS	RISK TO CHANGES IN THE MARKET VALUE OF ASSETS
· Freight rate risk	· Impairment losses
· Volatility of operating costs	· Pure risk
· Counterparty risk	

Table 1 - (Albertijn, et al., 2011)

PRICE RISK	CREDIT RISK	PURE RISK
· Freight rate risk	· Counterparty risk	· Natural disasters
· Operating-cost risk		· Collision
· Interest rate risk		· Technical failure
· Asset-price risk		· Human error

Table 2 - (Alizadeh & Nomikos, 2009)

LONG-TERM STRATEGIC RISKS	INDUSTRY AND MARKET-RELATED RISKS	OPERATIONAL AND COMPLIANCE RISKS	FINANCIAL RISKS
· Political risks · Substitution of oil · Technological changes	· Macroeconomic development · Freight rate fluctuation · Bunker price fluctuations · Sales and purchase price fluctuations	· Compliance with relevant maritime regimes · Vessel utilization · Safe operation of vessels · Terrorism and piracy · Availability of experienced seafarers and staff · Compliance with environmental regulations · Stability of IT systems · Fraud · Insurance coverage	· Funding and liquidity · Interest rate risk · Currency risk · Counterparty risk ·

Table 3 - (TORM A/S, 2017)

COMMERCIAL RISKS	FINANCIAL RISK
· Fluctuations in ship values	· Funding and liquidity risk
· Bunker price risk	· Credit (counterparty) risk
· Fluctuations in freight rates	· Interest rate risk
· Piracy	· Currency risk
· Oil spills	· Capital management risks
· Total loss of the vessel	
· Insurance coverage	
· Stability of IT systems	

Table 4 - (Dampskibsselskabet Norden A/S, 2016)

Starting from the classification by Albertijn et al. (2011) classification illustrated in table 1, it is seen that there are two main groups of risks for a shipping company: risks from changes in operating cash flows and risks from changes in the market value of assets.

The first group includes freight rate risk, volatility of operating costs and counterparty risk. Being the main source of income, freight rates constitute the biggest operating exposure for a shipping company and hence fluctuation of freight rates has a direct impact on a company's profitability. Moving forward, the category of volatility of operating costs includes changes in bunker prices, interest rates and exchange rates. Fuel costs account for 20-25 per cent of the total voyage costs and due to its alignment with world oil prices, costs of bunker fuel are quite volatile, and therefore represent a major source of risk. Changes in interest and exchange rates are also important as they may cause cash flow and liquidity problems, especially for distressed shipping companies. The final category, counterparty risk (also credit risk) is related to the uncertainty that counterparties will perform its financial obligations in full and on time.

Continuing with the group of risks arising from changes in the market value of assets, the first factor is the risk of impairment losses. Considering that listed shipping companies must apply fair value accounting for the vessels on their balance sheets, fluctuations in the value of ships entail

large impacts on the loans that were taken with a ship as a collateral and value of a company in general. Lastly, the authors describe pure risk as the possibility of a reduction in vessel values from physical damage, accidents, and losses due to force major.

The next authors, Alizadeh & Nomikos (2009) divide risks into three categories which are named differently, but in fact cover same risks as described by Albertijn et al. (2011). The categories are: price risks, credit risks and pure risks. Price risks include freight rate risk, operating-cost risk, interest rate risk and asset-price risk. All of these risks along with the second category of credit risks were discussed earlier in the description of the risks listed by Albertijn et al. (2011) and need no further elaboration.
Elaborating on pure risks, the authors suggest that for a shipping company possible pure risks could be damages or loss of a vessel due to natural disasters, collision, technical failure or human error.

Going further, two frameworks used by larger Danish shipping companies are presented to expand the perspectives on risk management within the industry. This allows for a comparison between the literature and industry professionals and ensures that the initial list of risk factors that will be investigated is not based on only the literature or only the industry.
Analysis of the reports has shown that risk management initiatives are similar in both companies, yet the main difference is that TORM emphasizes attention to strategic and compliance risks and in total has four risk categories, while Norden classified all risks into two broader categories – Commercial Risks and Financial Risks. It is noteworthy that Norden's classification is mostly in line with the classifications from the literature. TORM on the other hand seems to perceive risk management in a more sophisticated manner and has added to its consideration such risks as political risks, substitution of oil, technological changes, macroeconomic development and compliance with relevant maritime and environmental regimes and availability of experienced seafarers and staff. Thus TORM is the input from the industry that adds other aspects to risk management and the general perception of risk. The risks TORM exclusively includes will be brought into consideration in the next steps towards the development of a list of risk factors in shipping.

Risk Management Strategies & Tools in the Shipping Industry

Having discussed different risks inherent to the shipping industry, it is also important to discuss what are the strategies and tools to manage those risks. In regard to general risk mitigation strategies, there are mainly four principal risk management strategies, namely: avoidance/elimination, reduction, transfer, and acceptance (Mullai, 2009). Yet, there are certain risk management tools and techniques that could assist shipping companies in coping with various risks. Albertijn et al. (2011) advises that the "integrated approach" to risk management is a combination of three different techniques that are used by companies in order to manage their risks:

1. Modifying operations
2. Employing financial derivatives
3. Adjusting capital structure

The purpose of the "integrated approach" is to gather all risks that a company is exposed to, and to then find the best combination of derivatives and capital structure adjustments in order to limit all remnant risks that cannot be better managed through minor operating adjustments. Diversification of vessel types and sizes, and longer time-charter contracts could be considered as examples of operations adjustments and may help shipping companies and ship owners to decrease overall risk of freight rate fluctuations. However, those operating strategies are considered to be inflexible and costly to implement as it is expensive and time-consuming to buy and sell vessels, while counterparty risk becomes major concern in case if a long time-charter contract is fixed at a high price and the freight market declines (Albertijn, et al., 2011). Meanwhile, the Bunker Adjustment Factor (BAF) is used as an operational tool to transfer the risk of fuel price fluctuation from shipowner to shipper. However, not many shippers appreciate BAF in their contracts and it is suggested that it could be eliminated through bunker hedging (Menachof & Dicer, 2010). Other operational techniques used to lower bunker costs could be shifts in bunker fuel grades to one with higher viscosity, modernization of propulsion system, hull designs and machinery, or slow steaming technique. These methods however also have downsides as older vessels mostly cannot deal with high viscosity grades, and thus improvement of vessel design can only be done on newbuilds (Notteboom & Vernimmen, 2009).

The second strategy of an integrated risk management approach is hedging and employment of financial derivatives, which is extensively utilized within the shipping industry. Forward Freight Agreements (FFAs), forwards, futures, swaps and options are recognized to be the most often used derivative instruments (Alizadeh & Nomikos, 2009) that should cover most financial and commercial risks to a shipping company. Considering that freight rate volatility is the largest exposure of a shipping company, the industry has invented a freight hedging mechanism called a Freight Forward Agreement, which was firstly introduced to the market in 1992 and which has since grown to an overall value of 125 billion USD in 2008. The second tool used to hedge freight rates is a Freight Option and the difference is that a holder of an option could either exercise the option or drop it, while FFAs are binding contracts. Nevertheless, in both cases a shipping company needs to pay a premium for using derivative instrument and that is the main consideration, when making the decision of whether to hedge or not (Alizadeh & Nomikos, 2009). Going further, bunker hedging is the next important financial risk management tool, where the core principle is same as with FFAs. However, for bunker hedging, companies do and should however use any kind of derivative instruments best suiting their needs (Alizadeh & Nomikos, 2009). Moreover, counterparty risk can be hedged through credit derivatives (Alizadeh & Nomikos, 2009) and ship value risks can be hedged through a Forward Ship Value Agreement (Albertijn S. et al. 2011). As such there are many possibilities for shipping companies to hedge a wide variety of the inherent and identified risks in the industry.
Concluding on the derivatives part, it is added that financial risks such as interest rate and exchange rate risks are also mitigated through derivative instruments, although the exchange rate risk could be naturally hedged if all transactions of a company are performed using the same currency. (Albertijn et al. 2011)

Finally, some risks could be managed by adjusting a company's capital structure. As mentioned, shipping companies require large capital and funding in order to sustain operation due to the expensive assets necessary. As such there are also many risk considerations coupled to this need for capital that differentiates the shipping industry from several other global industries in which companies also perform risk management in the forms of ERM and SRM. An example is that this need for capital, acts as a natural barrier for new market entrants in the shipping industry. Some of the specific added risk considerations due to the capital intensity of the industry are: ship value,

ship portfolio risk, container prices, scrap prices and equipment lifecycles. Derived from this capital intensity, there is also the question of financing and managing the risk of lending to finance operations (Albertijn et al., 2011).

Since 2007, the banking industry was severely affected by the financial crisis and this has impacted the shipping industry as well. Blocked access to capital markets has led to funding and liquidity difficulties for many maritime firms in the private sector which heavily relied on banks for capital (Wang, et al., 2014). Furthermore, debt capital has traditionally been the paramount source of external finance in the shipping industry as more than 80 per cent of external funding has been covered by debt finance (Drobetz, et al., 2013). In relation to this point, Albertijn et al. (2011) states that financing ships, shipping companies and shipping operations will be a key challenge in the maritime industry moving on. This means that shipping companies will be forced to raise capital through issuance of bonds and public equity, as most banks will no longer accept the risks inherent to the shipping industry on their balance sheets. Instead of acting like risk-bearing lending institutions, banks would most probably shift to be institutions that function more like investment banks and providing capital market solutions such as financial derivatives.

There are also positive sides as shipping bonds can provide borrowers with accommodative terms than loans from banks. However, investors should carefully analyze the default and liquidity risks, as the study of 50 shipping bonds issued during 1992-2004 has shown that 26 per cent of these bonds defaulted, which is a very high negative ratio (Grammenos, et al., 2008).

Another way for a private shipping company to raise capital is to go public. Sharp increase in freight rates during mid-2000s, has significantly increased investors interest towards shipping industry and was accompanied by a growing number of IPOs. Furthermore, effective risk management through hedging and financial derivatives might be able to decrease the need for capital by limiting exposures of a company. At the same time, it may reduce volatility of the operating cash flows and reassure potential lenders about firm's ability to avoid financial distress. (Albertijn et al., 2011)

Closing this section, the definition of risk management by Stulz (1996) previously determined to be the definition in this paper can be related to the shipping industry: shipping companies' management policies and capital structures should have as a goal to minimize the cost of capital and secure ability to make strategic investments at any given time. This is under the condition that

efficient acquisition, operation and maintenance of a fleet are considered to be the core competences of a shipping company (Albertijn et al., 2011).

2.3.3 Supply chain risk management

Supply chain management in shipping is considered to be a highly important competitive factor and a way to achieve competitive advantages through supply chain integration (Song & Panayides, 2012, pp. 101-125). This integration can lead to a better control of the value chain, cost advantages, better product offerings and also better risk management throughout the supply chain. Further, as the review of the literature on risk management in shipping suggests, the literature on the topic of risk management in the supply chain is not coupled to the shipping industry, leaving a gap in the literature despite the big influence the supply chain has to shipping in general. For this reason it is logical to include a perspective on supply chain risk management in order to couple this to the shipping industry, since supply chains and supply chain management is a vital factor of competitiveness in the industry, and as the literature on both supply chain risk management in shipping and shipping firm's risk-taking behavior is scarce.

Risk management must always consider both internal and external factors, but when done in supply chains it naturally becomes more extensive and complex than it already is when being performed only on a company's level. This is especially true due to the fact that global supply chains today are exposed to more risks than national or local supply chains in the past (Chopra & Meindl, 2013, p. 160). However, literature, techniques and experiences based on risk management in individual organizations are not always directly applicable to a supply chain context (Pettit, et al., 2010). Because the supply chains of many organizations are spread across the globe and involve various companies in different countries, as well as their suppliers in other countries, again, the supply chain of any international organization is exposed to a multitude of risks. These risks include economic risks in the form of exchange rates, duties and taxes, cultural risks, political risks and infrastructural risks which all may force a company to alter its strategy and impact its global operations (Mentzer, 2001). The above mentioned risks are all factors that can influence the supply chain and all organizations which are part of it, potentially leading to supply chain disruption which can result in major financial losses, negative impact on shareholder value and on operating performance (Macdonald & Corsie, 2013).

The objective of the supply chain is to maximize profit by balancing productivity and profitability in order to best source and move goods (Manuj & Mentzer, 2008). Because of this complex task it is essential that a supply chain is agile and able to adapt to changes in the environment and competition (Gligor, et al., 2015). Wieland & Wallenburg (2012) argue that supply chain risk management can help with agility and enhance it in order to improve the performance of organizations in the specific supply chain. This position is backed by Chopra and Sodhi (2004), who also highlight the need for responsiveness in the supply chain and that this responsiveness can be developed through supply chain risk management.

The challenge for managers when doing supply chain risk management is to mitigate risks in the supply chain, without decreasing profits for the company. Therefore the managers' job is similar to that of a portfolio manager in that the goal is to attain the highest possible profit for varying degrees of supply chain risk (Chopra & Sodhi, 2004). Indeed this is the task for any risk manager, but the task becomes more complex when performed for a whole supply chain.

A classic model on risk management includes three stages; risk analysis which is the process of preparing the risk management and analyzing the various risks. Risk evaluation is the stage in which the risks are compared and ranked so as to develop the optimal mitigation strategies for the identified risks, the last stage is risk management in which the decisions are made and the actual handling of the risks take place. This model is a cyclical process and re-assessment is an essential part of it (Zsidizin & Ritchie, 2009, pp. 86-98). Another step-by step model for risk management in supply chains is proposed by Manuj and Mentzer (2008) who develop a five-step cyclical process including: risk identification, risk assessment and evaluation, selection of appropriate risk management, implementation of strategy and mitigation of supply chain risks. This framework includes most of the same aspects as the one put forward by Zsidizin and Ritchie (2009).

Pettit et al. (2010) suggest a different approach than the step-by-step approaches above when they argue that resilience is the key in managing a supply chain and thus propose a framework for supply chain risk management with the goal of developing resilience. The argument is that increased capabilities and decreased vulnerabilities in a supply chain are positively related to the development of resilience. In further analysis, Pettit et al. (2013) develop the Supply Chain Resilience Assessment and Management tool that measures sources of change along with

strengths and weaknesses of an organization. They further find that there is a linkage between increased resilience and increased operating performance, and find that the tool can help in improving an organization's resilience.

Other authors argue for combining supply chain management with risk management in order to achieve the best results, because relational factors such as relationship length, trust and shared understanding are helping in strengthening financial performance for the supply chain as a whole (Li, et al., 2015). Here they take a more holistic approach to risk management and emphasize the importance of supply chain management in supply chain risk management and the focus there needs to be on relationships due to this correlation (Harland, 1996).

However, the case of the cyclical approach to risk management is backed by Chopra and Sodhi (2004) who also argue for continuous testing of supply chains to assess risks and improve mitigation. Yet, the same authors also argue that managers must be aware of and understand the diversity and multitude of risks present in the whole supply chain in order to develop strategies that can help in minimizing these risks. Hereby companies and managers are required to use varied approaches to both supply chain management as well as risk management depending on the supply chain network.

The authors of this paper agree with the idea that supply chain risk management also entails supply chain management and thus a focus on the relationships within a given supply chain. This approach provides a more holistic view of the supply chain and combined with a higher focus on supply chain management, including relationship management, it reveals more risks present in the supply chain due to risk information sharing and ensures a better ground for managing these risks due to risks sharing.

3 EMPIRICAL STUDY

This chapter focuses on the empirical study, and how this has been developed and carried out. The purpose of the research, as well as the approach, strategy and method is covered in chapter 2, and this chapter describes the application of the research design to the empirical data collection.
The chapter will start with an analysis of the Danish shipping industry and the risk factors inherent in the industry through a screening of companies. This screening will be combined with the theoretical findings from the literature review, to form a preliminary list of risk factors. The list developed from this process will then be tested with a professional shipping company in order to determine the applicability, understandability and if there are any gaps in the list. This list of risks is what will be included in the questionnaire, and thus what will further be the basis of the interviews undertaken afterwards.
Hereafter the interview guide will be developed as a result of the research questions and in part of the responses to the questionnaire. This will also be tested with the same shipping company to receive feedback and determine if all necessary aspects are covered from a professional point of view.

3.1 Preliminary shipping risks screening

For the purpose of identifying risk factors facing the shipping industry, a screening of Danish shipping companies is undertaken to complement and develop the understanding developed in the review of the literature on the topic. This combination of takeaways from the literature and the risk screening will provide the foundation for the online-questionnaire and further data collection.

The shipping risks screening will be an archival research and will constitute of three parts. The first part will focus on the analysis of information, in regard to risk management, available from the annual reports of selected Danish shipping companies. While the second part, will be devoted to the analysis of risk classifications presented in the literature review versus risks referenced by shipping companies. Lastly, a conclusion will be drawn by combining the two previous parts and

making a draft of risks inherent to the Danish shipping industry which will be further tested in the parts to follow

3.1.1 Risk Management in the Danish shipping industry

Considering the available resources and the time horizon of the study, the selection of the appropriate sample of Danish shipping companies naturally came after an intensive web-search. The Danish Shipowners Association consists of 45 members, which are companies registered as shipowners in Denmark. According to the association, the members account for more than 95 percent of the Danish merchant fleet (Danish Shipowners Association, 2017).
According to Saunders et al. (2009) such a sampling method is a purposive sampling, which is used when data from entire population cannot be collected, the sample is small and purpose of the research is exploratory. Unfortunately, this method cannot guarantee that a sample will be representative, yet as the majority of the Danish fleet is represented it is believed that the sample can sufficiently serve the exploratory purpose of the research.

Before analysis was initiated, certain criteria were set up and applied in order to exclude companies not suitable for the research. Hence, considering the research questions and limitations, the following selection criteria were applied:

- *Headquartered in Denmark*
- *Involved in international vessel operation*
- *Annual report or website provides information on risk management attitude and initiatives*

The first criterion is logical as the scope of the research was narrowed to the Danish shipping industry, due to time and resource constraints.
Secondly, involvement in international vessel operation has been chosen in order to avoid companies that only own vessels and companies that are involved in off-shore business. The former would not be subjected to many shipping risks, since the main risks for these would be linked to ownership of an asset. The latter would be influenced by very specific risk factors related to an off-shore industry, which is unrelated to the subject of this research and the research questions.
Finally, as the preliminary shipping risks screening is a secondary data desk research, the criterion

of having references about risk management, available for free access, should help to expel companies that cannot bring any valuable input to the analysis through this method of data collection.

In table 5 below, the companies found as members of the Danish Shipowners Association are evaluated based on the three criteria:

Company name	HQ in Denmark	Involved in vessel operation	References about RM
Maersk	X	X	X
TORM	X	X	X
DFDS	X	X	X
Norden	X	X	X
Hafnia Tankers	X	X	X
Ultragas	X	X	-
Teekay Shipping	-	X	X
Uni-Tankers	X	X	X
Fjordline DK	X	X	X
Lauritzen	X	X	X
KNOT Management	-	X	X
Herning Shipping	X	X	-
Royal Arctic	X	X	X
Vattenfall	-	X	X
Stena RoRo	-	X	X
StenaLine	-	X	X
Viking Supply Ships	-	X	X
ALBA Tankers	X	X	-
DONG Energy	X	-	-
Crystal Nordic	X	X	-
Evergas	X	X	X
Svitzer	X	X	-
Axis Offshore	-	-	-
Corral line	X	X	-
Maersk Oil	X	-	-

HESS	X	-	-
Clipper	X	X	X
Kirk Kapital	X	-	-
Weco Shipping	X	X	X
Nordic Shipholding	X	X	X
Ultrabulk	X	X	X
Falcon Maritime	X	X	X
Monjasa	X	X	X
Team Tankers Management	X	X	X
Nordic Tankers	X	X	X
XO Shipping	X	X	-
Fortuna Seaside	X	X	-
Dansk Rederi A/S	X	-	-
Erria	X	-	-
ID management APS	X	-	-
Navision	X	X	-
Nordic Bulk Carriers	X	X	X
RN Dredging BV	X	X	-
TKB Shipping	X	X	-
Unifeeder	X	X	-

Table 5 - Screened companies

On the basis of this initial analysis, 19 out of 45 companies are left for the preliminary shipping risks screening.

Seven companies were excluded due to a HQ disposition outside of Denmark. Eight companies were only ship owning or off-shore companies, and 19 companies had no references regarding risk management (some of the companies overlap due to mismatch with 2 or all criteria).

After careful study of the available information on the remaining 19 companies, it was found that six companies, or 32 percent, of the sample have identical general risk categories, namely operational risks and financial risks. Moreover, in all 19 cases the company considered financial risks and in few cases financial risk factors were considered as the only threat. From here we may conclude that financial risks are paramount for Danish shipping companies and this is not surprising, since operating in a turbulent and capital intensive industry means that firms can easily incur major losses and risk bankruptcy if financial risks are not managed properly.

Going deeper into the financial risks category specific risks are highlighted as often found: freight rate fluctuations, bunker price fluctuations, changes in interest rates, currency risk, funding and liquidity risk, counterparty (credit) risk, and capital management risk. It must be noted that some companies classify freight rate and bunker price fluctuations as operational risks, and hence these risks will not be repeated when stating operational risks.

In regard to operational risks, many companies unite them with the sub-categories market risks and compliance risks. Therefore, risks related to these three categories are further listed: macroeconomic development, sales and purchase price fluctuations, decrease in vessel value, compliance with relevant maritime and environmental regulations, vessel utilization, safe operation of vessels, availability of experienced seafarers and staff, stability of IT systems, fraud, insurance coverage, oil spills, total loss of the vessel, terrorism and piracy, pool risks (if several companies put vessels in one pool for shared use, they are then subjected to the risk that the pool will not be utilized efficiently), availability of ships for charter, technical failures, extreme weather conditions, accidents, and developments in cargo volume.

Lastly, a few companies mention the category of strategic risks in their annual reports. Included strategic risks include: political and legal risks, substitution of oil, and technological changes.

Table 6 below summarizes the references to various risks and categories companies include in their reports.

Companies / Risks	Maersk	TORM	DFDS	Norden	Hafnia Tankers	Uni-Tankers	Fjordline DK	J. Lauritzen	Royal Arctic	Evergas	Clipper	Weco Shipping	Nordic Shipholding	Ultrabulk	Falcon Maritime	Monjasa	Team Tankers Management	Nordic Tankers	Nordic Bulk Carriers	TOTAL
Freight rates	X	X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	16
Bunker price	X	X	X	X				X		X	X	X	X	X	X	X	X	X	X	15
Interest rate	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X		16
Currency risk	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X		X	16
Funding and liquidity	X	X	X	X	X		X	X					X	X		X	X	X	X	13
Credit risk	X	X	X	X	X	X		X		X			X	X		X	X	X	X	14
Capital management				X	X								X	X			X	X		6
Sales & purchase price		X																		1
Vessel value	X			X				X			X	X					X			6
Macroeconomic	X	X	X							X	X	X							X	7
Cargo volume	X		X					X	X	X	X									6
Vessel utilization		X						X												2
Vessel availability			X																	1
Pool risks						X							X					X		3

Compliance	X	X	X					X		X	X	X							**7**
Safe operation	X	X	X					X		X		X							**6**
Experienced staff		X						X		X	X	X							**5**
Stability of IT	X	X	X	X				X											**5**
Fraud		X																	**1**
Insurance coverage		X	X	X				X				X		X		X			**7**
Oil spills	X			X								X		X					**4**
Total loss				X															**1**
Terrorism & Piracy	X	X		X				X				X		X					**6**
Technical failures	X		X																**2**
Accidents	X		X					X											**3**
Extreme weather			X																**1**
Political & Legal risks	X	X	X					X											**4**
Substitution of oil		X																	**1**
Technological changes	X	X																	**2**

Table 6 - Screened risks

From the above table, it is seen that freight rate, interest rate and currency risk are the three most often referred risks with 16 out of 19 referencing these risks. Following are bunker price risk, credit risk, and funding and liquidity risk, having 15, 14 and 13 references respectively. Capital

management risk, macroeconomic developments, decrease in vessel values, cargo volumes fluctuations, compliance with relevant maritime and environmental regimes, safe operation of the vessel, experienced staff, stability of IT systems, insurance coverage, oil spills, political and legal risks, and terrorism and piracy are all enjoying mid-range of 4 to 7 references. Further, sales and purchase price risk, vessel utilization, vessel availability, pool risks, fraud, total loss, technical failures, accidents, extreme weather, substitution of oil, and technological changes scored in the lowest 1 to 3 references range.

These findings show, that according to the available secondary data information on the sampled companies, financial risks are perceived to be the most important for Danish shipping companies. This is followed by operational, market and compliance risks. Strategic risks however, are referenced only by some of the larger shipping companies.

3.1.2 Risk categorization

As seen in the literature review, the two shipping risks classifications presented by academics categorize risks differently than industry professionals. In one case risks are grouped to: risks to operating cash flows and risks to changes in the market value of assets. In the second case, three risk categories are defined, namely: price risk, credit risk, and pure risk.

On the other hand, industry professionals divide risks mainly into two general categories: financial risks and operational risks, and with sub-categories of compliance and market risks being mostly put under the operational category.

Furthermore, some of the largest firms also add strategic risks as a separate category of their agenda.

This difference in classifications adds to the point that the academic world still lacks a more unified approach towards a shipping risks classification. Moreover, there is certainly a gap between shipping risks classifications by business professionals and by scholars. However, both academic classifications cover all of the top referenced risks by companies and some of the mid-ranged risks, meaning that the discrepancy is not major and that the literature also includes several points that are supported by the industry.

Summary

Summarizing the previous parts, it can be concluded that despite shipping risks classifications by academics and shipping companies differ, there is a definite overlap on the top and mid-ranged referenced risks. The main difference is that shipping companies on individual basis go deeper into risk areas concerning their specific business operations, with some of the larger companies also considering strategic risks. Furthermore, it was found that all of the top referenced risks were financial risks, confirming that being multinational and highly capital intensive, shipping industry needs to put financial risk management on the frontline.

As a consequence of this initial analysis, an initial draft of risks has been created to form the basis for an online questionnaire. Combining the classifications from scholars and working professionals, it has been decided to group risks into four categories: financial risks; operational, compliance and market risk; strategic risks; and sure risks.
The draft of the four categories and with the included risk factors is presented in table 7 below.

Financial risks	Operational, compliance and market risks
Freight rate volatility	Stability of IT systems
Bunker price fluctuations	Insurance coverage
Interest rate risk	Terrorism & Piracy
Currency risk	Oil spills
Credit risk	Availability of experienced staff and seafarers
Funding & Liquidity risk	Safe operation of the vessel
Capital management	Compliance with relevant maritime and environmental regimes
	Macroeconomic developments
	Vessel value risk
	Cargo volume
Strategic risks	**Pure risks**
Political & legal risks	Natural disasters / Extreme weather
	Accidents
	Technical failure
	Total loss of the vessel

Table 7 - Preliminary risk categorization

This initial draft will be further tested with the Danish shipping company Unifeeder in order to get opinion directly from the target group company and ensure that the questionnaire will be understandable. Despite Unifeeder not qualifying for the sample for the preliminary shipping risks screening due to a lack of risk management references in its annual report, the company agreed to participate in the project by assessing the risks draft and providing insight information in regards to risk management within the organization through a pre-test interview.

3.2 Online questionnaire

After the development of an initial list of risk factors in the shipping industry, the focus moves to the next step in the empirical study. This section of the chapter is aimed at explaining the reasons behind selecting a questionnaire as a data collection technique as well as describing the process of creating the questionnaire.

As per Saunders et al. (2009), the questionnaire is an efficient tool for collecting responses from a large sample and is regarded as the most popular data collection technique within the survey strategy. Furthermore, the literature suggests that it is better for a research to link questionnaire with other data collection methods instead of using it as the only source of data. Despite the sample not being large, by applying the questionnaire data collection method in combination with other strategies, reliable data can be reached. Further, it is the intention to test how well questionnaires can serve as a tool for primary data collection within the Danish shipping industry in combination with archival research and semi-structured interviews. This in turn could be used as a pre-test for the global shipping industry study.

When designing a questionnaire, Saunders et al. (2009) lists several important points, which could maximize validity and reliability of a questionnaire. Careful design, clear and pleasing layout and pilot testing are all among these points. Therefore, it was decided to construct a questionnaire using the traditional view of risk management framework, as it provided a clear concept of risks evaluation and at the same time reflected the initial findings from the literature and the company screenings. The traditional risk management tool, the risk matrix, is a framework advising that in order to distinguish, analyze and prioritize various risks; they should be assed in relation to probability and impact on an organization. As an outcome, the risk matrix will be created highlighting low, medium, high and very high threatening risks for the Danish shipping industry based on the findings in the questionnaire. Despite the traditional view of risk management does not cover upside potential of risks, it should be able to illustrate a general picture of risks evaluation within the industry. Furthermore, in order to expand the findings of the research, it was decided to add third question and ask participants to evaluate an overall level of protection of their company against each of the risks. Evaluating all three parameters, participants will be requested to put a mark from 1 to 5 against all risks, with 1 being the lowest score and 5 the

highest. Lastly, before the pre-test, it was also decided to put few intro questions in order to improve quality of the questionnaire by making it more approachable and get some additional information from the companies. The full questionnaire is found in the appendix as appendix 1.

The additional questions further allow for assessing results on an individual basis and divide by segments or size. They further confirms the applicability of the company by affirming the selection criteria and they moreover provides a clearer picture of the hedging tools being used as these are expected to be the most used tools to manage the many risks of financial nature that are found to be present in the industry. This is the expectation since employing financial derivatives is considered to be a more appropriate technique to manage financial risks, according to Albertijn et al. (2011), and thus these extra questions will further add value to the assessment of the literature on risk management in shipping

3.2.1 Pre-test

After these initial considerations and preparations, a face-to-face meeting with Unifeeder and a manager within their Operations & Bunkers department was scheduled in order to test the questionnaire for its understandability, and to further receive additional input from the industry. First, the opinion of the general concept of the questionnaire was tested and it was confirmed that this approach should make sense for use in the industry, in order to map the most and the least threatening risks.

The next step was to test if the shipping risks classification is appropriate and understandable, and the company added that it found the pure risk category to be a bit confusing. Further explanation and definition of pure risks has clarified meaning of the group, yet, considering the risks in this category, it was advised to put all risks under one name. This was complied with and the category has been altered to include one risk: total loss or damages to the vessel due to natural disasters, accidents or technical failure. It was agreed that in this way the understanding of the pure risk meaning should be easier to grasp.

Going through risks of other categories, it was suggested that since the questionnaire would be mostly answered by middle managers, they would not be able to evaluate a capital management risk; as such discussions are usually performed on the top management level. Besides, it was advised that oil spills could be considered as a part of compliance and insurance coverage risks,

while safe operation of the vessel could be also put under compliance with relevant maritime and environmental regimes risks. Moreover, the cargo volumes risk could be merged with macroeconomic developments as there is a straight forward connection.

Lastly, the discussion on the company's risk management revealed that there are certain employees assigned to monitor and research risks of macroeconomic developments as well as technological changes, and it was advised to add the latter risk to the strategic category due to its high importance for shipping companies around the world. Consequently, the final risk categorization is presented in table 8 below.

As a final point in the pre-test, the intro questions were discussed and confirmed to be appropriate and understandable

Financial risks	**Operational, compliance and market risks**
Freight rate volatility Bunker price fluctuations Interest rate risk Currency risk Credit risk Funding & Liquidity risk	Stability of IT systems Insurance coverage Terrorism & Piracy Availability of experienced seafarers and staff Compliance with relevant maritime and environmental regimes Macroeconomic developments Decrease of vessel value
Strategic risks	**Pure risks**
Political & Legal risks Technological development	Total loss or damages to the vessel due to natural disasters, accidents or technical failure

Table 8 - Final risk categorization.

3.3 Interviews

The last part of this chapter on the empirical study and method is devoted to the interviews that will take place after the results from the online questionnaires have been gathered and analyzed. On the basis of these results, stand-out responses and responses that illustrate the overall responses well will be selected for the process of interviews that will develop a deeper understanding of the topic risk management in shipping by utilizing semi-structured interviews. According to Saunders et al. (2009), by using semi-structured interviews researchers may omit or add questions during interviews, depending on specificity of the organizational context. This should allow the interviewers to uncover particular insights of individual cases and to get more primary data for further analysis. Moreover, the purpose of non-standardized (semi-structured) interviews is also to gather data for a qualitative analysis, which are meant to answer the questions of what, how and most importantly why (Saunders , et al., 2009). Hence, the chosen method should serve well for the selected case study strategy and the exploratory purpose of the research.

Moreover, Saunders et al (2009) also suggest that semi-structured interviews are most advantageous as a data collection method, when questions are either complex or open-ended, which is the case for the planned interviews. The content of the interview guide and the questions included, partly arise from the literature review and partly from the more subjective view of the researchers regarding what information is required for the research.
Additionally, Unifeeder advised that the chances to get companies to participate would increase if the interview was designed for a 30-minute time frame. Thus, 9 questions were formulated to allow for the answering of all of these, while also including time for follow-up questions regarding insights or other findings during the interview process. The interview guide is presented in its entirety in the appendix as appendix 2.

The interview guide divides the interview into two parts, one on the company and its overall strategy, and one on the more specific approach the company takes towards risk management. This structure was created to start obtain general information about the company's business as this might reveal certain trends or patterns, and to set the tone for the interview a being an open conversation about the company in question. Further, it was expected that the findings in the first

part might be valuable for the second half of the interview, which is aimed at revealing information on risk management perceptions and initiatives.

Firstly, interviewees were asked to briefly outline the company and its business, which of course was read on the website and in annual reports, but was used to check if anything new information would arise and further to open up the conversation. Moreover, this question could uncover probable strategic risks in the company's operations.
The next question is devoted to the financial strategy of the company and its capital structure. According to Albertijn et al. (2011) financing will be a key challenge in the maritime industry due to constraints of bank lending, and therefore, the second question will test the theory and uncover what the current situation in regard to financing and liquidity is in the shipping industry. Furthermore, it should pinpoint what could be possible sources of financial risks for a company.
The third question is aimed at gathering information about the company's operational strategy in order to deeper understand the nature of the business and to get a sense of what potential sources of operational risks are.
Closing the first part of questions, it was deemed valuable to gather information on how companies measure the performance. Wang et al. (2014) argues that academic research has mostly used the concept of efficiency to evaluate performance, however performance could be related to financial performance, which is measured by accounting ratios and the level of risks involved; or overall efficiency, measured by utilization and allocation of available resources. Hence, the final question should provide information on what method of performance measurement and management is generally used among the Danish shipping companies, potentially adding valuable insights on companies' strategy as well as financial risk exposure.

The second part of questions will start from a question of whether company uses risk management initiatives or not. This is rather a rhetoric question, as interviewees will be chosen from the companies which, at least to some extent, use risk management. Yet, this question will lead to possible answers, which should reveal information on the deciding factors to implement risk management. This will in turn provide insights into the approach companies take to risk and risk management, and whether they are seen as pure threats or also opportunities to be utilized.
The next question will request the interviewee to evaluate the impact of risk management on a

company and to compare it with costs required for implementation and maintenance of risk management initiatives. The goal of this question is to understand how risk management is perceived by companies; whether it is truly something valuable or is it something they are forced to do at own cost.

The interview will continue with an inquiry to name the most threatening risks for a company. Findings from this question should test whether the online questionnaire results of risks evaluation would be in line with the interviews results. Hence, data will be checked for validity and possible inconsistencies will be taken into account.

One aim of the project is to outline actual risk management strategies and techniques used in the shipping industry. Therefore, the next question naturally came up as an extension of the previous one to further develop on the approach taken to risk management by the given company. Furthermore, after the interviewee explains how the given company deals with the most threatening risks, it is planned to ask what risk mitigation tools and strategies are, or could be, used for coping with all other risks stated in the online questionnaire.

Finally, the last question of the interview will be dedicated to a supply chain risk management perspective. Considering that the supply chain is shown to have major influence on shipping companies, and that the literature available on the topic of supply chain risk management in shipping is very scarce, it was decided to include a supply chain perspective into the research and to gather information on what working professionals think about application of the prospect of implementing and working with supply chain risk management.

The included questions, along with investigative questions about themes coming up during interviews, should provide an opportunity to collect valuable information for the research and enrich the findings with individual opinions of professionals working within the industry.

3.3.1 Pre-test

As was the case with the questionnaire, it was decided that a pre-test for the interviews and the inter guide was required. The reasons were many of the same, but here also included the possibility to assess the interviewers' interviewing competences and secondly to make corrections to the questions if required.

Unifeeder was chosen as the company in which to pre-test the interview as this was the same

place and manager that had reviewed the questionnaire and thus would bring the same subjective attitude to this evaluation. The company agreed to a new session in order to assist on the interview pre-test by both answering the questions and thus participate in an interview, and by further including feedback on both content and procedure of the interview. Through this pre-test it was found that the questions included were regarded as reasonable and thus the interviewee provided solid information for the future analysis.

The one question posing an issue and which could not be answered was related to the capital structure of the company. The interviewee was mainly involved in the operational processes, and thus financial details were some that the interviewee was not fully aware of. However, it was advised that the hedge fund behind the company has a very strong financial liquidity, and as such all questions were answered to a satisfactory degree. This means that the pre-test found the interview to be successful and that its structure was viable for the future application.

4 EMPIRICAL FINDINGS

The empirical study undertaken as part of this project, and the approach taken to the collection of data as described in previous chapters, lead to findings which are the focus in this part of the paper. The empirical study was done in three phases; screening of companies, questionnaires, and interviews. The risk screening of companies has been described in the previous chapter, and so the focus here are the findings from the collection of data from companies operating in shipping, and within the same criteria as used in the screening.

The purpose of this part is to develop an overview of the responses and answers given by companies who are experiencing the industry and environment every day in both questionnaire and interviews, and analyze these in comparison to the risk screening, the literature review, and the pre-test interview on which the list of risks in the shipping industry rests

This part will start off with an analysis of the responses to the questionnaire in order to create an overview of the risks, as well as how likely and how impactful the respondents believe the found risks to be. This will lead to a further analysis of the risks included in order to evaluate their applicability to the shipping industry and their impact through the use of the traditional risk matrix which will help identify what risks are most important to shipping companies. Hereafter the analysis of the questionnaires will turn to the tools used to protect against the identified risks and an analysis of how well the companies believe themselves to be protected against the risks.

Next, the analysis will switch focus to the interviews conducted, both before and after the release of questionnaires. The purpose of the interviews were to deepen our understanding of the risk factors in the Danish shipping industry in order to better assess which risks to include in the list of risks and to understand how the companies in the industry deal with these risks, and manage both the upside and downside potentials.

Therefore, the analysis of the interviews will firstly focus on the findings from the questions related to financial and operational strategies of the companies, while also will touch upon performance measurement. Then the focus will turn to the actual risk management and handling of the various risks in shipping, supported by a cross-analysis with the findings from the questionnaire

4.1 Questionnaire

The questionnaire consisted of two parts; one focusing on the risk factors in shipping and one on the handling of these risks within the industry. It was released to the majority of companies included in the screening after the pre-test interview had been conducted and served to further tune the framework for risks in shipping. The questionnaire was sent to a total of 19 companies, selected based on their applicability to participate in the previous risk screening and the required criteria. Of these 19 companies, 10 came back with a response to the questionnaire, including the company which had been the subject of the pre-test interview. This is a response rate of less than 53 percent which provides a certain limitation of the study. With such a limited amount of subjects a low response rate is a limitation that needs to be confronted and considered when evaluating the study. More on the response rate and the limitations as well as potential reasons will follow later in the chapter.

Regardless of the low response rate, the replies are still of significant value since they provide input from companies conducting the operation of vessels in the shipping industry and their first-hand experience in dealing with risks and especially risks specific to the shipping industry.

The following analysis of the questionnaire will consists of two parts; first, a part focusing on the risk factors assessed, second a part focusing on the management of these risks and the companies' protection against the various factors. It begins with an overview of the answers to the questionnaire in regards to the risks present in the industry and the likelihood and impact of these risks. This will allow for an analysis using the traditional risk management tool, the risk matrix, which in turn will provide the foundation for an analysis of the overall threat the various risks pose, that will develop the risk framework and its validity. Hereafter the remainder of the questionnaire will be analyzed with a focus on the management of the risks included in the questionnaire, some of the tools used for this management and how well companies today are protected against the risks identified in shipping.

4.1.1 Risk factors in shipping

The questionnaire included several different questions as previously described. Some of these included the risks identified as being important to the shipping through the literature review,

company screening and pre-test listed and asked respondents to evaluate the individual risks according to perceived likelihood, potential impact, and the company's protection against the specific risks.
The tables below present the responses to the questions about likelihood of occurrence and impact in case of occurrence, with a value from 1-5 signifying the likelihood and impact. The higher the score, the more likely and the more impactful the respondents perceive the various risks. All scores the individual risks have received are averaged in the right hand column to find the average likelihood and impact of every risk factor and illustrated in the tables below.

From table 9 below it is seen that financial risks include both the risks perceived to be most likely and the risks perceived to be least likely. Due to the big variety in risks included in the financial risk category this does not seem surprising, however when considering that most of these risks stem from varying market conditions and general market volatility it may be surprising that the discrepancy between the most and least likely risks in the same category is as big as seen here. The two high-scoring risks may however also be considered outliers which are particularly likely in the shipping industry and thus score higher than the average financial risks which may also be present in other industries.
The category of operational risk is another which includes a broad variety of risks ranging from terrorism & piracy to insurance coverage and macro-economic development which are risks closely tied to various financial and pure risks as well. The difference in perceived likelihood is also fairly high within this category as it was within the financial risks, which may signal that the amount of risks included in these categories mean there will be certain differences in the likelihood of the included risks. Here however it seems more natural that the discrepancy reaches this level since the nature of the risks is also more diverse and they do not all stem from the same underlying factors as is the case for the financial risks. Generally the operational risks are perceived to be quite likely to occur, with scores above medium, and this shows that the need for a category of operational risks is present and that the risks are seemingly present in the shipping industry.
The strategic risks score just around medium in terms of likelihood, indicating that the shipping companies do expect some strategic development to occur and that both threats and opportunities may arise from strategic risks.

Pure risk is a category including one broad classification and received a score close to high, indicating that damages or worse from various hazards is quite likely to occur in the shipping industry. This can be due to the broad category including risks from both natural disasters and storms, to technical failures that result in damages to any asset owned by the company, but due to the high score the category certainly seems applicable to shipping.

When focusing on some of the individual risks, it is clear that the risks of changes in the freight rate and the bunker price are by far the risks perceived to be most likely to occur and affect the companies included in this study. This can be assumed to be partly explained by the nature of these risks and their inherent volatile and unpredictable character because they stem from market movements. The market, be it a stock exchange, commodity exchange or the market for shipping services, is a complex institution consisting of many different actors, agendas and other influences that create the unpredictability and complexity present in any global marketplace (Jing et al., 2008). As such it is no surprise that these are the risks professionals focused on daily operations are most concerned with and view as the most likely risks.
A few other risks follow the two mentioned above as the most likely to occur since they scored 3.5 or above on average; stability of IT systems, compliance with regulations, macro-economic development, decrease of vessel value and pure risk in the form of total loss or damages to the vessel. The focus and fear of threats to IT systems is natural with the focus there is on this issue today, and with the increase in both vulnerabilities and attacks as more parts of all businesses become digitized (McKinsey & Company, 2014). A focus on compliance also seems obvious given the nature of the shipping industry as an international industry, where regulations from many different countries and international organizations must be complied with. In combination with the use of heavy and polluting machinery, this creates a complex environment where the risk of mismanagement increases. Macro-economic development is out of the hands of most shipping companies, and all included in this part of the research. Thus it is also obvious that the perception is that changes to macro-economic circumstances can occur and affect the companies, perhaps even through the price development in freight rates or bunkers, which were listed as the most likely risks to occur. Decrease in vessel value is a risk all ship-owners face and one that occurs often as assets age and decrease in value, something that can only be mitigated through scrapping or sale, although it is possible to alter maintenance to counter some of the impact of this risk.

However, the decrease in vessel value is also closely connected to the freight rates and the macro-economic development, because these factors influence the market for shipping and thus the value of any given vessel. When the freight rates are high a vessel will have a higher value regardless of age due to the fact that it offers the opportunity to do business immediately opposed to newbuilds, whereas the value of a vessel may decrease significantly if freight rates diminish as the value of doing business decreases. An example of this is taking place at the moment where the market is saturated and many ships are being scrapped because of the mismatch between demand and supply which has persisted for some years now (Danish Ship Finance, 2014). Lastly, pure risk was also listed as a risk likely to occur according to the perception of the respondents.

Risk likelihood \ Companies		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 8	Company 9	Company 10	Average
Financial risks	Freight rate volatility	5	5	4	4	5	5	5	4	5	4	**4.6**
	Bunker price fluctuations	5	5	4	4	5	5	5	4	5	4	**4.6**
	Interest rate risk	5	1	3	2	3	1	4	3	3	2	**2.7**
	Currency risk	3	2	3	3	3	2	4	2	3	3	**2.8**
	Credit risk	2	1	3	1	2	2	3	2	3	3	**2.2**
	Funding & Liquidity risk	3	1	3	1	2	1	3	3	2	2	**2.1**
Operational risks	Stability of IT systems	5	2	4	3	5	3	4	3	4	4	**3.7**
	Insurance coverage	4	3	3	2	5	1	3	3	3	4	**3.1**
	Terrorism & Piracy	1	1	1	2	3	3	3	3	3	4	**2.4**
	Availability of experienced seafarers and staff	5	3	4	2	5	3	4	3	2	2	**3.3**
	Compliance with relevant maritime and environmental regimes	4	4	4	2	5	3	4	4	2	3	**3.5**
	Macro-economic development	4	4	4	2	5	4	4	4	3	3	**3.7**
	Decrease of vessel value	5	4	4	3	5	3	3	4	3	4	**3.8**
Strategic risks	Political & Legal risks	4	3	3	2	3	4	3	3	3	2	**3.0**
	Technological development risk	3	3	4	2	3	2	2	2	3	2	**2.6**
Pure risks	Total loss or damages to the vessel due to natural disasters, accidents or technical failure	5	3	4	3	2	4	3	4	4	4	**3.6**

Table 9 - Risk likelihood

As was the case in table 9 and the results on likelihood, there is a broad range of scores in the perceived impact of financial risks as well, shown in table 10. The same risks that score high in

likelihood score high in impact, and the scores scoring low in likelihood also score low in impact. This further enhances the discrepancy within the category and may signal that some risks need to be reconsidered as key factors to the shipping industry. It also indicates that both the general threats and opportunities from financial risks are perceived to be below medium, but there are outliers specific to the shipping industry that do offer both threats and opportunities of impactful character.

The perceived impact of the operational risks is quite similar to the likelihood of them and this strengthens the argument for these risks to be included in the list of risks in shipping. All risks are perceived to have a medium impact or above which means that all risks can offer significant threats and possible opportunities that can have a big effect on a company. This is natural due to the focus on operation shipping companies need to have, the nature of the assets being used and the global and volatile environment in which ships operate. Because of these factors, any operational risk occurrence can massively affect a company, in both positive and negative ways.

The category of strategic risks include risks that are perceived to have a medium impact and as such be able to significantly impact a shipping company but without posing the most impactful threat or opportunity should it occur.

Pure risk also scores high on impact which also seems natural as this category can entail massive damage to any asset or the complete loss of a vessel. The impact of pure risk can thus be extremely high and may even in the worst of cases include fatalities, but the inclusion of smaller damages as well seemingly means that this category does not score as high on impact as others included in the survey.

When moving into the individual risks, a similar picture to the likelihood responses emerges when table 10 is analyzed; freight rate volatility and bunker price fluctuations are perceived as being the most impactful just as they are perceived to be to most likely to occur. This may be surprising when held against other risks such as total loss of a vessel or an attack by pirates. However, there is no doubt that both of these risks are capable of having major impact on any shipping company as it can alter both costs and revenue dramatically, causing extreme financial difficulty, or bring massive opportunities. These risks may be considered the most impactful for exactly the same reasons that they may be considered very likely to occur according to the respondents; the market is complex and unpredictable.

Three risks come in as also very impactful with a score of 3.5 or above on average; terrorism & piracy, compliance with regulations and macro-economic development. The two latter also score above 3.5 on likelihood and are thus the most impactful when considering the combination of likelihood and impact. Macro-economic development again ties to the development in the market and this can partly explain why this risk is listed so high. It can affect a shipping company dependent on trade in a multitude of ways, and the impact can result in both huge losses as well as gains. Compliance with regulations can impact a company in many ways. Obvious downside effects can be penalties from not adhering to national or international regulations or brand value losses due to bad publicity due to noncompliance or poor CSR strategies and operations. As such the impact of compliance risks can range from minor offences to major publicity issues affecting the company for many years, but can also entail upside potential as for example positive publicity through lowered pollution or other sustainable initiatives. The last risk scoring 3.5 or above in impact is the risk of terrorism & piracy. Here the upside potential is difficult to spot, although publicity can be a result of such an event; it would take a highly cynical professional to wish for this kind of publicity. The downside potential can be both delays to operations, damages to assets and in the worst case even human lives. Therefore it can also seem surprising that this risk is not listed higher as it might generally be considered to have the potential to result in the worst loss of all, that is lives, but the respondents were asked to judge the risks from a company perspective and in this view a major financial loss due to sudden drops in freight rates may hit a company harder. It is also worth noting that this risk only includes downside potential, something which may affect the perception of potential impact in respondents.

The remaining risks all scored below 3.5, but none of the risks included received an average score below 2.6, which corresponds to slightly below medium impact. This reveals that the respondents perceive all the risks included as real threats, real opportunities or both. It is also an indicator that all the risks included are in fact present in the shipping industry as they could have fairly significant impact on the company as a whole. This will be further investigated in the rest of the analysis in order to determine whether these risks are in fact all present in the shipping industry and how exhaustive the list might be.

Despite the discrepancy in both likelihood and impact it is important to keep in mind that likelihood does not consider impact and those risks less likely can have a major impact on a

business and vice versa as more likely risks can be less impactful, especially if a company is able to manage such a risk well and thereby be well-protected against it. Further, a risk occurrence of major impact may be overall less impactful than many occurrences of less impactful risks and thus the responses will be subject to influence from the respondents personal opinions and experiences.

Risk impact / Companies		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 8	Company 9	Company 10	Average
Financial risks	Freight rate volatility	5	5	4	4	5	5	5	4	4	4	**4.5**
	Bunker price fluctuations	5	4	4	3	5	5	5	4	4	4	**4.3**
	Interest rate risk	3	2	3	3	3	2	4	3	2	1	**2.6**
	Currency risk	3	2	3	3	3	2	4	3	2	2	**2.7**
	Credit risk	2	2	3	2	4	3	3	2	3	2	**2.6**
	Funding & Liquidity risk	2	3	3	3	3	2	3	3	2	2	**2.6**
Operational risks	Stability of IT systems	5	2	3	4	4	3	3	2	4	2	**3.2**
	Insurance coverage	2	2	3	5	2	3	3	3	4	3	**3.0**
	Terrorism & Piracy	3	4	3	5	3	4	3	3	4	4	**3.6**
	Availability of experienced seafarers and staff	5	3	2	3	3	4	3	2	3	4	**3.2**
	Compliance with relevant maritime and environmental regimes	5	2	3	3	5	4	4	4	3	5	**3.8**
	Macro-economic development	4	5	3	4	3	3	3	3	4	3	**3.5**
	Decrease of vessel value	4	3	3	4	3	3	2	3	3	3	**3.1**
Strategic risks	Political & Legal risks	4	3	3	4	2	3	2	3	3	3	**3.0**
	Technological development risk	3	4	3	5	2	2	2	2	3	2	**2.9**
Pure risks	Total loss or damages to the vessel due to natural disasters, accidents or technical failure	5	3	3	4	3	4	3	3	3	4	**3.5**

Table 10 - Risk impact

4.1.2 Risk matrix

The traditional view of risk management has previously been discussed in the literature review and criticized for only including the downside potential of risks and thus neglecting the management of the opportunities that are also present in various risks. This however, does not mean that the traditional approach does not offer significant and useful input to the area of risk management. The risk matrix is an example of such an input and will be used in the analysis of the responses to the questionnaire in this paper.

The risk matrix, as previously described, is made up of two factors, likelihood and impact, and disperse risks according to these two factors. The risks with the highest combination of likelihood and impact, and thus the most impactful risks are located towards the upper right corner.

In table 11 below the average scores for each risk in the previous section, for the parameters likelihood and impact are listed, and then averaged in the column to the right in order to determine the combined risk level and thus how overall impactful the individual risks are perceived to be by the respondents. The combined risk level is found by averaging the likelihood and the impact of each risk. The risk level is rounded to one decimal and thus, in cases where the average sum has consisted of two decimals the result has been rounded up. This has been done to simplify the overview of risks and because this assures that no risk is underestimated, as this can be a real danger in managing risks (Kimball, 2000).

Table 11 creates a good overview of the risks and their perceived risk level, and it will also serve as an assisting tool when creating the risk matrix based on the responses and this table. The table summarizes the responses to the questionnaire on the likelihood an impact of the various risk factors. From this summarized table it is unsurprisingly clear that the risks with the highest risk level and thus the most threatening are the two that scored highest both likelihood and impact. It is also worth noting that the lowest scoring risks reach a combined level of 2.4, which is a score between low and medium risk level, and only two of the included risk factors are perceived to have a risk level below 2.5.

	Risks	Average Likelihood	Average Impact	Combined Risk Level
Financial risks	1. Freight rate volatility	4.6	4.5	**4.6**
	2. Bunker price fluctuations	4.6	4.3	**4.5**
	3. Interest rate risk	2.7	2.6	**2.7**
	4. Currency risk	2.8	2.7	**2.7**
	5. Credit risk	2.2	2.6	**2.4**
	6. Funding & Liquidity risk	2.1	2.6	**2.4**
Operational risks	7. Stability of IT systems	3.7	3.2	**3.5**
	8. Insurance coverage	3.1	3.0	**3.1**
	9. Terrorism & Piracy	2.4	3.3	**2.9**
	10. Availability of experienced seafarers and staff	3.3	3.2	**3.3**
	11. Compliance with relevant maritime and environmental regulations	3.5	3.8	**3.7**
	12. Macro-economic development	3.7	3.4	**3.6**
	13. Decrease of vessel value	3.8	3.1	**3.5**
Strategic risks	14. Political & Legal risks	3.0	3.0	**3.0**
	15. Technological development risks	2.6	2.9	**2.8**
Pure risks	16. Total loss or damages to the vessel due to natural disasters, accidents or technical failure	3.6	3.5	**3.6**

Table 11 - Overall risk levels

The risk levels found in table 11 have been used to fill in the risk matrix that is figure 3. The risk matrix focuses on the downside potential of the risks included and thus illustrates how threatening the risks are perceived to be based on the two parameters of likelihood and impact and the responses to the questionnaire. The risks are divided according to table 11 but are rounded up to nearest full number to align the illustration and to ensure that no risk is underestimated.

The matrix is divided into four groupings; low level risk, medium level risk, high level risk and very high level risk.
The low level is marked in green in the below figure and includes risks with a score beneath 2.5. This level includes risks number 5 and 6 which are credit risk and funding & liquidity risk. These risks are both tied to the financial structure of a company and are especially considered to have low likelihood of occurring. Although the impact is rated slightly higher, both still receive medium level scores on impact and thus the overall risk level also becomes of the low level. The questionnaire thus suggests that these risks are of lesser importance to shipping companies than the other risks included in the list.
The medium risk level is in yellow and includes the most risks of all categories, scored from 2.5 to 3.4 in overall risk level. These are risks that must be considered, managed and taken seriously, but not the risks that are most threatening to the company. Six risks are found to be medium level risks, with the small difference that risk 9, terrorism & piracy has a lower score for the likelihood of occurring than the remaining medium level risks. The other risks in the medium level are; interest rate risk, currency risk, insurance coverage, skilled staff availability, political & legal risks, and technological development. These risks come from a variety of categories as they range from financial risks to operational and strategic risks.
The high risk level is illustrated in orange and includes risks with an overall risk level between 3.5 and 4.4. In this category five risks are located, whereof four are placed at the exact same level and one has a slightly higher impact. The four are; stability of IT systems, macro-economic development, decrease of vessel value, and total loss of vessel. These risks all score higher in likelihood than in impact, but one risk is found to have the same level of likelihood and impact; compliance with regulations. This risk is found to be more impactful than the other risks in this category, potentially due to the long-term repercussions this threat may entail.

The final category is that of very high risk which is marked in red in the figure below. This category includes all risks with the very high overall risk level of 4.5 or above. Two risks score this high in the survey and are thus considered to be the most threatening risks. The two risks are naturally also the ones scoring the highest in both likelihood and impact; risk of freight rate volatility and bunker price risk. One of these, bunker price risk is found to have roughly the same impact as compliance with regulations in the high level category, but due to the increased likelihood of occurrence this risk is located in the very high level category. Freight rate volatility however, is found to receive very high scores above 4.5 in both likelihood and impact and is thus rounded up to the highest level of threat possible in the risk matrix.

The matrix provides an overview of all risks found to be key risk factors to the shipping industry through the deductive study, and thus the risks included in the questionnaire. It is clear from this overview that the majority of risks are logically placed in the medium to high level categories, and that there are fewer outliers in the low or very high categories. Further the matrix is able to provide an idea about the most threatening and acute risks, and as such also which risks to pay the highest attention to. All risks are clearly important and none can be neglected as all included risks can result in massive losses and damage to a company, but some are more likely to create a lasting loss and impact on a company than others based on the risk level. It is obvious that the risks that are more impactful and thus more threatening to a shipping company must be managed in order to ensure that the company is not struck by an event and a loss so devastating that it cannot be overcome. Once these very threatening risks are duly managed, an organization can move down in the risk matrix and attempt to protect and guard the company against other big threats, as lower level risks are not to be neglected in any way.

The risk matrix serves a very useful purpose, it allows an organization to structure its risks and threats based on their likelihood and impact and it can thus work to better manage the various risks based on their overall risk level. In this case, most risks are found to be fairly significant threats according to the respondents, and this is in line with the deductive study that has created the preliminary list of risk factors in the shipping industry. The outliers in the low level end are financial risks that may not be specific to the shipping industry, and which do not have the same importance to shipping companies and the industry as a whole as the remaining risks included in the list of risk factors. They are risks that are included because the shipping industry is a very

capital intensive industry, where the need for capital is high and thus the risks stemming from credit and funding & liquidity were thought to be highly relevant as also argued in the literature review. Based on the answers received to the questionnaire, these risks are however found to be less impactful and thus of lesser importance than the literature suggests. However, both are found in several company screenings in the initial risk screening, as well as in parts of the literature on risks in shipping. Because of this, these risks are certainly seen as relevant for the shipping industry in alignment with the literature, but further analysis is needed in order to determine how important and impactful these two financial risks are to the shipping industry. This will be further analyzed through interviews conducted with shipping companies, which will give an opportunity to develop the understanding of risks in shipping.

Next, the analysis of the questionnaire will shift focus towards how to protect against the risks found to be significant for shipping, by analyzing the hedging tools utilized by the responding companies as well as their perception of how well the companies are guarded against these risks.

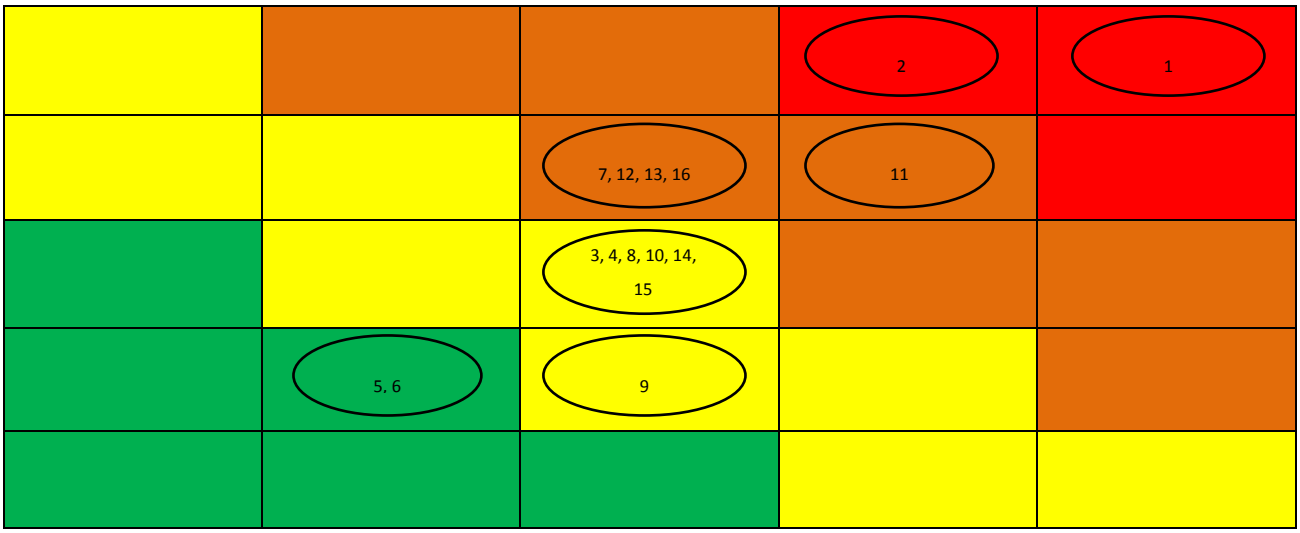

Figure 3 - Risk matrix

4.1.3 Dealing with shipping risks

Through analysis of parts of the responses to the questionnaire, it was found that there was a basis for most of the risks included in the initial framework. However two risks were found to be close to a combined risk level that did not justify the inclusion on the list of key risk factors in the shipping industry. These risks will be further assessed later in the analysis as interviews conducted with select respondents are analyzed in order to deepen the understanding of the risk factors in shipping and what risks are to be included.
First however, a further analysis of the questionnaire will focus on the ways companies are dealing with the risks identified in shipping and how well the companies are protected against the various risks.

The questionnaire was divided in two parts, the part focusing on the handling of risks consisted of a series of yes/no questions regarding financial risk management in the form of hedging of various risks, and a table like the ones asking about likelihood and impact of the identified risk factors, simply focused on the individual companies' protection against each risk.
The five hedging tools included in the questionnaire were:

- *Hedging of freight rate risk*
- *Hedging of bunker price risk*
- *Hedging of interest rate risk*
- *Hedging of exchange rate risk*
- *Hedging of counterparty risk*

All respondents came back with a reply to the five tools, but none included other hedging techniques they used, suggesting that the list may prove exhaustive for the risk that shipping companies use hedging against. Hedging techniques are often used to lower the threat of a given risk by eliminating the unknown aspect for a smaller cost. However opportunities for gains can be present in the development of the interest rate, exchange rates, bunker prices and freight rate as these risks provide both upside and downside potential and these can also be managed opportunistically to pursue potential financial gains. In the questionnaire it was however asked if the hedging tools were used to protect against the threat that these financial risks also pose.

The replies to the question regarding the five tools are showed in table 12 and this shows that there is a clear discrepancy between which hedging tools are used by the shipping companies. None of the responding companies use hedging against counterparty risk, but seemingly trust the contracts and agreement in place. In case a company is struck by this risk however, and experiences that another party is not fulfilling obligations, it can prove costly if this hurts the business in by for example limiting sales and revenue. However, with proper contracts in place the company affected by counterparty risk should be able to secure against actual losses because of the contractual circumstances. If however the counterparty for example goes out of business and the company cannot get the full amount outstanding, it can experience a loss due to the decision of not hedging against counterparty risk.

Seven out of the ten responding companies use hedging against exchange rate risk. This risk has the potential to harm companies involved in international business, and as most shipping companies are, and all the included respondents are, it may seem surprising that not all are utilizing hedging tools against exchange rate risk.

Interest rate risk is present when organizations are indebted and thus risk paying more or less depending on the changes in the interest applicable to their inherent debt. Eight out of the ten companies surveyed in the questionnaire use hedging against interest rate risk in order to protect themselves against the development in the interest rate.

Hedging against bunker price fluctuations was the most common of the included hedging tools and used by nine of the ten responding companies. As bunker use is significant for shipping companies it is natural that this is a commonly used tool in order to mitigate the threat of rising prices. Bunker price fluctuations was also one of the two risks listed as having a very high combined risk level in the analysis above, and thus protection against such a risk that seems both likely and impactful is natural for most shipping companies.

Freight rate risk was the other risk that achieved a combined risk level above 4.5 and as such was identified as a very high risk. However only seven out of the ten companies are using hedging tools against freight rate risk despite the fact that this was found to be the most impactful risk of all in the previous analysis. Therefore it is very interesting why some companies do not try harder to protect against the impact this risk can have on an organization, and whether it is down to resources or strategy will be investigated further in the analysis of the conducted interviews.

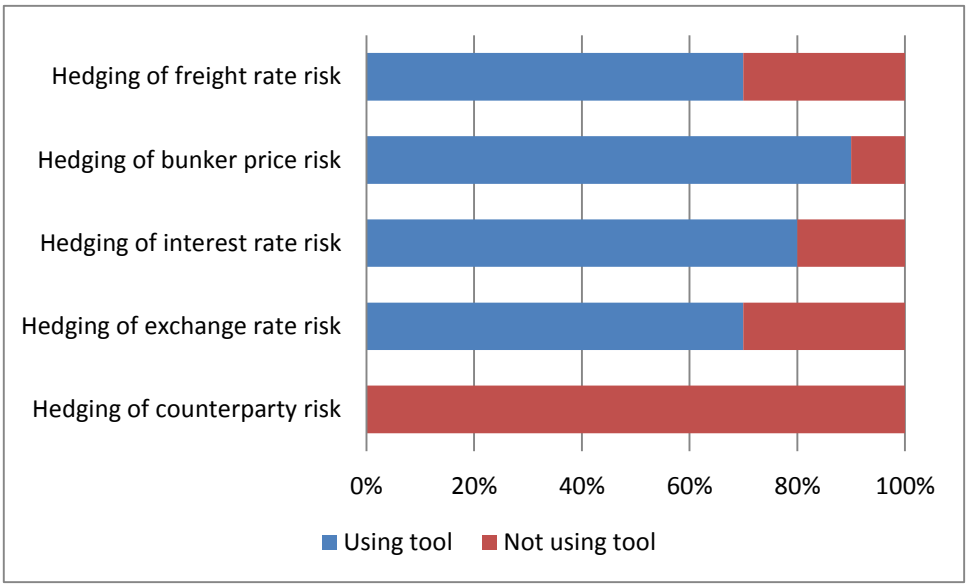

Figure 4 - Hedging tools

Table 13 provides an overview of the responses to the question of how well-protected the various companies perceive themselves as being against the individual risks identified in the shipping industry. A higher score here, on a scale from 1-5, indicates a higher perceived level of protection against the specific risk, the categories were classified as; 1: very low – 2: low – 3: medium – 4: high – 5: very high.

The general overview in the table below gives the impression that the surveyed companies are generally well-protected against many of the risks present in shipping. Few risk factors receive a cumulative score below 3 which corresponds to a perceived medium level protection against the risk, and as such the companies are on average well protected against most risk. The tools used for protection against the various risks can be many and not all will be covered in this part of the analysis, which will simply attempt to outline the nature of risk management in the shipping industry before the interviews allow for deeper understanding of the actual processes of risk management.

Protection against financial risks is generally high and this is the risk category which receives the highest average scores of the four risk categories identified. The lowest score is 3.3 and the majority of the risks in this category receive scores closer to 4 than to 3. The fact that the companies are well-protected against financial risks is unsurprising given the nature of risk management with financial risk management as one of the oldest disciplines (Borghesi & Gaudenzi, 2013, pp. 26-27) and that financial risk management generally is well-developed and used in many different industries. Miller & Waller (2003) describes real options reasoning as the

pursuit of gains through the opportunity to either acquire or sell assets for a given price in the future. It is a classic financial risk management tool used to both guard against changes in the future environment as well as attempting to take advantage of these. The high level of protection further aligns well with the findings from the previous question regarding hedging tools and the use of these as it was found that the majority of companies used hedging tools to deal with various financial risks such as freight rate risk, bunker price risk, interest rate risk and exchange rate risk. These are also all risk factors that score high on the perceived level of protection as all risks receive scores above 3.5. Credit risk is the only category receiving an average score below 3.5, and as such the risk companies are least protected against on average. At the same time however, it was also the risk that received the lowest combined risk level and it is thus very likely that many companies simply do not focus as much on this risk as on other financial risk factors present in the shipping industry.

The protection against operational risks is generally also quite high, as all but one risk factor receives scores above 3.5. These high-scoring risks range from IT stability to staff availability and insurance coverage. Thus it shows that these risks are well-known to shipping companies and as such also strengthens the argument that these risks are to be included in the list of risk factors present in the shipping industry. Moreover, the fact that a broad range of operational risks are covered this well shows that the shipping companies included generally have well-established risk management procedures in place according to their own perception. General tools used against operational risks are very diverse as this category includes very different kinds of risk. Compliance needs to be managed through clear descriptions and policies and as an integrated part of the company and its risk management (Hopkins, 2011), whereas asset value and as such the decrease in vessel value can be managed through the use of derivatives much like some financial risks (Albertijn et al., 2011). As such there are many tools needed when managing operational risk and an organization-wide approach is needed to include all operational risks. TORM highlights this in their annual report as well as they focus cross-functional cooperation as the overarching tool that allow them to minimize operational risks (TORM A/S, 2017). The need for many different tools and cross-functional cooperation is also visible in the results from the questionnaire, the companies surveyed here clearly use various tools based on the differences in level of protection. Some believe they are very well covered against threats from compliance issues while others see

themselves optimally covered against threats from IT risks. The discrepancy in the results may signify the lack of research on specific shipping risks and a lack in shipping companies as to integrated and organization-wide risk management framework. The risk factor scoring below 3.5 in the operational category is macro-economic development. As previously mentioned, this risk entails a lot of uncertainty and unpredictability as well as the fact that the macro-economic development is outside the companies' sphere of control. Companies can attempt to use hedging tools such as hedging against freight rate volatility and bunker price fluctuations in order to partially guard against the threats constituted by the macro-economic development. However, despite the fact that many are using such tools, the lower score to this risk shows that this entails such uncertainty that the companies are not able to protect themselves against the potential dangers.

Strategic risks, constituted by political & legal risks and the technological development, are all factors that score below 3 in this question about protection. This reveals that companies, at least some companies, do include considerations about strategic risks and the threats and potentially the opportunities they entail. However several also perceive themselves as not well-protected against these risks that can challenge their strategic starting point. This can seem understandable given the focus there have been on disruption recently, especially since part of the focus has been on the development of the shipping industry and how new technologies and market entries could threaten the old and perhaps more traditional companies in the industry (Friis, 2016; Siren, 2015). This may have encouraged some companies to develop measures to counter the threats of strategic risks, or to even attempt to take advantage of the opportunities also present in this category. This could for example be done by using scenario planning which is attempting to develop ones strategy based on possible future scenarios (Miller & Waller, 2003) and is already being attempted in the shipping industry which is aware of both the threats and the opportunities from especially technological development (Communications, 2016). The same focus may however also have made other companies aware that they have not had significant or sufficient focus on strategic risks which can have prompted a realization present in some responses, that they are not well-protected against strategic risks at present.

Pure risk is the final category of risk included in the questionnaire and focuses on the loss or damage to assets due to various external circumstances. This risk scores among the lowest of all

factors in the perceived protection against the risk, showing how this risk entails many different factors that can influence the company and how these factors can be fairly unpredictable and difficult to protect against. Nonetheless, the score of 2.8 equals a medium level protection and shows that companies do not view themselves as particularly vulnerable towards this risk. Measures for protection against pure risk are generally the basis of traditional risk management (Andersen et al., 2014). These are often insurance policies used to prevent, protect and cover against the threats stemming from pure risk. Tools used to guard against pure risk are often financial tools which are thus used in the management of financial risks as well such as various derivatives apart from insurances (Alizadeh & Nomikos, 2009). The two risk categories are however differentiated due to the nature of the risks and where these come from, but as seen in the questionnaire both can have great impact on a shipping company.

Overall the perceived protection against the risks included is fairly high as no risk factor receives an average score below 2.8. A score of 2.8 corresponds to medium level protection and as this is the lowest score any factor receives, it must be concluded that the respondents perceive themselves to be well-protected against all risks included in the list. At the same time it is noted that no risk receives and average score of 4.5 or above as was the case in the overall risk level, and as such the respondents find some risks i.e. freight rate volatility and bunker price fluctuations, to be more impactful than they perceive themselves to be protected against these risks. The results show that there is a general consensus of good protection against all risks, but at the same time it reveals definite room for improvement which may be the result of the limited research on the topic of risk management specific to shipping.
In the analysis, certain tools found in the literature on risk management are highlighted in the protection against the various risk categories. These tools will be cross-analyzed with the findings from the interviews in order to create a better understanding of the risk management practices used in the shipping industry and how companies work to manage threats and opportunities stemming from the risk factors included in this analysis.

Companies / Risk protection		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7	Company 8	Company 9	Company 10	Average
Financial risks	Freight rate volatility	2	3	4	2	4	4	3	5	4	5	3.6
	Bunker price fluctuations	4	3	4	2	4	4	5	5	4	5	4.0
	Interest rate risk	4	3	3	5	3	4	3	4	3	4	3.6
	Currency risk	5	4	4	5	3	4	4	4	3	5	4.1
	Credit risk	3	3	3	3	3	4	3	3	3	5	3.3
	Funding & Liquidity risk	4	3	3	3	3	4	3	4	3	5	3.5
Operational risks	Stability of IT systems	3	3	3	3	5	5	3	3	5	5	3.8
	Insurance coverage	5	3	4	5	4	5	3	3	4	4	4.0
	Terrorism & Piracy	2	3	4	4	4	5	4	3	4	3	3.6
	Availability of experienced seafarers and staff	4	3	4	4	4	4	3	4	4	4	3.8
	Compliance with relevant maritime and environmental regimes	3	3	4	4	4	4	2	4	3	5	3.6
	Macro-economic development	2	3	3	4	3	1	2	3	3	4	2.8
	Decrease of vessel value	3	4	3	4	4	4	3	3	4	4	3.6
Strategic risks	Political & Legal risks	2	3	3	4	3	1	2	3	3	4	2.8
	Technological development risk	4	3	3	4	3	1	2	3	2	4	2.9
Pure risks	Total loss or damages to the vessel due to natural disasters, accidents or technical failure	2	3	3	4	3	1	2	3	3	4	2.8

Table 12 - Risk protection

4.2 Interviews

After the results from the questionnaire were analyzed, six companies were selected to conduct semi-structured interviews, however only four of these were able to participate. Four of the companies were selected based on the highest or the lowest results of risk evaluations in at least one of the questionnaire tables in order to understand reasoning behind such assessments. Further, two of the six companies were selected because their responses were well-aligned with the average responses. As such, the two companies with the highest risk evaluation, the two with the lowest risk evaluation, and the two closest to the average were approached for interviews, were as one of the companies with the high risk evaluation and one company representing the average were not able to participate.

Together with the pre-test interview, a total of 5 interviews were conducted and used for further analysis. The first part of the interview was devoted to a general overview of a company's business, its financial and operational strategies, and performance management, while the second part focused on various aspects of the risk management and actual mitigation strategies and tools. This part of the chapter will focus on the outcome and the findings from the interviews, before analyzing these in combination with the previous findings from the questionnaire. This will result in an analysis of each identified risk factor, its importance to shipping and the strategies and tools used in managing them.

4.2.1 Interview findings

General information on companies provided a better understanding of their operations and shed light on potential risk management problems, while it also ensured relevance of additional questions. However, interviewees found it difficult to answer the second question related to the financial strategy and capital structure of the company. This result has repeated findings of the pre-test and confirmed that employees involved in operations management are not explicitly informed about financial strategies and decisions of a company. Meanwhile, all of the interviewed employees were aware about the general situation in regard to funding and confirmed that there is a strong financial background in each of the companies. However, it was also advised that most segments of the shipping market still did not recover after the recession and that there are many shipping companies around the world who struggle to find financing.

Contrary to the previous question, the third question related to operational strategies was explicitly answered and provided valuable information for the research. First of all, companies advised that they focus mainly on one market segment in order to excel their niche and business operations. For instance, one of the companies advised:

"Even when the bulk carrier segment is down at the moment, we still manage to operate with good margins. Our niche business, which involves transportation via ice class bulk carriers, is barely affected by competition and allows for higher profits".

Moreover, the company has managed to secure advantageous time charter contracts and low freight rates have only increased their margins further. This is a prominent example of how a shipping company taking its niche could extract benefits even during bad market conditions. On the other hand, such findings provide counter-arguments towards strategies about diversification of the vessel portfolio. Yet, further studies on this subject are required in order to make definitive conclusions.

Going further, it was found that shipping companies mainly use four operational strategies in terms of chartered versus owned vessels. First, to own vessels and to charter them out; second, to own vessels, charter them out and also to operate part of your fleet; third, to own and operate part of a fleet and to charter vessels in, when and if they are needed, from companies employing the first and second strategy; and last, to use pure operation of vessels taken on charter or tramp voyages. It is notable, that 2 out of 5 companies were using last strategy of pure chartering and were found to be highly profitable. The next two companies employed the third operational strategy and had stable operating incomes. However, the last company used the second strategy, owning all of their fleet and chartering vessels out, and this company was posting losses due to a bad freight rate market for bulk segment and was afloat only owing to strong financial backing. Consequently, it could be suggested that the operational strategy of a pure chartering might be the most profitable during the unfavorable market condition. However, these findings should be tested on a wider scale. Finally, the flagging policies, which signify different environmental, safety and labor standards, were advised to be not of a high concern with no priorities being given to the lowest or the highest standard flags.

Closing the first part of questions, interviewees advised that to the best of their knowledge

companies are using accounting ratios and various key performance indicators in order to monitor and measure performance of a company, while the overall efficiency and allocation of resources is considered to be more of strategic and operational tasks.

Continuing with the second part of questions, all of the companies confirmed to use risk management initiatives in various forms. The deciding factors to start using the risk management were however different. In one case, it was a natural decision due to the growth of a company and hence higher exposure to bunker and freight rate risks. The other company was publicly listed and thus risk management was a requirement to ensure stable cash flows and to avoid unexpected loses for shareholders. However, the majority of companies stated, that considering the volatility of the shipping industry, risk management is a prerequisite for all reputable companies to keep a company afloat and to avoid bankruptcy. These findings indirectly support 3 out of 4 reasons to use risk management strategies stated in the literature review. Further, it was confirmed that the costs of using risk management tools are justified by the outcome and that the risk management is determined to be an essential part of the shipping business.

4.2.2 Shipping risks and management strategies

In this next part, the findings from the interviews will be combined in a cross-analysis with the findings from the questionnaire to assess each risk factor included in the study. This will allow for an analysis of the overall threat and opportunity each risk pose to the shipping industry, and thus reveal what risks are the most important. Further, it will allow for an analysis of the risk management tools and strategies that are used in shipping based on all the collected data and this will in turn help answering the research questions.

Freight rate volatility

The factor of freight rate volatility was regarded as the most threatening during both the questionnaire and interviews. This is in line with Alizadeh and Nomikos (2009), who state that freight rate volatility is the most important source of risk for a shipping company, since it has direct influence on a company's profitability. Considering operational strategies, freight rate volatility certainly has an impact on companies employing any of four strategies, yet it differs from a one case to another. For instance, the backwardation of a freight market will have a negative

effect for shipping companies that charter vessels out, and vice versa this effect would be positive for companies that take vessels on a time charter.

It is notable that 70 percent of companies that replied on a questionnaire, and all of the interviewed companies, said to use Forward Freight Agreements (FFAs) to hedge their freight rates. There was no difference on which operational strategy a company were using, all of them saw hedging of freight rates as the most efficient and effective way to decrease volatility and to stabilize cash flows. However, the questionnaire also highlighted that the overall protection level against this risk averaged at 3.6. Considering that the combined risk level of freight rate volatility is the highest, such a level of protection could be threatening. Further, during interviews companies clarified that geographical routes and vessel types are not always exactly the same as the available hedging contracts and hence shipping companies are forced to purchase the FFAs with the best correlation index. As a result of this, a part of the freight rate volatility risk is left uncovered. Continuing, some companies also advised that even if a FFA is purchased, there still could be a settlement risk. For instance, if the FFA is purchased for a monthly voyage and a vessel is delayed for a week due to bad weather, a company will need to settle the FFA after a one month and will be subjected to a freight rate risk for an additional week. Hence, the freight rate risk remains the major threat for shipping companies.
Meanwhile, interviewees advised that they are not aware if real options are used in order to mitigate this risk. Further, in the annual reports of sampled companies, it was found that in order to reduce freight rate volatility some organizations try to build a balanced portfolio of vessels, cargoes and geographical areas, while others assess entering into long time-charter contracts. The general analysis of annual reports however confirmed that the majority of the sampled companies stated freight rates hedging as the most common tool to mitigate the freight rate risk.

Bunker price fluctuations

Bunker price fluctuations is the second most threatening risk, also according to both the questionnaire and interviews. Such a high rating confirms findings of the literature that fuel oil price fluctuations are a major source of risk and therefore should be managed. The interviewed companies further elaborated that fuel costs savings are of paramount importance and receives high attention from top management, with various benchmarks and key performance indicators

being designed to track fuel purchasing efficiency. Further, besides tracking efficiency of a purchasing department, companies also try to protect themselves or gain some level of control against bunker price volatility. Hence, all of the interviewed companies affirmed that risk management tools are applied in order to mitigate this risk. This is also proved by the online questionnaire results, where 90 percent of the companies stated bunker hedging as being used. Going further, there were two main risk management strategies mentioned during interviews, which are also in line with the literature. Three companies advised that they use financial derivatives for hedging bunker price fluctuations. Moreover, the analysis of annual reports also indicated that use of financial derivatives is a primary method to cope with bunker price fluctuations within the chosen sample, while Unifeeder and one more company declared that they apply Bunker Adjustment Factor (BAF) to contracts and in this way eliminate the risk completely by transferring any negative price fluctuation to clients.

The only residual risk mentioned by Unifeeder was a mismatch in payment terms, since clients pay for the freight when it is delivered, while most of bunker suppliers apply 30 days credit terms. However, the most important is that these findings might be contrary with findings of Menachof and Dicer (2010), whose study advises that application of a BAF is less efficient for liner shipping companies than hedging. Even though, the study was conducted only on a basis of the North Atlantic trade route, the example of Unifeeder indicates that more cases and companies should be studied in order to conclude that the BAF is not efficient.

Continuing, some companies advised that in order to mitigate bunker price fluctuations, they tend to find cargoes in Russian ports and fill up vessels with low cost bunkers, while then to use a slow steaming technique in order to decrease the daily fuel consumption. This also allows avoiding bunkering in expensive locations if the vessel has a round trip. Although, the slow steaming is only possible when a market is in recession and there are not enough cargoes for all vessels, it is still a mitigation strategy being utilized especially in the market of today. If the market is not in a downturn, vessels cannot afford to sail slowly, since this would mean to lose profit from delivering more cargoes, and thus this strategy is only utilized during conditions as currently present.

Concluding on this specific risk, companies have marked an average protection level at 4.0, which signifies that bunkers hedging could be more efficient than freight rate hedging. It was suggested

during interviews that this might be due to bunkers being a more standardized product and hence being easier to find perfect match for hedging.

Interest rate risk

Operating within the shipping industry involves extensive capital requirements. As a result, companies need to take loans or use other means of funding. Therefore, the risk of changes in the interest rate is affecting most of the shipping companies. However, according to the questionnaire, this risk is classified to be in the medium level, with the overall protection score showing 2.7. This tells us that companies do not perceive an interest rate risk as a major threat and are not willing to put extra effort in order to mitigate it. At the same, the questionnaire also highlighted that eight out of 10 companies hedge interest rates, meaning that this risk is actually taken seriously and being managed proactively. Furthermore, most of the annual reports include this risk, and advise that companies are affected by changes in the interest rates. The interviewed companies explained that due to the financial situation in most of the western world, interest rates have decreased and thus are not perceived as a big threat. However, the situation could change when the market picks up and consequently shipping companies might alter their evaluation of this risk.

When asked about mitigation strategies, all of the interviewed and most of the questioned companies replied that they were using interest rate derivatives as the only tool to mitigate this risk. It is worth noting, that most of the interviewees did not know exactly which financial strategy is used by the company, meaning what is the debt to equity ratio. Like in the pre-test, this was due to the interviewed employees being mostly involved in vessel operations. However, that could also lead to a conclusion that the information about the company's financial strategy is not widely transmitted throughout the company. Luckily, this information is mostly publicly available and it was found that all of the sampled companies are involved in long and short term debts. Therefore, the interest rate risk level should be reassessed when the market situation will change in order to test if the result of this study is not subjective to prevailing market conditions.

Currency risk

Currency risk, or exchange rate risk, applies when a company's revenues and expenses are denominated in different currencies and thus a company may have both negative and positive impact of changes in currency rates.

The currency risk has a score of 2.7 on the risk level as the interest rate risk and enjoys the same high number of references found during the annual reports analysis. However, the protection level stated by the companies is 4.1, which is 0.5 higher than the interest rate risk result and might signal that companies are better protected against currency risk. During interviews, it was found that all participating companies try to perform transactions using same currency, mostly USD and EUR. Hence, this creates a natural hedge for companies and eliminates a major part of the threat from exchange rate risk. Nevertheless, administrative expenses are still paid in DKK and present the residual risk, which is usually covered through financial derivatives. As per the questionnaire, seven out of 10 companies, stated to use exchange rates hedging, and during interviews companies further confirmed that in case the natural hedge is not possible, financial derivatives are the best way to mitigate this risk.

Credit risk

Credit risk is related to the uncertainty that as to whether a counter-party will perform its financial obligations in full and on time. According to the questionnaire results, credit risk, or counterparty risk, falls into the green square on the risk matrix. This indicates that the counterparty risk is not perceived to represent a real threat for shipping companies. Moreover, none of the respondents use credit risk hedging, even though the average protection level is only at a mark of 3.3. Considering turbulence of the shipping industry and recent bankruptcies of Copenship and Hanjin, such results are surprising. Hence, after a further investigation companies advised that the credit risk is a major issue within the shipping industry in general and that there are many fraudulent and incompetent firms. However, through due diligence with a constant reassessment, along with long-lasting partnerships with reputable companies the sample companies were able avoid most of the credit risk issues. One of the companies advised, that:

"In order to secure stable cashflows we avoid taking higher margin, but riskier business"

It was further suggested that even though there is a large number of shipping companies, it is quite easy to get a reference on the required counterparty through an existing network and various digital resources. As shipping is a highly relationship oriented business, this serves as the first barrier for untrustworthy companies.

Funding & Liquidity risk

Being highly capital intensive, the shipping industry puts additional pressure on companies with its capital requirements. At the same time, since the industry is very turbulent it is not always easy to ensure funding and persistent cash flows. Hence, funding and liquidity could be an issue, especially for private and smaller companies. This is the last risk of the financial category and just as the credit risk it was assigned to a low impact/likelihood category. This is also an interesting result considering that Albertijn et al. (2011), Wang et al. (2014) and Drobetz et al. (2013) argue that banks have significantly decreased shipping loans since the global financial crisis of 2008 and thus financing in the maritime industry should be a key challenge. Going deeper into this question during interviews, it was uncovered that the interviewed companies have a strong financial back-up and therefore are not worried about funding and liquidity issues. However, the companies also advised that there are many shipping firms worldwide, who are struggling to secure funding for development projects and even for existing operations. These are mainly companies who own a major part of their fleet, especially bulk carriers, containerships and off-shore vessels, because these segments of the shipping market were hit the most by the recession and are still operating under difficult circumstances.

Regarding mitigation of this risk, companies have stated that the exceptional performance of a shipping firm together with its professional risk management approach should secure opportunities to get funding through banks or company bonds. Meanwhile, private companies can go public and attract the required capital by issuing shares. However, this method will impose stringent regulations over all of the company's decisions and actions. That could bring more control over an organization and could as a result slow down the development as decision making processes will take more time.

Stability of IT systems

The next risk, stability of IT systems, opens the operational, compliance and market category of risks and according to the risk matrix is perceived as a risk of high level. This was also confirmed by several annual reports, where companies stated that undisruptive and secured performance of IT systems is one of the key conditions for successful operations. Meanwhile, the evaluation of protection against this risk has shown a score of 3.8, which could signify that shipping companies put efforts into mitigating this risk. Hence, it is important to understand what the possible solutions are to ensure stability of IT systems.

First, the interviewed companies advised that the optimal way to cope with this risk is to have a dedicated and professional IT department, who will be responsible for maintenance and development of IT systems on a daily basis. It was further advised that the education of employees by the means of seminars and courses is also considered to be an effective method and helps to prevent such issues as virus attacks, which are performed through infested e-mails.
Companies also confirmed that a cross-functional cooperation supports stability of IT systems in the way that an IT department gathers insights from other departments in order to have a holistic view of the processes inside the company and to ensure that critical processes could work without interruption.
Meanwhile, there are more specific techniques stated in the annual reports of some companies. For instance, Norden states that their IT department has created an emergency technical capacity with an IT environment distributed on 2 locations with mirrored critical systems. Whereas, J. Lauritzen in addition to a duplicated infrastructure and an emergency capacity, also runs regular tests to identify what time is required to completely restore IT systems. In general, interviewees stated that significant attention is put into ensuring the stability and security of IT systems and at the moment the most common problem is cyber-attacks, where hackers obtain information about a company's operations and afterwards send invoices from the name of a company with a request to pay those invoices to a new bank account. It was suggested that stringent payment procedures and organization compliance policies should be in place in order to minimize losses from such actions.

Insurance coverage

Insurance coverage is a risk when a company is not willing or able to insure any or all known risks which could be faced by the company. With a combined risk level of 3.1 and a protection level of 4.0, it could be concluded that shipping companies are well protected against this risk. Moreover, the interviewed companies advised that insurances are purchased for the majority of possible accidents, which may impact operations and liquidity of a company. The most common accidents at sea were mentioned as: oil spills, collisions and technical failures. Furthermore, it was advised that reputable companies join Protection & Indemnity clubs (P&I clubs), which require membership fees, but in return offer financial support and assistance in case of accidents. P&I clubs also help to increase the level of compliance of shipping companies, as besides membership fees, a certain level of environmental, safety and labor compliance must be met.
Concluding on this risk, none of the companies advised that they had major issues connected to insurance coverage. Moreover, companies suggested that there is a wide range of insurance companies who offer their services to cover practically all possible risks if there is such a need.

Terrorism & Piracy

Terrorism & Piracy is the next operational risk, which is more appropriate to companies sailing through the piracy zones or close by. This risk falls into a medium risk level group and has a protection level of 3.6. Hence, the protection level is perceived to be satisfactory considering that the combined risk level is at 2.9. However, it was found interesting this risk only receives a medium impact level, when the consequences could be fatalities. Subsequently, during interviews companies clarified that within the last decade terrorism & piracy accidents have significantly decreased with efficient anti-piracy campaigns and operations. During the most successful operations vessels were released with no harm to a crew or a cargo. Moreover, ships that sail in the risk zones usually hire on board guards or convoy guards in order to safely pass dangerous areas, while there are also navy vessels of various countries patrolling unsafe territories for immediate support in case of an accident. It was also advised that insurance could be purchased against this specific risk, but due to the high costs it would be relevant only for vessels intensively sailing within piracy zones. Finally, all interviewees confirmed that during their working period vessels were not involved in terrorism or piracy accidents, which might be a reason for the low impact score.

Availability of experienced seafarers and staff

Availability of experienced seafarers and staff issues were mentioned by several companies in the annual reports. Yet, according to risk and protection levels, this risk is not perceived to be threatening by companies who replied to a questionnaire.

Going further, companies advised that in regard to the onshore staff it is common to offer internship programs to local students in order to spot the most talented ones and retain them afterwards by offering attractive full time contracts. This helps to avoid sunk investments in new employees, who would not be able to manage the job properly. At the same time, it allows companies to educate capable employees with considerably lower costs during the educational period.

In regard to seafarers, shipping companies who were only chartering vessels were not involved in the crewing process and hence could not provide information on this issue. While companies who also operated owned vessels said that this is an important aspect of a vessel's operations and having an experienced crew is a precondition for a lower number of accidents and consequently lower costs for dry docks, delays and casualties. It was further advised that educational trainings and seminars could be a good way to keep a high proficiency and a compliance level of seafarers, whereas good conditions of an employment should keep them loyal towards the company.

Compliance with relevant maritime and environmental regimes

Shipping provides us with a remarkable example of a globalized industry and as any industry it is governed by certain regulations (Sampson & Ellis, 2015). By 2016, two main bodies – the International Maritime Organization (IMO) and the International Labor Organization (ILO), under the broad framework of the United Nations Convention on the Law of the Sea (UNCLOS 1982), were responsible for developing and maintaining workable regulations within the framework (Stopford , 2009). Non-compliance with certain maritime and environmental regimes could lead to fines, decreased freight rates due to bad reputation, and even a ban to enter certain ports. The prominent example is Paris Memorandum of Understanding on Port State Control, which has the mission: *"To eliminate the operation of sub-standard ships through a harmonized system of port State control."* (Paris MoU, 2016). This memorandum applies high environmental, safety and labor standards for incoming vessels, while results of all Port State Control checks are presented on a website. Therefore, compliance with these regulations could increase the reputation and

attractiveness of a vessel for the next hire, while non-compliance would result in the contrary. Furthermore, in case of a systematic non-compliance vessels are banned from entering in ports of countries, who signed the memorandum.

Considering the above, it can be concluded that non-compliance could lead to substantial reputational or financial losses for a company. Hence, it is important to control this risk. The importance of compliance is also confirmed through the questionnaire, where it is assessed as a high level risk. At the same time, the protection level is at 3.6, meaning that companies are not putting extra effort to ensure the high level of compliance. The low attention to flagging policies further confirms these results. Elaborating on this subject, companies advised that usually compliance above minimum standards ends up in additional costs, which make a shipping service of your company less competitive. One interviewee has provided an example, saying that:

"IKEA, that is considered to be a "green" company, officially demands its providers to have a high level of CSR initiatives. However, when it comes to business, the company was always choosing cheaper providers over the corner no matter how good their CSR initiatives were."

This goes in line with (Sampson, et al., 2016), who argues that current regulatory frameworks do not truly create a "level playing field" and that there is very little incentive for socially responsible shipping companies to pursue higher standards, while less responsible operators might be able to gain a competitive advantage by applying lower standards. Yliskylä-Peuralahti & Gritsenko (2014) further argues that difficulties arise from the absence of the enforcement mechanism to ensure compliance on the international level. Nevertheless, several annual reports and all of the interviewed companies advised that there are Social Corporate Responsibility (SCR) policies in place and especially Danish companies are known to be pursuing "greener" shipping. Meanwhile, it was suggested that the mitigation of this risk could be performed through stringent corporate policies, employee trainings and contract clauses, which will imply large fines for non-compliant practices.

Macro-economic development

Macro-economic development is a risk that is essential for the shipping industry, as 95 percent of goods traded internationally as measured by weight, and sixty-six as measured by values, are transported on the ocean by ships (DeSombre, 2006). Consequently, this projects any changes in the macro-economy, either positive or negative, onto the shipping industry in a highly influential way. The situation is further developed by the specificity of the market, since the shipping market is inelastic and during recessions there is overcapacity of available vessels, which drives freight rates to extremely low levels. Whereas, during booming periods there is not enough vessels and it takes several years to build a new ones if required, hence at a certain point freight rates increase drastically (Alizadeh & Nomikos , 2009). Furthermore, the interviewed companies advised that some of the shipping firms neglect the cyclicality of economy and order new builds during a booming period, which are delivered already when economy is turning to a downward trend. This worsens the situation with overcapacity during a recession, yet also creates opportunities for some companies to purchase or charter vessels at a fire-sales price.

The above information provides reasonable ground to support the importance of this specific risk, which is also confirmed by companies, who evaluated macroeconomic developments as a high level risk. At the same time the protection level was assessed to be one of the lowest and scored only at 2.8. This result was explained by the uncontrollable and unpredictable nature of forces which shape macroeconomic developments. Although, most financial risks can be hedged, there are many other risks stemming from the macro-economic development which could affect the business of shipping companies.

Going further, it was found that three out of five interviewed companies are using scenario planning to modulate and prepare for the various developments of the economy and the market. This helps to build a sustainable strategy and minimize costs in case of adverse market conditions.

Decrease of vessel value

Decrease of vessel value is highly correlated with macro-economic developments and is also considered by companies to be a high level risk. However, a level of protection against this risk showed mark of 3.6, which is considerably higher than the previous risk. Going deeper into this question during interviews, it was identified that only one interviewed company, besides

operating, also owned all of its vessels and thus was highly affected by this particular risk. The rest advised that the risk of decrease in vessel value is simply avoided or reduced by chartering all or part of the vessels instead of owning all of them. On the other hand, the company who also owned operated vessels commented:

"Chartering avoids risk of decrease in vessel value during recession periods, but also misses advantages of extra profit and capacity during booming periods."

Although, it was confirmed that decrease in vessel value during economical downswings severely affected shipping companies, who own vessels, and negatively affects financial statements as companies are required to adjust value of their assets according to fair value accounting standards. It was also advised that interviewees are not aware if the companies are using Forward Ship Value Agreements in order to hedge vessel value, but a qualitative guess was that such derivatives are expensive and most probably are not popular within the shipping industry taking in account high pressure of the existing ship costs.

Political & Legal risks

Political & Legal issues are the first strategic risk factors faced by shipping companies and according to the questionnaire are classified as medium level risks. It is worth noting, that the level of protection against these risks is at the same low level as against macro-economic developments risk. This is not surprising as both macro-economic and political & legal risks have overlaps. Moreover, neither of them can be controlled by shipping companies. Yet, political & legal risks could be more specific to certain countries or trading routes, which would affect only a small part of the shipping industry. Companies further elaborated that political & legal risks are perceived as a moderate threat, since there are almost no ways to avoid or mitigate this risks. The only mentioned possible way was to use a scenario planning approach for risks which could arise in specific trading areas. As an example, one company stated that:

"A scenario planning for Brexit was done in order to prepare for potential downsides of that event for our company's business."

It was further mentioned that sanctions, embargoes and changes in legislations all entail additional pressure and resource requirements for a shipping company to operate legally.

Technological development risk

Risk of technological developments was among the least popular during the preliminary risks screening. However, a questionnaire pre-test has revealed that this risk could be important for shipping companies, even though they do not speak out loudly about it. Further, the questionnaire results identified that a risk of technological developments was assigned to a medium risk level group with a mark of 2.8. Notably the protection level against this risk is just slightly above and has reached 2.9. During interviews, companies explained that in general there is constant attention towards technological developments and people in charge closely monitor the situation, and that such an average threat result could be explained by a slow phase of technological developments, which allow enough time for the analysis and required actions. On the other hand, a medium protection level was explained by a long lifecycle of a vessel, which is around 30 years. Hence, there is a certain degree of inflexibility to follow technological innovations as dry docking is very expensive and new buildings take several years to be finished. One of the companies elaborated:

"There are continuous researches performed within the industry on such issues like: optimal hull and fan designs, engine fuel efficiency and IT systems."

Furthermore, the same company advised that in order to reduce this risk it is required to keep close contact with research organizations and keep an eye on the latest developments in order to be able to act faster than competitors.

Total loss or damages to the vessel due to natural disasters, accidents or technical failure

Finally, the last risk and the only pure category risk is related to a total loss or damages to the vessel due to various adverse events. This risk is regarded as a high level risks, while its protection level is only at 2.8. Companies advised that pure risk is mainly mitigated through insurances, which is line with the findings from the literature. Further, it was stated that there is a very limited number of mitigation strategies of this specific risk, while insuring all possible cases would be too expensive. That could explain the moderate protection level of the risk.

Moreover, possible mitigation strategies are mainly related to accidents caused by human error, since such adverse events as natural disasters and technical failures could hardly be controlled or avoided, and thus are usually classified as a force major. Notably, the number of marine casualties and accidents in Europe increased from 1.271 to 3.025 in 2011 and 2014 respectively, with 25

percent of these being classified as serious and very serious. Furthermore, the loss of control was found to be a major reason for accidents to happen, constituting 24 percent of the total causes, whereas, the primary contributing factor, which led to the accidents was a human erroneous action (European Maritime Safety Agency, 2015). Hence, it seems to be essential for shipping companies to put efforts into at least reducing pure risk connected to human errors. Following preventive methods were stated by companies as potential mitigation strategies of human erroneous actions: rigorous pre-employment tests, regular proficiency checks, on board trainings, educational seminars, and fatigue control.

4.3 Summary of findings

As a result of the responses to the online questionnaire and the application of the traditional risk management view, a risk management matrix was created. The matrix provides an overview of all risks found to be key risk factors to the shipping industry through the deductive study, and thus the risks included in the questionnaire. Further, the matrix provided an idea about the most and least threatening risks, and as such also highlighted which risks should attract the highest attention of shipping companies.

The majority of risks were assessed as medium to high level risks with fewer outliers in the low or very high categories. It is worth noting, that two of the important risk factors stated in the literature review, namely credit risk and funding & liquidity risk, received the lowest combined risk level in the matrix. This anomaly was further addressed with the companies during semi-structured interviews and it was uncovered that both risks are essential for the shipping industry. It was further advised that there are many shipping companies, in the global industry, who struggle to receive funding and financial support for its projects and operations. Hence funding & liquidity questions are quite acute at the moment. Yet, all of the interviewed companies have strong financial backing and that could to some extant explain the low threat level shown. Going further, the companies also confirmed that credit risk is crucial if not paramount for successful business operations of a shipping company. However, the perceived low level for this risk could be explained by long-lasting and trustworthy business partners and avoidance to take higher margin, but riskier business.

The medium risks category includes: interest rate risk, currency risk, insurance coverage, skilled staff availability, political & legal risks, technological development, and terrorism & piracy risks. These risks should definitely be managed, though they do not imply the highest threat for a shipping company's operation and therefore the focus should be shifted to the next categories of high and very high level risks.

The high level risks group contains following risk factors, which should be paid special attention: stability of IT systems, macro-economic development, decrease of vessel value, total loss of a vessel and compliance with regulations. Whereas the most efforts of a shipping company's risk

management initiatives should be directed towards the two very high level risks, management of these risks is also found to be of high priority and importance to shipping companies.
The very high level risks, freight rate volatility and bunker price fluctuations, are natural risks to manage and to attempt to perhaps both guard against and take advantage of.

Further findings from the questionnaire confirmed that 90 percent and 70 percent of the companies, who replied, are using bunker hedging and freight rates hedging, respectively. This means that companies are well aware of the importance of these risks and put considerable effort into avoiding or at least reducing them. Moreover, eight out of 10 companies also hedge against interest rate risks and seven out of 10 hedge against exchange rate risk.
However, none of the respondents stated to hedge against counterparty risk and during interviews this outcome was clarified identically to the result of risk matrix in regard to the credit risk. In general hedging is widely applied among companies within the Danish shipping industry and is considered to bring substantial value.

The last part of the questionnaire was devoted to the assessment of the perceived protection level against all risks in order to test it towards risk matrix results. Overall the perceived protection against the risks included is fairly high as no risk factor receives an average score below 2.8. At the same time, it is noted that no risk receives and average score of 4.5 or above as was the case in the risk matrix, and as such the respondents find some risks i.e. freight rate volatility and bunker price fluctuations, to be more impactful than they perceive themselves to be protected against these risks. The results show that there is a general consensus of good protection against all risks, but at the same time it definitely reveals certain room for improvement, which may be the result of the limited research on the topic of risk management specific to shipping.

Continuing with the interviews part, it was found that it was rather hard for the interviewees to answer the second question related to a financial strategy and a capital structure of the company. This result has repeated findings of the pre-test and confirmed that employees involved in operations management are not explicitly informed about financial strategies and decisions of a company. Meanwhile, all of the interviewed employees were aware about the general situation in regard to funding and confirmed that there is a strong financial back up behind the companies. Going further, it was uncovered that most of the interviewed companies focus on its niche

business segment, which could be a counter-argument towards strategies of vessels portfolio diversification. Yet, further studies on this subject are required in order to make conclusions. It is also worth noting, that according to the results of the interviews, an operational strategy of pure chartering might be the most profitable during the unfavorable market conditions. However, due to a low number of analyzed companies these findings should be tested on a wider scale. Closing the first part of questions, interviewees advised that to the best of their knowledge companies are using accounting ratios and various key performance indicators in order to monitor and measure performance of a company. While the overall efficiency and allocation of resources is considered to be more of strategic and operational tasks.

In regard to the second part of questions, all companies confirmed to use risk management initiatives. Yet, the deciding factors to start using risk management varied from natural growth to a requirement of a publicly listed company. Moreover, the majority of the companies stated, that considering the volatility of the shipping industry, risk management is a prerequisite for all reputable companies to keep a company afloat and to avoid bankruptcy. These findings indirectly support 3 out of 4 reasons to use risk management strategies stated in the literature review. Further, it was confirmed that costs for using risk management tools are justified by the outcome and that the risk management is determined to be an essential part of the shipping business.

Regarding specific risks and their mitigation strategies, it was uncovered that freight rates and bunker price fluctuations are perceived to be the most threatening risks, which is in line with findings from the questionnaire. Meanwhile, hedging of bunker price fluctuations could be more efficient than freight rates hedging due to it being a more standardized product. Whereas, freight rates hedging is not always perfect due to a settlement risk and possible mismatches of geographical routes and types of the vessels with available FFA contracts. Further, it was found that the medium risk level of an interest rate risk could be affected by prevailing market conditions, as interest rates are currently low, and hence in order to test if the result of the study is not subjectively biased it should be reassessed when the market situation will change. In regard to currency risk, it was investigated that all of the participating companies strive to apply a natural hedge strategy. This means that most of transactions are performed by using same currency, mostly USD and EUR, hence eliminating major part of the exchange rate risk.

Continuing with operational, market and compliance risks, the companies advised that a dedicated IT department, education of employees and cross-functional cooperation should help to reduce the risk of stability of IT systems and ensure undisruptive business operations. While the insurance coverage risk was not of high concern and it was stated that there is a wide range of insurance companies who offer their services to cover practically all possible risks if there is such a need. Further, it was found that within the last decade terrorism & piracy accidents have significantly decreased with efficient anti-piracy campaigns and operations. Meantime, none of the interviewees have witnessed such an accident with the company's vessels and that could explain medium risk level assessment. Mitigation of the next risk of availability of experienced seafarers and staff was advised to be done by offering attractive employment contracts to seafarers and internship programs to local students in order to spot the most talented ones and cut costs during educational period. Talking about the risk of compliance, it was noted that vessel flagging policies, which signify different environmental, safety and labor standards, are not of a high concern with no priorities being given to the lowest or the highest standard flags. The companies commented that customers are not ready to pay extra for the completely sustainable shipping and that there are not enough incentives from regulating organizations to pursue higher standards at your own costs. However, all of the interviewed companies also stated that they have SCR policies in place and that mitigation of compliance risk could be performed through stringent corporate policies, employee trainings and contract clauses, which will imply large fines for non-compliant practices. Continuing with the risk of macroeconomic developments, it was found that the shipping market is inelastic and is highly affected by fluctuations of the macro-economy. It was uncovered that three out of five interviewed companies are using scenario planning to modulate and prepare for the various developments of the economy and the market, what helps to build a sustainable strategy and minimize costs in case of adverse market conditions. The last risk of this group, decrease in vessel value, was found to be highly important only for one of the interviewed companies, while others reduced or avoided this risk simply by chartering all or part of their fleet. Although, it was confirmed that decrease of vessel value during economical downswings severely hits shipping companies, who own vessels, and negatively affects financial statements as companies are required to adjust value of their assets according to fair value accounting standards.

The next group of strategic risks has a combined risk level result of a medium range. Political & legal risks were perceived as a moderate threat, since there are almost no ways to avoid or mitigate such risks. The only mentioned possible way was to use a scenario planning approach for risks which could arise in specific trading areas. It was further mentioned that sanctions, embargoes and changes in legislations all entail additional pressure and resource requirements for a shipping company to operate legally. Meanwhile, an average threat result of the technological developments risk could be explained by a slow phase of developments, which allow enough time for the analysis and required actions. On the other hand, a medium protection level was explained by a long lifecycle of a vessel, which is around 30 years. Hence, there is a certain degree of inflexibility to follow technological innovations as dry docking is very expensive and new buildings take several years to be finished. Furthermore, the companies advised that in order to reduce this risk it is required to keep close contact with research organizations and keep an eye on the latest developments in order to be able to act faster than competitors.

Finally, it was stated that there is a very limited number of mitigation strategies of pure risk, while insuring all possible cases would be too expensive. That could explain the moderate protection level against pure risk. Moreover, possible mitigation strategies are mainly related to accidents caused by a human error, since such adverse events as natural disasters and technical failures could hardly be controlled or avoided, and thus are usually classified as a force major. Hence, it seems to be essential for shipping companies to put efforts in order to at least reduce the pure risk connected to human errors. Following preventive methods were stated by the companies as potential mitigation strategies of human erroneous actions: rigorous pre-employment tests, regular proficiency checks, on board trainings, educational seminars, and fatigue control.

5 TOWARDS STRATEGIC RESPONSIVENESS

This chapter will be a discussion of the findings and the outcome of the study. It will focus on the three perspectives that are the basis for the paper and the research; the individual company, the industry as a whole, and the supply chain and supply chain network. The point of this discussion is to use the findings from the analysis to discuss the state of risk management in shipping within these three perspectives, and to further discuss potential improvements. It is valuable to investigate how risk management in shipping can further develop to address the issues identified in the study.

The chapter will work through the perspectives, discussing the current state and potential improvements and combine these to discuss how risk management in shipping can be improved in the future.

5.1 The company

The initial basis of the study was a review of literature on shipping risks and a review of the risk management practices described by Danish shipping companies in annual reports. These reviews were compiled to a list of risks thought to be present in the shipping industry and the list was analyzed in accordance with the responses from individual companies in the Danish shipping industry.

The literature review also revealed many approaches towards risk management within a company, ranging from early editions where risk management was handled by the financial departments and focused on insurances (Borghesi & Gaudenzi, 2013, pp. 26-27), to more contemporary and organization-wide editions such as ERM (Enterprise Risk Management) and SRM (Strategic Risk Management) (Andersen et al., 2014). From the study it is found that risk management in shipping companies is also often a fairly integrated aspect of the company, with many companies accounting for organization-wide strategies in both reports and interviews. These approaches often focus on the specific risks that are present in the shipping industry, and thus also in this study as these reports were part of the basis of the study. Many companies included in the study are seen to use organization-wide approaches to risk management, such as ERM, to guide them and help handling the risk experienced. However, a big amount of shipping companies in the

Danish industry do not seem to be at the level where they are using an organization-wide approach or even systematically using risk management in their daily operations. Many companies were ruled out from the study since no public information about risk management was available, or because other selection criteria were not met. Because of this, nothing definitive can be said about the prevalence of extensive risk management frameworks in the shipping industry. Nonetheless, according to annual reports, there seems to be a general lack of a structured risk management approach in several of the Danish shipping companies that were included in the study.

Despite this lack in certain companies, there is a considerable amount of companies that do have risk management initiatives in place, albeit in many various forms. Some companies are focused on the financial tools available, as illustrated by one interviewee describing the approach to risk management as mainly focused on hedging through a centrally managed system. This reveals that some companies practice a fairly simple form of risk management, despite operating in several markets across a global world. Although several other shipping companies operating with risk management frameworks do utilize ERM or other extensive frameworks to a high degree, few are focused on including strategic aspects as argued to be necessary by several authors. Andersen and Læssøe (2014) argue for strategic responsiveness as a true driver of value creation and with the limited focus shipping companies seemingly have on this aspect of risk management it may be hard to both guard against and take advantage of strategic risks. Combined with the focus on disruption, technological development and potential new competitive entrants into the shipping industry such as Amazon (Lewis, 2016), this may spell out a big mistake on the part of the companies in shipping. It is fair to note however, that the majority of companies included in this study are smaller companies that, despite their international reach, are not capable of impacting the industry. At the same time, the major Danish shipping company Maersk Line has begun to manage the strategic risks and work towards both guarding and taken advantage of the technological development that is ongoing by entering into a new collaboration with the tech company IBM in order to digitize the their business model (Andersen, 2017). This does illustrate that some companies are aware that an organization-wide approach to risk management is not enough when the strategic foundation for the business model changes. This view is further backed by the same interviewee who previously described a company's risk management as focused on

centralized hedging, as it was mentioned that the company was moving towards owning fewer ships in order increase agility in their operations. This is another sign that some companies have begun increasing focus on strategic risks.

Further, the focus on centralized approaches to risk management may be flawed in international organizations as this neglects the fact that risks are varied and diverse in international companies. With operations in many locations it may also be necessary to allow local managers and employees to work more independent to best manage the various risks international companies face. A move from a more centralized risk management framework, to one incorporating strategy and engaging the various levels and locations of shipping companies will set them up to better utilize these markets due to an improved understanding of the local environment should help create a stronger local presence. Furthermore this inclusion would highly improve the strategic responsiveness of shipping companies which is helpful in creating effective risk management. Strategic responsiveness is a necessity in a fast-moving world because it allows companies to adapt to changes in the market, the economy or even disruptive changes in the industry (Andersen, 2009). This is however a move some companies in the Danish shipping industry has already made, as another interview revealed how risk management was developed and controlled by the central management, but that there was a focus on autonomy and responsibility at the employee level. In line with this approach, (Andersen, 2009) also finds that effective risk management, created in part from strategic responsiveness, is an indicator of higher performance and that innovation further enhances this relationship. Innovation, which is going to be an important strategic factor in a changing shipping industry, is able to increase the effectiveness of risk management. With a heightened focus on this and the combined use of both central and de-central approaches, shipping companies might be able to protect themselves better against the threats posed by the various risks, as well as be better positioned to take advantage of the opportunities presented by the various risks, whether they are financial, operational or strategic.

From the study it becomes clear that the approaches to risk management in shipping are many, just as the case is in the literature on risk management. The study however also reveals that there may be a tendency moving towards the inclusion of more strategic risk management frameworks that focuses the attention on both the threats and opportunities provided by strategic risks. This is however a move made without neglecting the risks that are traditionally and generally found to be

most important for shipping companies, risks from market deviations in the form of freight rate volatility and bunker price fluctuations.

5.2 The industry

As well as a difference in approaches to risk management in the literature, the same difference is visible in the shipping industry through the various approaches companies take to managing the risks they experience in shipping. There are some clear discrepancies in how companies protect against various risks and even in how likely and impactful they perceive the risks to be towards their company. This is for example seen in the risk of technological development and the potential impact of this risk. Several companies list this as one of the risks with the lowest impact and a score of only 2, whereas one company finds this risk to be potentially very impactful and score the risk 5. Further, companies operating in different environments and different industries will have different needs that will not be covered through the same approaches to risk management. However, even within the same industry, and the shipping industry in this case, differences in view and perception are natural and expected as biases are present in everything (Mitroff & Silver, 2010), just as social issues and cultural aspects within an organization can create risks that are thus not necessarily present in other organizations in the same industry (Vaughan, 2005). Nonetheless, it is however clear from the study that there are tools and perceptions that are more broadly founded than others and as such also characterize the industry. Financial hedging tools are widely used to cover against the risks regarded as both the most likely and most impactful, and various operational risks are furthermore seen as being important for the industry in general. The study does illustrate that the general perception within the industry is that financial and operational risks are the most important and also the ones companies are best at managing. This is to a high degree in line with a general traditional view of risk and risk management, where risks are perceived as threats that companies need to hedge against (Borghesi & Gaudenzi, 2013). Further it corresponds to a more classic approach to the management of risks that is being done through hedges and generally centrally controlled as part of financial management. One interviewee described his company's approach to risk management through the following quote:

"*We use financial hedging as this can cover us against the risk of losses due to variations in rates and prices…*"

This perception of risk and use of risk management is specific to a traditional view of risk and risk management which in turn is also clearly visible through the findings in this research. As such, despite the moves from some companies towards more organization-wide risk management, a higher focus on strategic risks and a better ability to include low-level managers and employees in the management of risk, the general perception of risk and use of risk management within the shipping industry seems to lie closer to traditional risk management than to more modern forms such as ERM or SRM.

This seems natural in an industry which is capital-intensive and highly dependent on the market movements in determining both cost and revenue. However, with the issues facing the industry it may be necessary for a paradigm shift. There has recently become major focus on disruption and especially disruptive technologies as touched upon in the previous part. This can result in a complete change of the industry if the companies present at the moment are not ready to develop and engage in new technologies, procedures and approaches. The current literature focusing on risk management in shipping is following a similar path to the more traditional approach of the companies included in the study. The focus here is generally on risks in this study classified as financial or pure (Alizadeh & Nomikos, 2009; Albertijn et al., 2011) and thus does not encourage an increased focus on strategic risks or even on the approach to managing these risks as it both assumed and recommended to keep the risk management as a financial function of its own. Here the top management does not become responsible for the risk management as it is not part of the strategic basis of the company but simply an operational financial function, and nor is there an inclusion or even focus on the strategic risks present in the industry and how the management of these can both help and hurt the companies. Thus there is not a focus on either ERM or SRM, despite the literature included being relatively recent. This may simply be a sign of opposing views and a perception that these risks are less important in the shipping industry. This perception is seen to be generally shared across the industry from this study as strategic risks were generally the ones companies seemed least worried about in the questionnaire. However, the interviews did as previously mentioned reveal that some companies and the professionals within them have started to look into strategic ways to respond to changes in the industry, most recently exemplified by the low freight rates which have challenged the industry for some time (World Trade Organization, 2016). At the same time some companies do already include these risks as

specific risk management focuses, given the fact that they were found in the Danish companies' frameworks for risk management on which this study is also based. One example is the company TORM that does have a focus on long-term strategic risks, and another is the biggest shipping company in both Denmark and the world, Maersk Line. Maersk utilizes an ERM framework for risk management where they attempt to include the whole organization (Maersk Group, 2017), and at the same time they are working towards the inclusion and development of new technologies as described above. This may thus be the best indicator that a shift in the perception of risk and risk management throughout the industry is occurring, since the industry's biggest company is moving away from a more traditional view and towards what might be described as SRM, combined with the direct information gathered through interviews that reveals how some smaller Danish companies are also following this move. The crisis the industry has been thrown into due to the challenge of low freight rates may have spurred this movement. It has already cost some companies their life and this threat may have been so real to others that it functioned as a "wake-up call" to the industry and encouraged an increased focus on strategic changes ahead. If this is in fact the case, the literature on the subject that will be read in a few years may look very different from what is available now, as this could very well illustrate the perception that was present throughout the industry only a few years back, before the current crisis took hold.

Risk management in the shipping industry can thus be described as generally being quite traditional in both the perception of risk and risk management based on the literature and the some of the findings in this study. However, there is clearly a move going on from especially the biggest companies included in this study such as Maersk and TORM who are also focusing on the strategic risks they are facing. Other companies are following this as exemplified through the interviews, and an actual shift towards a more strategic risk management focus from the more traditional ideas seems to be going on.

5.3 The supply chain

As described earlier in this study, there is a gap in the literature concerning supply chain risk management connected to shipping. This is true because the general perception in the literature is that supply chain management is an important of any shipping company's business model as it is essentially concerning the movement of goods, often in collaboration with other organizations. Combined with the increasing focus in the industry on strategic risk and the responsiveness to these, it seems as if a focus on supply chain risk management would be very well suited to help shipping companies deal with the risks they are facing as supply chain risk management can be a source of competitive and strategic advantage according to the literature (Song & Panayides, 2012). This final part of the discussion will bring in the perspective of risk management in the supply chain and couple it with the perspectives of the company and the industry in order to further discuss how risk management in shipping could be improved and how supply chain risk management can help with this.

An inclusion of supply chain risk management makes sense in the way that it allows all companies in the supply chain to work together in better managing the risks facing all participants of the supply chain since global supply chains are immensely complex and include a variety of risks (Mentzer, 2001). The complex networks of suppliers and buyers mean that the threats and opportunities present in all risks are shared by the participants as a disruption to one part of the chain would be able to influence another entirely. This leads to the threat of supply chain disruption which would highly influence all companies being part of a network struck by such a supply chain disruption (Macdonald & Corsie, 2013).
The complexity of managing risks across a complex network of suppliers rather than simply one company does make the challenge seem increasingly larger than focusing on the internal company. This may put off some companies, especially those that have a more traditional perception of risk and risk management, as the belief may be that risk management is done to mitigate threats and done by using financial means only. The simple difference in perception of risk and risk management is an individual, subjective concern and choice, and companies should pursue the risk management strategies they deem most profitable. It should not be a goal in itself to implement extensive risk management frameworks if the perception is that this would cost

more money than it would potentially save or earn. Further, considering the state of risk management in the shipping industry, it is a very real concern and a valid argument that companies need to be covered internally before being able to move into more complex and comprehensive focuses and collaborations with other companies focusing on risks and risk management throughout a supply chain network.
The reality of this is however, that the implementation of supply chain risk management regardless of anything will take its starting point in the individual companies as these must act to protect their own interests and manage their own risks. This can lead to increased cooperation on risk management, as well as a multitude of other things, between organizations in a supply chain, but it will have to begin with the individual companies. This is also the approach suggested in the literature (Manuj & Mentzer, 2008; Pettit et al., 2010; Chopra & Sodhi, 2004) as the frameworks focus on what individual companies can do in order to improve the management of risks in the supply chain.

With this in place, some of the major points for supply chain risk management from the literature can be brought into play. Due to the complex environment in which all international organization, including shipping companies, operate in, a focus on agility and adaptability is necessary (Gligor, et al., 2015). By the use supply chain risk management, companies can increase this agility which allows them to better adapt to changes such as the current challenge in the shipping industry with overcapacity and low freight rates (Phillips, 2016). This agility is coupled to performance for both the company and often also the remaining supply chain (Wieland & Wallenburg, 2012) and thus supply chain management may improve agility. Further, supply chain risk management is naturally extended to increased collaboration between suppliers and buyers. This improved collaboration will come from and with trust, and a better understanding of the needs of the individual companies, which in turn can also help performance in the companies involved (Li, et al., 2015). Both the increased agility and the improved supplier relationships, allows a company to become more responsive to the various challenges in the supply chain which is yet another feature that is shown to improve the performance of company as well as supply chain as a whole (Chopra & Sodhi, 2004). At the same time it connects to the idea about strategic responsiveness within general risk management (Andersen, 2009) and how this is important in order for companies to guard and take advantage of the changes that are happening in the world. This strategic

responsiveness comes from including strategic risks in the management of risks within a given company, often in the form of SRM (Andersen, 2009). Thus the argument for supply chain risk management becomes that it highly improves an organization's ability to develop strategic responsiveness and adapt to the risks present in the market in which it operates. This will however be dependent on an organization's strategic approach to both risk and risk management, and as such it is necessary to develop the organizational culture to represent the perception of risk set out by this strategy.

It is however, necessary to look at the responses from the interviewed companies when asked about the possibility and potential upsides as well as downsides to using supply chain risk management. These are examples of organizations operating in the shipping industry which is so dependent on its supply chain and at the same time the organizations that will both need to implement such changes to the company strategy and culture and the ones that will be able to benefit from the mitigated losses or realized opportunities.
Several interviewees mentioned a suspected complexity and challenge of both implementation and operation of supply chain risk management. One example was an interviewee who responded:

"*I imagine this will be both very costly and very difficult to engage in. Relationships with our suppliers is something we work actively with, but to extend these relationships and engage in risk management might be quite complex. I do though see the possibility of this creating value to the company as you would be able to better forecast and make the changes needed if something happened to one of our partners.*"

From this response it is clear that the complexity of the supply chain is generally what seems discouraging to this professional. It is the idea of aligning risk management initiatives throughout the supply chain that seems overwhelming and very challenging. It is however also clear from the response that the employee is aware of the potential benefits from engaging in supply chain risk management and how this can increase agility and responsiveness in the company and supply chain. The misconception here however might be the same as previously addressed, that supply chain risk management needs necessarily to be aligned between all companies present in the supply chain, and that these must all agree on the strategy by which it is done. By focusing on

supply chain risk management, a company becomes able to control more risks in the supply chain, regardless of whether they are collaborating with only some companies in the supply network or the majority (Bandaly, et al., 2012). This form of risk management, as all others, starts with the company itself and with an already established focus on supplier relationship management, as is the case with this response, the road to supply chain risk management does not have to be long and complex.

It is however clear from other responses as well, that this approach to risk management does not align with all companies' expectations or perceptions:

"*…supply chain risk management is not a focus for us, also because we think this might invite suppliers to feel too "safe" and not give their best possible to us.*"

The perception amongst companies and how they get the best product, service and price varies greatly. Some companies view collaboration as a liability as above and does not invite to close collaboration and trust between the organization itself and business partners. This is despite collaboration and trust being identified as a positive indicator of performance for the companies engaging in business (Panayides & Lun, 2009). Further, trust has a positive relationship to innovativeness in a partnership, and when this is put into the context of supply chain risk management the arguments for collaboration and development of trust are many. Innovation is found to enhance the positive relationship between effective risk management and strategic responsiveness, which in turn has a positive relation to overall performance of an organization (Andersen, 2009).

The development of supply chain risk management is thus both a way to become better at managing various risks in the supply chain in which an organization is operating. It is also a way to further create collaborations and grow trust with business partners who can help the risk management initiatives and the companies. Further, the trust created can help companies be more innovative which may in turn make them more responsive. If a focus is then also given to the strategic risks of the environment in which the company operates, then increased strategic responsiveness can be cultivated through the use of supply chain risk management. This can ultimately lead an organization towards improved performance, just as it should help manage strategic risks that are important for the future development and even survival of shipping

companies.

This relational process is illustrated in figure 6 where an initial focus on strategic risks and supply chain risk management, leads to eventual improved performance through various operational improvements throughout the supply chain participants.

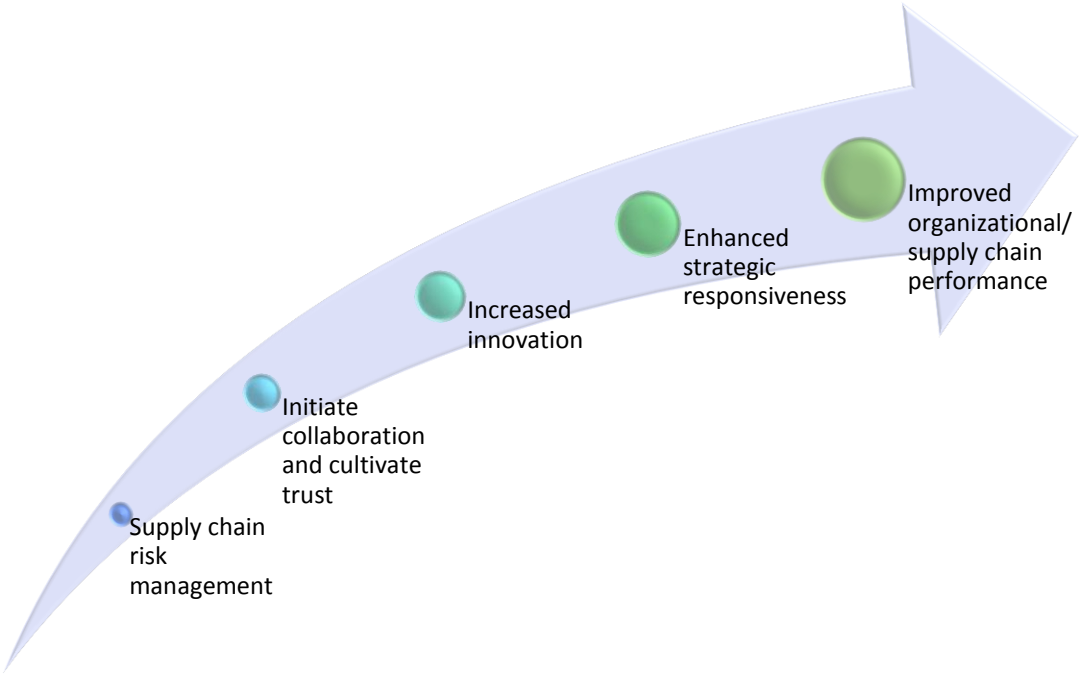

Figure 5 - Relational process of supply chain risk management

Risk management in shipping may be very diverse and the perception of risk and its management is quite conservative and traditional. However, a shift is appearing to be ongoing, with especially larger shipping companies focused on engaging the entirety of the organization, while also including a focus on the strategic risks present in an industry that is experiencing increasing pressure for change.

For organizations that have not yet developed risk management strategies with a heightened focus on strategic risks, a focus on supply chain risk management may be an opportunity to develop both the risk management, supply chain management and as a result of these, the performance of that organization.

6 CONCLUSION

The final chapter will finish the paper by summing up all findings and considerations that can be taken away from the study in a conclusion, in order to answer the research questions asked in the introduction.
Further, it will reflect over the potential managerial implications from this study. This will focus on how the findings and considerations may influence the management of risk in the shipping industry in the future and what managers focusing on risk management in shipping can take away from the study.
Hereafter the need for future studies on the subject will be discussed and assessed. The goal is to outline some limitations of this study and reflect over the gaps that still need to be filled through future research on shipping and risk management.
Following will be a part focusing on potential improvements in future studies on the topic or of the kind. A particular focus will be on the methodological approach and what the approach used in this paper brings to the field as well as how it can potentially be improved in the future.

6.1 Research answers

RQ1: What are the most important risk factors present in the shipping industry today?

The shipping industry is exposed to a variety of risks, and as shipping companies are simultaneously operating on an international scale, the risk exposures are further increased. Through the use of literature and reports from operating shipping companies, an outline of key risk factors in the industry was developed and further specified through sparring with a company operating daily in the industry. The final categorization of risks consisted of four risk categories and was distributed to companies relevant to the study.

The most important risk factors within shipping are found to be of financial character and related to the industry and the market development, as freight rate volatility and bunker price fluctuation have the highest combined level of likelihood and impact according to industry professionals.

Other risk factors are however not to be neglected as these are also found to be important risk factors in the shipping industry and sources of significant threats as well as opportunities.

The most important risk factors in shipping are thus of financial character, but other financial risks are similarly found to be amongst the least important in the industry.
Operational risks is the category which the industry perceive to be generally most important, and as this category is simultaneously connected to the most important financial risks, the operational risks are the ones the shipping industry are mostly concerned with.
Strategic risks are generally not perceived as highly important in the industry, yet some professionals and several larger shipping industries are more concerned with strategic risks than the general industry. Thus these companies are leading a shift towards increased focus on strategic risks and the importance to the shipping industry, however this is not yet materialized and strategic risks have limited significance to the industry.
Pure risk is an overall concern within the industry and of importance to shipping companies. Major threats are present within this risk category, and thus it is important for shipping companies to evaluate this risk.

RQ2: How are shipping companies approaching and dealing with the risks they are facing today?

Shipping companies have varied perceptions the individual importance of various risks to the industry. Related, shipping companies have different perceptions of risk and risk management as concepts, and as a consequence also very varied approaches to the handling of risks.
Some companies perceive risk as sources of pure threat, whereas others view both opportunities as well as threats within risk factors. However, in general the industry has a traditional perception and approach to risk, which means that financial hedging methods are the most commonly means of dealing with the risks inherent to the shipping industry.

The majority of companies researched utilize financial hedging tools to manage the financial risks of freight rate volatility, bunker price fluctuation, interest rate variations and exchange rate variations. The financial risks are further handled through other tools such as freight forwarding agreements (FFAs) and derivative tools, as well as more strategic approaches such as relationship development and management.

Operational risks are varied and thus also handled through the use of many tools and strategies. Hedging tools are also used when managing certain risks of operational nature such as macro-economic development and decrease of vessel value. Meanwhile, also more strategic tools are utilized to manage risks such as staff availability, stability of IT systems and compliance issues. Strategic risks are generally less managed in the shipping industry, and no general tools can be concluded as being used to handle strategic risks. However, several companies are aware of especially legal restraints that can interfere with a company's operation, and developments in technology that can shift the strategic basis and the opportunities within shipping.
Pure risks are broadly managed in the industry, primarily through financial tools such as insurances and various hedging tools that can cover a company against the threat that is primarily present in pure risk.

With the difference in perception of risk, the outlook on risk and risk management is also very varied within the industry. Several larger companies are detecting increasing strategic threats to the shipping industry and the strategic basis of the companies, and are thus starting to increase focus on improving management of strategic risks. With especially the high technological development occurring, and the threat of especially potential new entrants in the industry, and more extensive focus on risk management and strategic responsiveness is also needed within shipping. This strategic responsiveness, that can help both guard and utilize various risks, can be cultivated through the development of supply chain risk management as this is positively related to improved performance through enhancement of trust, innovation and responsiveness.
Such a development in the perception of risk and the approach to risk management may prove necessary for the industry, however will also require intensive efforts in adjusting the general approach to risk management in shipping.

6.2 Managerial implications

The results of this study have some value for professionals in shipping and risk management as it provides an idea about the importance of various risk factors present in the industry and further illustrates the current situation in handling these risks.
For managers working with risk management in shipping it is essential to know and identify what risks are present in the industry and both threatening the company as well as opening opportunities for it. For this reason the identification of the risk factors in shipping based on the Danish shipping industry, provides a solid foundation for managers working with risk. Furthermore the results show what risks the industry generally find to be most likely and most impactful, and thus most important. This knowledge provides professionals with a better idea about the industry and environment in which they operate and further enhances their understanding of risk through the utilization of several perspectives from within the industry. This allows managers an improved starting point for initiating further work to identify the most important risks to the individual company.

Moreover, the analysis of current approaches towards handling the identified risks provides professionals with an understanding of the industry's general perception of risk and risk management. It becomes clear for professionals that the industry is generally quite traditional in its perception of risk and primarily works with centralized financial risk management tools. However, that fact that there is a big diversity in the approach various companies has towards risk management means that companies should align their risk management frameworks to the individual company's strategy. An alignment between risk management and strategic basis is necessary because the company will otherwise risk working in opposite directions and not fully benefit from the risk management being done. A potential implication of the study is that risk management should be closely tied to the strategy of a given company in the shipping industry to ensure best possible mitigation and exploitation of various risk factors.

Another implication of the study is a new angle on risk management in shipping through the utilization of supply chain risk management and an increased focus on strategic risks. Through the connection between supply chain management and risk management it becomes increasingly

possible for companies to move towards strategic responsiveness and thus increased performance in the company. It is necessary for shipping companies to develop the appearing trend where risk management both becomes organization-wide and includes strategic risks. Managers must be sure to engage in strategic risks to ensure future survival and development of the company, and supply chain risk management is a tool that is able to make a major impact for companies in this endeavor. A focus on collaboration and risk management in the supply chain enhances agility and innovation which are both essential for developing the strategic responsiveness that is the objective of strategic risk management.

6.3 Limitations and methodological improvements

The study is an attempt to research the shipping industry in terms of the risks present and most important, as well as the perception and approach generally taken towards the handling of these risks. The study is based on a deductive identification of risk factors in the shipping industry through literature and an inductive identification by screening Danish shipping companies. Despite the broad basis on both literature and empiric data from Danish shipping companies, the identification of risk factors rests on a fairly thin foundation as the literature is scarce and the empirics come solely from the Danish industry.
The research could have been done on a wider scale, taking different clusters of shipping companies worldwide, divided by size or business segments, which could have increased practical value and generalizability of the findings. However the Danish shipping industry is big and can function as a good reflection of the global industry; nonetheless more research is indeed needed to confirm that the results found here are applicable to the global industry as this is only a generalization without confirmation. This is a clear limitation of the study since it is not confirmed on a global scale, but the limitations in terms of both time and access prevented a deeper research that includes companies from outside of Denmark, and thus on a global scale to increase generalizability of the study.

Another limitation of the study is the access to all and unlimited data. As mentioned, data was only available from Danish companies and thus from the Danish shipping industry, but only a part of the companies operating from Denmark were able to contribute to the study through either published reports, response to the questionnaire or interviews.
The fairly low response rate to the questionnaire of around 53 percent provides the study with a certain limitation in its generalizability as this means a smaller portion of the industry is presented and thus the industry and its approach to risk may not be captured completely in the study. An improvement to this study, and a necessary focus of futures studies, would come from ensuring a higher response rate to the questionnaire. Further, the amount of interviewed companies was a part of the industry that was smaller again, and thus the in-depth understanding of the industry and risk management may be flawed and limited due to this. However, the companies interviewed were chosen based on size, applicability and earlier responses and is thus assumed to provide a

fairly broad spectrum of various perceptions within the industry. The companies interviewed were however smaller companies which, albeit still being international and operating in multiple countries, did not have the same size as bigger global companies such as Maersk or its rival MSC headquartered in Switzerland. And despite the companies being representative for several different perceptions and approaches, this is a limitation to the study, that the global shipping industry as a whole was not represented by companies of bigger size as well.

Another area that constitutes a limitation to this particular study is the broadness of the inclusion in especially the supply chain and industry perspectives. These perspectives are mainly viewed from the focal point of shipping companies and the shipping industry, and thus neglect inputs from ship owning companies, port authorities, terminal operators, cargo sellers, various suppliers and customers, which would have provided a more versatile and comprehensive picture of the risk management perception and approach in the context of the industry and especially of the supply chain.

These limitations to the study represent valuable learnings for future research, and reflections for future improvements to the methodological approach that has also been tested through this study. The study has tested the approach and found that it is possible and reasonable to assess the industry based on both questionnaires and interviews. However, due to the limited amount of literature on the subject, it will be necessary to improve the basis on which the list of risk factors is developed to ensure all is included. This can be done through both the inclusion of more, and more international, companies in the risk screening, but the optimal approach may be to deduct the risk factors present in shipping on the basis of the empirical data collection and hereafter test the importance and handling of these through both interviews and potential case studies. Further, if the improvements to the methodology mentioned here are implemented in future research, it will be able to better generalize the results of using supply chain risk management as a tool of developing strategic responsiveness. This is because the methodological improvements will give a better foundation for generalizations to the global shipping industry and its risk management procedures to be made, and this in turn will improve the insights into how supply chain risk management can be a useful tool for shipping companies. This is an area that requires

future research as mentioned previously, and for that case studies and broader, global studies will provide a better basis for determining and generalizing the results of this study.

6.4 Future studies

The findings from the study points towards the need for a higher focus on strategic risk management in shipping due to the traditional view that is currently dominating, and how supply chain risk management can be a way to achieve this.
There is a further need to study the current approach and perception of risk and risk management in especially a global context since only Danish companies have been included in this study. Therefore it is necessary to confirm if the situation is similar in shipping companies based in other markets. Further these future studies must also investigate whether a shift is seemingly occurring which seems to be the case in the Danish industry where several larger companies have begun specific work on strategic risk management.
There is a further need to research the tools of risk management used in the shipping industry, and whether these tools are the most effective available. This study shows how financial hedging tools are the favorites of most shipping companies and future research should include a focus on other aspects of risk management, especially tools to manage operational risks as this could prove highly useful for the industry as a whole.

In regard to some of the findings on the operational strategies of shipping companies and the handling of these risks there is also a need for further investigation. The findings for instance identified that a shipping company focusing on only one business segment has a better chance of being successful and may extract benefits even during bad market conditions. On the other hand, such findings provide counter-arguments towards strategies of diversification of the vessel portfolio. Yet, further studies on this subject are required in order to make definitive conclusions. Further, the findings suggest that an operational strategy consisting of pure chartering may be the most profitable during the unfavorable market conditions. However, in order to assure the generalizability of this claim, it should be tested on a wider scale.
Further, the findings reveal that Unifeeder is successfully using BAF in its contracts and this is contradictory to the findings by Menachof and Dicer (2010), whose study advises that the

application of BAF is less efficient for liner shipping companies than hedging against the risk of bunker price fluctuations. The study by Menachof and Dicer was only conducted on the North Atlantic trade route, and thus the example that Unifeeder provides indicates the need for more cases and companies to be investigated in order to compellingly conclude that the BAF is not efficient.

Moreover, due to the recession and the poor condition of the shipping market, interest rates decreased and thus are not perceived as a big threat. However, the situation might change if the market improves, and consequently shipping companies may alter their evaluation of this specific risk. Hence, the interest rate risk level should be reassessed if the market situation changes in order to test if the result of the study is not subjective to the current market conditions.

Future research on risk management in shipping must also include a focus on supply chain risk management given the importance of the supply chain in shipping. Because of this high importance of the supply chain in shipping, it is necessary to further develop the knowledge on the best approach to both supply chain management and risk management. Some current research show that collaboration in the supply chain can both improve performance and risk management, and future research must further investigate this assertion in order to better conclude on the optimal approaches for shipping companies.

Research on supply chain management and risk management must be combined to a higher degree to develop the understanding of supply chain risk management and the opportunities present by using this strategy. This research may further enhance the findings and assertions from this study, that supply chain risk management and strategic risk management are positively correlated and further positively influence performance of both individual shipping companies and supply chain as a whole.

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8 LIST OF FIGURES AND TABLES

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9 APPENDICES

Appendix 1: Questionnaire

- *What is the name of your company?*
- *Does your company has Risk Management initiatives in place? (yes/no)*
    - *If yes, which of the following initiatives does your company use?*
        - *Freight rates hedging*
        - *Bunker prices risk hedging*
        - *Interest rates risk hedging*
        - *Exchange rates risk hedging*
        - *Counterparty risk hedging*
        - *Other:_____*
- *How would you evaluate the likelihood of the following risks, on a scale of 1-5 with 1 being very low and 5 being very high?*
- *How would you evaluate the impact of the following risks, on a scale of 1-5 with 1 being very low and 5 being very high?*
- *How would you evaluate the overall protection of your company against the following risks on a scale of 1-5 with 1 being very poor and 5 being very good?*
- *Do you have any additional information to add or other comments?*

Appendix 2: Interview guide

The company and its overall strategy:

- *Could you tell us brief overview of the company (type of vessels, number of vessels, main operation areas)*
- *What is financial strategy of your company? (capital structure)*
- *What is operational strategy of your company? (vessels types, size, age, chartered vs owned, flagging policy)*
- *How do you measure performance in the company? (financial performance by accounting ratios and the level of risk involved OR by overall efficiency, utilizing inputs into a production process and managing allocation distribution?*

Risk management in the company:

- *Does your company use any Risk Management initiatives?*
    - *If yes, what were the deciding factors to use RM?*
    - *If no, what were the factors to decline use of RM?*
- *Do you think risk management has significant impact on business results? What are the costs versus outcome?*
- *Which risks do you perceive as the most threatening for the company?*
    - *How do you cope with these risks?*
- *Does your company apply risk management practices on a supply chain level? If no, what do you think could be advantages and disadvantages of such approach?*