



**UNIVERSITY OF PIRAEUS**

**DEPARTMENT OF MARITIME STUDIES**

**M.Sc. IN MARITIME STUDIES**

**RISK MITIGATION STRATEGIES IN BULK  
SHIPPING.**

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Masters' Dissertation, which has been submitted to the Department of Maritime Studies as part of the prerequisites for the acquisition of the Masters' degree in Maritime.

Piraeus

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## ACKNOWLEDGEMENTS

I would like to thank all those who contributed directly or indirectly to the completion of the postgraduate course and to the completion of the dissertation.

Mr. Lagoudis Ioannis, for *patiently* listening to my developing hypothesis and providing invaluable assistance in conducting my research and writing this thesis. His availability and support throughout the thesis have greatly helped me to gain a better understanding of the shipping industry.

Finally, this thesis is dedicated to the memory of my best friend, Agis.

## **Abstract**

Bulk shipping companies face various risks that vary in severity and need to be mitigated. There are few empirical studies to identify and evaluate risk management strategies in maritime activities with different risk consequences. The objective of this study is to identify appropriate risk management strategies and evaluate their relative importance.

A literature review and a series of questionnaires were sent to a range of stakeholders around the world. The questionnaires provided us with the necessary perspective and information on hedging decisions and practices of ship owners and managers.

After a systematic review and research of the literature, 13 hedging strategies were identified. The results of the questionnaire survey showed that among the 13 strategies, the top three were "Regular employee training", "Chartering Strategies" and "Improving some initiatives (ISPSS Code, Safety Management System (SMS))".

The present work contributes to shed light on risk mitigation strategies by providing insights into the difficulties and issues that characterize the global shipping market and how corporate managers can find ways to make these strategies more attractive.

**Keywords:** Bulk shipping, Risk management, Risk mitigation Strategies.

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## 1. Introduction

Risk is an essential part of trading and investing. Companies in the shipping industry are exposed to fluctuations in all types of financial prices as a natural consequence of their operations. A ship owner faces two types of risk.

Operational Risk that is the risk that the ship owner or operator faces in the day-to-day operation of the vessel, and Ownership Risk that is the risk that arises from holding a particular asset in its portfolio. Risk must be understood and controlled in order to be properly managed.

Over the years, various theories and financial instruments have been developed to manage risk. Risk management is a term that easily slips through one's fingers when trying to formally define it. Perhaps it is easier to agree on a definition of what it is not. Risk management is not a theory of unthinking compliance, but a theory that helps a company choose the risks it is comfortable with and minimize the risks it does not want to take.

Risk management has to do with all forms that involve adventure and unpredictability, is a process for identifying, measuring, reporting, and controlling risks. It does not necessarily mean risk reduction. "The goal of risk management is not to reduce risk, but rather to quantify and control risk" (Freight Metrics, 2003).

Some salient features of the bulk shipping industry are market volatility, dependence on unforeseen factors, and risk. Compared to other industries, the predictability is not the same. Therefore, risk management and choosing the strategy to reduce the negative impact of the risk factor is an urgent need.

The competitiveness of the company depends on factors such as strategic planning, which is necessary for the management of any business that is subject to uncertain and highly variable conditions that can significantly affect the performance or success of the company.

It is more important than ever to evaluate alternative strategies to identify tactics that will maximize success with any planned growth. Risk mitigation strategies provide an approach to skilfully evaluate the risks that arise and the alternatives available, as well as an effective means to plan better tactics given the circumstances.

Therefore, periodic reassessment of the company's goals and plans and development of an updated strategy is required. We distinguish some risk management strategies in bulk transportation and examine their suitability.

In order to reduce the negative impact of such risks, the identification of appropriate and effective risk mitigation strategies for bulk shipping companies has attracted considerable attention from both academia and the shipping industry.

Researchers have addressed various strategies in the literature such as cooperation and networking, diversification of portfolio and fleet, remaining independent, delegating tasks to external management companies, forming strategic alliances, and merging with small companies, various investment strategies, energy-oriented strategies, internalization of operations, chartering strategies.

The paper attempts to provide a systematic overview of risk mitigation strategies in the bulk shipping industry and analyse the efficiency of the identified strategies. It is largely based on the selection of effective risk mitigation strategies in container shipping by Chang, Xu, Dong and Yang (2019). We decided to pick up, acknowledge and confirm these themes for the bulk cargo industry as well. In particular, some of the shipping risks are closely interrelated, so the mitigation strategies are not proposed only for a specific risk. The aim of this paper is to answer the following research questions:

RQ1. What are the potential strategies that can mitigate risk in bulk shipping companies?

RQ2. What strategy (ies) is (are) the most important to be addressed?

Due to resource scarcity, shipping companies need to invest wisely in various risk mitigation strategies. This thesis will help them to determine the order of investment in risk mitigation.

The contribution of this master thesis is twofold. Through an extensive literature review and SPSS statistics, the risk mitigation strategies in the bulk shipping industry are identified. This will provide valuable information to companies on the strategies available to reduce the negative impact of risk.

## 2. Identification of risk mitigation strategies from the literature review.

Robinson (2015) proposes co-operation and strategic alliances to achieve mutual benefits in supply networks through maximizing attributable joint profit (by optimizing operations) and leveraging the benefits of cooperation. He proposes collaboration as an important business strategy for bulk chains. Limited and finite infrastructure resources (at least in the short term); infrastructure that is common to all users and must be shared; infrastructure with a high net present value that tends to have excessive costs and over which the individual firm may have little control. In addition, each company will seek to achieve economies of scale in an operating environment where large fluctuations are commonplace and where mutual adjustment is a constant.

Theotokas and Katarellos (2001) examined the strategic options available to small shipping companies to increase their reliability and remain competitive in the market, no matter how high the demand will be. These opportunities consist of strategic alliances with preferably larger companies and mergers with other small and medium-sized companies. Alliances with larger companies can lead to a reduction in operating costs. In addition, companies can access broader channels of information. It is important to note that alliances are based on mutual leadership and decision-making (Papadakis, 1999), a fact that may negate the ability of small shipowners to maintain commercial management of their vessels and consciously apply the strategy of purchasing and selling vessels.

However, it has been shown that this type of cooperation can be mutually beneficial if common ground is established regarding the goals of the alliance (Theotokas, 1997). When they merge, they can combine their core competencies, i.e. their cost-effective technical management, while taking advantage of the economies of scale to develop their personnel and software and increase their reliability. A critical factor in the success of this decision is the corporate philosophy of the shipowners and the prevailing organizational culture of the companies, which could lead to disagreements overpower and control. However, since the merger is based on equality, these obstacles can be removed. The Greek experience has shown that cooperation agreements based on equality, which went beyond power and control disputes, had an overall positive effect on the partners. Even agreements that were suspended in advance contributed to the development of the partners (Theotokas, 1997).

According to Harlaftis and Theotokas (2004), co-operation and networking between different companies increase the sources of information; using the best services and knowledge that can be obtained, rather than relying on internal applications, is seen as a point that every shipping company should focus on when deciding on its strategy.

Lorange (2001) emphasizes the importance of network organization and strategic partnerships to mitigate risk. It is clearer to draw on the best services and knowledge that can be obtained than to rely solely on in-house applications. It is supported that out-sourcing and strategic partnerships are becoming increasingly important.

Alexandridis et al (2018) studied financial risk management strategies concerning portfolio diversification. The results suggest that portfolio diversification reduces freight rate fluctuations by up to 35% for mixed portfolios of container, dry bulk, and tanker freight rate routes. Furthermore, the results of using freight futures contracts in a portfolio approach suggest an additional reduction in freight rate risk of up to 23%. The constant hedge ratio models perform better than the time-varying hedge ratio models in most cases studied, both in and out of sample, suggesting that risk mitigation positions do not need to be updated as new information arrives in the market. This method applies portfolios of container, dry bulk, and tanker freight futures along with corresponding portfolios of physical freight rates to improve the efficiency of risk diversification for practitioners in the shipping market. The empirical results of their study have important implications for general business, trading and hedging strategies in the shipping industry and may lead to a more liquid and efficient market for the freight futures market.

Cullinane (1991) was the first study to use the investor's effectiveness function to examine the relationship between risk and return in shipping investment; he asserts that attitude towards risk should be taken into account when studying investment decisions in shipping.

Alizadeh and Nomikos (2004) study the value efficiency of forward bunker markets in different geographical locations and for different maturities. Given the recent increase in the use of derivatives on bunker oil for risk management in the shipping industry, it is important to investigate whether these instruments meet the needs of market participants. The results show that market participants receive accurate signals from forward prices and can use the knowledge generated by these prices to guide their decisions in the physical market. Therefore, shipping companies can use forward prices as indicators of future bunker price developments. The fact that forward prices are unbiased predictions of future settlement prices also means that forward contracts are often an efficient and effective tool for hedging against bunker price fluctuations.

Amir H. Alizadeh, Nikos K. Nomikos (2007) refer to hedging ship price risk with freight derivatives in another study. Managing ship price risk is a compelling factor for ship owners not only because it affects the balance sheet value of their business, but also because a decline in the value of a ship can affect a ship owner's solvency and its ability to service its debt. However, this method of risk management may have a limited effect due to the direct correlation between the costs of different types of vessels, as shown by Alizadeh and Nomikos (2009). Moreover, this method of diversification, although theoretically sound, may not be economical and applicable to the shipping market due to the lack of liquidity and market depth, high transaction costs and brokerage commissions, and thus the time required to complete a sale and purchase transaction due to inspections, surveys and preparation of documentation.

Alizadeh and Nomikos (2006, 2007) examine the profitability of tactical trading strategies in shipping investments, utilizing models to optimize risk and return on shipping investment strategies. This usually includes holding portfolios of ships that are well diversified in terms of size, type, or age. Nevertheless, this method of risk management can have a limited effect because of the positive correlation between prices of different vessel types, as is shown by Alizadeh and Nomikos (2009). In addition, this method of diversification, although theoretically sound, may not be economically and applicable to the market for ships because of lack of liquidity and market depth, high transaction costs and brokers' commissions, and the length of time required to complete a Sale and Purchase transaction due to inspection, survey, and preparation of documentation.

Harlaftis and Theotokas (2004) mention the importance of diversification of investments as an essential business method to reduce the risk of shipping companies and to cope with the volatility of freight markets. Diversification in domestic and international business is a common practice of shipping entrepreneurs. Another important factor for the successful business strategy of tramp shipping companies is a systematic method for sales and purchasing.

The investment strategy is critical to the survival and performance of a shipping company because of the fragility of the markets. Timing is the component that determines the potential of investments. There are two types of strategies that allow timing to be exploited. The first is that of "beat of the market", i.e. buying and selling ships in the short term, and the second is that of selling transportation services in the long term. In the first strategy, profits are made from the sales and purchases of ships, and in the second, profits are made from the trading of ships (Hope and Boe, 1981).

It is obvious that for a firm whose profits come primarily from sales and purchases, either cost level or reliability are secondary factors. As noted earlier, in this case, the company's reserves allow it both to finance the operation of its vessels and to take advantage of opportunities in the S&P market during periods of low freight rates (Goulielmos, 1999). In contrast, for a company that is more interested in trading its vessels, the cost level and reliability are of primary importance as factors that define competitiveness. (Theotokas and Katarelou, 2001).

Lagoudis, Naim and Potter (2010) referred to the chartering strategies and the mix of strategies adopted by a company operating a fleet of vessels depending on the current and expected freight rate market level and the degree of its customer orientation. Freight rate fluctuations bring both opportunities and threats that can be offset by a company's internal and external flexibility. A combination of strategies

allows the shipping company to achieve a high degree of flexibility in the utilisation of its capacity by switching between spot, time charter and pool strategies.

Haralambides, (1996), Lorange and Fjeldstad, (2012) have analysed the strategy of joining a pool. Building a fleet of many different ship-owners that, under efficient management, achieve the necessary "critical mass" that enables it to compete for contracts, exploit economies of scale, become visible to charterers through its size and standards, and finally, provide a reasonable return to its members through its diversification and risk spreading. A shipping pool is a joint venture in which ship owners market their vessels as a unit and share revenues. The main objective is to increase the capacity to take on large cargo contracts (CoAs), but motives also include the use of improved capacity and technology sharing (Haralambides 1996).

By purchasing a portfolio of CoAs, the pool can adjust fleet needs, minimize ballast bags, wait times, etc. Most pools have restrictions on the vessels they take into their operation. They systematize in terms of size, age, speed, quality routines, etc. There are large pools in various segments of bulk carriers and smaller, specialized wet cargo types; pools are also common in reefer vessels. However, there are no pools for large standard tankers such as VLCCs, large bulk carriers, gas tankers, or car carriers. (Haralambides, *The economics of pools in bulk shipping pools*, 1996).

Another risk mitigation strategy is to transfer technical management or other ship activities to ship management companies. This strategy assures companies of higher reliability by increasing HR and SWR. It also enables the companies to maintain their flexibility in the sales and purchasing market. However, this decision does not drastically reduce the cost level as this is achieved by paying fees to ship managers. The fees and all other costs incurred will not be less than their current technical management costs. Moreover, they will be forced to give up an element of their core competence, which is cost-effective technical management. (Theotokas, 1998) (Theotokas and Katarellos, E., 2001) (Lorange, 2001) (Lyridis and Zacharioudakis, 2012).

According to Gammelgaard and van Hoek - (2006) conflict of interest can be such a big problem that it can affect the future of a corporation, and the solution may lie in very simple activities through which managers are closely monitored and controlled. The authors came to this dubious conclusion by studying the development of public companies, which in their time, despite the strict monopoly of functions and methods, could not do without the initiative and novelty of the so-called ordinary.

Poulsen and Sornn-Friese (2015), there is a tendency in this relationship to maximize their utility, and this is a good reason to expect that the agent/operator will not always act in the best interest of the owner/client. The client can limit this tendency by providing incentives to the agent to bring the goals of both parties closer together, and by carefully monitoring the agent's actions and limiting deviant behavior.

According to Meade and Sarkis (2002), as with any community of representation between different market sectors, in the case of the ship-owner, the contract determines the degree of decision-making by the management company. The ship-owner may require the management company to take over the commercial operation of the vessel, or the ship-owner may want the manager to take full control of the commercial operation of the vessel, the insurance of the vessel, the purchase of spare parts and 12 supplies, all management and technical support, and the provision of a well-trained and qualified crew. In the latter case, the manager takes over the vessel under a comprehensive management contract as the sole representative of the ship-owner.

Ganesh (2005) reports that the manager sells services cheaper and at almost the same or higher level than the production of the services. For example, the manager is a very large firm that has good market access - an important factor in finding suitable labor - and can get better prices because of the large volume of trade in supplies, spare parts, and so on.

According to Tyan et al. (2003), a ship-owner with one or few vessels can avoid the disproportionate costs of an internal organization by outsourcing management to a third party. The manager who manages a large fleet is able to accommodate additional vessels and benefit from the advantages of a large fleet (cheaper prices for supplies, fuel and repairs, technical support, strict line organization and procedures).

The advantages of transferring ship management to a third party are much greater in the shipping industry than perhaps in any other industry where an agency is used.

Jung, Chen, and Jeong (2008) examined that the relationships created by "third party ship management" in the shipping industry are complex and their complexity is increased by new technologies. The new technologies can help to reduce the complexity of the relationships to highlight the benefits for the shipping company and the ship management provider. The trust and wider effective relationships between ship-owners and their supporting companies described by Head and Hassanein (2002) can be ensured by the proper functioning of their procedures. This can be more easily achieved through the development and promotion of new technologies.

Knemeyer and Murphy (2004) reported that more than 1/3 of the world fleet is in the hands of ship management companies. The reason for this is that in most cases the opportunity cost to the user (the ship owner) of this relationship is greater than the losses that could result from the ship owner's mismanagement or higher management costs.

Maintaining independence as a risk mitigation strategy makes it easier to overcome the difficulties of the new shipping environment unless internal development is pursued as a method of achieving critical mass. As mentioned earlier, small shipping companies cannot develop economies of scale to reduce their costs because of their status. In addition, their reliability and therefore their competitiveness decreases, especially during periods of low demand. Nevertheless, independence as an option of stability or internal development could offer some advantages to companies if properly combined with their investment strategy. (Theotokas and Katarellos, 2001).

Independent ship-owners make faster decisions due to the lack of bureaucracy, especially regarding new ship orders. Such orders are placed especially in times of high freight rates. This drives independent ship-owners to increase their share of the global oil tanker fleet. (Lyridis and Zacharioudakis, 2012).

I-Masry, Ahmed and Olugbode, Mojisola, and Pointon (2010) suggest that risk management is commonly used by financial directors, corporate treasurers, and portfolio managers to reduce the risk of the firm. The objective of risk coverage is to minimize the volatility of the firm's earnings or cash flows, thereby reducing the volatility of the firm's value. If the company is exposed to risk due to changes in the exchange rate, interest rate, or oil price, hedging can serve as a buffer that protects the company from unexpected cash flow losses. Forwards, futures, options, and swaps can mitigate the residual risk, even if it comes at a cost. It is only prudent that the impact of residual risk is constantly monitored to protect the existence of an industry that is very important to national sustainability, growth, and economic development.

Triantafylli and Ballas (2010) refer to some strategies such as adopting long-term time charter contracts as the main investment strategy, but also using fleet lay-up or back sales as an alternative strategy when the freight market has low performance levels. Refraining from outsourcing and maintaining absolute control of the company at strategic and operational levels is considered a core competence and source of competitive advantage.

Scarsi (2007), who studies market cycles and the propensities of ship owners, refers to diversification strategies and how they can be based on the expectation of achieving risk mitigation through the resulting diversification of income. Timing is identified as the most important decision factor in investment decisions.

Thanopoulou, (1998), Lyridis and Zacharioudakis, (2012) have mentioned the strategy of reducing administrative costs by raising a flag of convenience. These flags have adopted a more relaxed attitude towards taxes and regulations, especially on issues of crew nationality. States such as Panama and Liberia have attracted many vessels under their flags, although the benefits of oil tanker ownership are enjoyed by shipowners from countries such as Greece, the US and Japan.

Yuan, Nian, He, and Yan, (2019) propose certain strategies for energy conservation and marginal cost-effectiveness. Five mitigation strategies are considered, including speed reduction, trim optimization,

autopilot adjustment, weather routing, and speed control of pumps and fans. Two criteria, such as cost-effectiveness and marginal cost-effectiveness, are applied to evaluate the mitigation strategies in terms of cost and energy savings. These criteria can improve business decisions when prioritizing mitigation strategies under budget constraints.

Eriksen and Norman (1976) argue that operating in the spot market entails higher risk for the shipowner and lower risk for the charterer since charterers can cover peaks in their transportation needs without resorting to long-term contracts. Therefore, the authors suggest that shipowners need a freight rate premium to commit their vessels to voyage charters rather than a secure income from a time charter. This would imply a negative risk premium in the charter market.

To identify the risk mitigation strategies that can be employed by bulk shipping companies, an extensive literature review was conducted in Section 2. Literature reviews are commonly used in academic studies to identify risk mitigation strategies (Mitchell, 1995).

In order to categorize risk mitigation strategies appropriate for the dry bulk shipping industry, both the literature on risk management in dry bulk shipping and the literature on risk management in the general supply chain was reviewed, as the latter studies may contain strategies applicable to dry bulk shipping.

For example, regular employee training is an important risk mitigation strategy in general supply chain management. (Richardson, 2000; Elkins et al, 2005), can also be applied in bulk shipping operations (Triantafylli and Ballas, 2010), (Theotokas and Katarelos, 2001). Therefore, the literature on general supply chain management was used to examine the applicability of the strategies identified in the literature to bulk shipping operations.

The routing and scheduling of ships can be viewed in a broader context of transportation planning. The design of the transportation system sets the constraints on ship routes, such as Ports of loading, ports of discharge, shipment sizes (by the size of storage facilities) and vessel types, fleet size, and combination. To deal with delays, shipping companies could include a time buffer when creating the schedule to mitigate the effects of an unreliable schedule. (Chopra and Meindl, 2010), (Ronen, 1983).

Most research on bulk carrier routing and scheduling has focused on a reduced version of the complex topic. However, in practice, unexpected complexities and possibilities often emerge that are not considered in the context of the fundamental problem. The basic routing and scheduling problem for bulk carriers is presented by Fagerholt and Ronen (2013) along with three realistic extensions.

Improving safety and security can mitigate risk in shipping by implementing safety rules and regulations such as ISO 27001 and ISPS code. Mokhtari K. and Ren J. (2014) emphasize that in the shipping industry, most assessments, methodologies, and frameworks for dealing with hazards, risks, and security issues are for assessment rather than management. This shows that there is a lack of a coherent risk management framework or methodology in various areas of the shipping industry, such as logistics and shipping, to make risk-based decisions, especially for the strategy, construction, operation, management and even decommissioning of shipping-related applications. Their work explores these physical boundaries and risk-based activities within the shipping industry and recommends an appropriate risk management methodology that, in addition to the evolving role of risk managers, can enable industry users to first become familiar with the idea of risk management on a holistic level.

Mazaheri A. and Ekwall D., (2009) address the impact of the ISPS code from the perspective of an overall port. The results of this case study show that a better level of security within the port is the most important impact of the code. The implementation of the ISPS Code has had a significant impact on the port and port activities, including better control of port property, restriction of unauthorised access and a much improved working environment. In addition to the benefits of the ISPS Code, there are also some disadvantages, which could be summarised as increased operating costs and a significant implementation cost.

This study on supply chain security summarizes several changes in the way supply chain security should be addressed. Supply chain security should not only include theft prevention, but also counterterrorism.

In addition, the focus is now on addressing global issues rather than just local or national issues (Sweet, 2006). Contingency planning should incorporate the concept of crisis management to achieve better resilience.

In summary, security is no longer just an intra-organisational issue, but affects all actors in the supply chain (Closs and McGarrell, 2004). These four parts of supply chain security clearly argue for internationally regulated solutions such as the ISPS Code, but depending on local differences in security needs, the international supply chain security programme may provide either too much (costly) or too little (insufficient) security.

Bhattacharya, (2012) takes a different approach. It draws on wider research on the management of health and safety in the workplace to determine whether the employment and social conditions that support effective implementation of self-regulation are present in the maritime context. The findings show a significant difference between managers' and seafarers' awareness of the application of the Code, resulting in a large gap between its intended purpose and practice.

The evaluation shows that the critical factor is the lack of seafarers' contribution to the management of occupational health and safety. The basic causal aspects for this lack of involvement lie in the seafarers' poor employment conditions and low trust in their supervisors.

Puisa R., McNay J., and Montewka J. (2021) examine whether there is merit to the claim that harm reduction is more practical, i.e., cost-effective. Seven FSA studies were commissioned to identify risk control options and their cost effectiveness in mitigating risk. All of these studies were intended to shed light on future security regulations and security practices in the industry.

The following table is demonstrating the main risk mitigation strategies in bulk shipping industry based on the literature review.

**Table 1: Risk Mitigation Strategies based on Literature Review.**

Strategies	Purpose of Strategy	Authors
Co-Operation and Strategic Alliances	To capture mutual gains in supply networks. Maximising the attributable joint rewards (through optimising operations) and allocating the benefits of cooperation based on fairness. Coordinate their activities to improve their competitiveness	Robinson, (2015), I. Theotokas, Katarellos, (2000), Harlaftis & Theotokas (2004) Lorange, (2001)
Portfolio Diversification	A financial risk management strategy is formulated to hedge well-diversified portfolio of freight rates by taking positions in multiple futures contracts, capturing the correlations and covariance between them, and therefore, minimizing risk more effectively. The traditional freight rate risk management through portfolio diversification can be an effective risk management solution. Holding Portfolios of ships well diversified in terms of size, age, type.	Alexandridis, Satya Sahoo, Dong-Wook Song, I. Visvikis, (2018), I. Theotokas, Katarellos, (2000) Amir H. Alizadeh, Nikos K. Nomikos, (2006), (2009). Harlaftis & Theotokas (2004), Scarsi, (2007)
Remain Independent	Independence as a choice either of stability or of internal development, might offer a few advantages to the companies if it is properly combined with their investment strategy. Differentiating their business activities or integrating vertically, expanding in production of previous stages	Theotokas, Ioannis, & Katarellos, E., (2001), Dimitrios V. Lyridis and Panayotis Zacharioudakis, (2012), Androniki A. Triantafylli & Apostolos A. Ballas, (2010)



	(backward) and/or subsequent stages (forward)	
Forward Bunker Contracts	Market participants acquire accurate signals from forward rates and utilize the information generated by these prices to guide their physical market decisions; Shipping operators can apply forward rates as indicators of the future course of bunker prices. Additionally, the fact that forward prices are unbiased predictors of future settlement prices implies that forward contracts can be an efficient and effective instrument for hedging against bunker price fluctuations.	Amir H. Alizadeh & Nikos K. Nomikos, (2004)
Freight Derivatives	Freight derivatives can include exchange-traded futures, swap futures, forward freight agreements (FFAs), and container freight swap agreements and derivatives. These instruments help ship-owners and operators manage freight rate risk.	Amir H. Alizadeh, Nikos K. Nomikos,, (2007), I-Masry, Ahmed & Olugbode, Mojisola & Pointon, John., (2010)
Development of Internalising operations	Alternative for those companies that had neither the resources to pursue the strategy of internal development nor the business culture that would allow them to become members of networks. Higher reliability for the companies through the increase of the HR and SWR. Allows companies to retain their flexibility in the sale and purchase market.	Theotokas, Ioannis, & Katarellos, E., (2001)
Assignment to Ship management Companies	Assignment of technical management or other ship activities to ship management companies. Securing the achievement of higher reliability for the companies through the increase of HR and SWR. Allows companies to preserve their flexibility in the sale and purchase market	Theotokas, (1998) Theotokas, I & Katarellos, E., (2001) Lorange, (2001) Lyridis and Zacharioudakis, (2012), Gammelgaard and van Hoek (2006), Poulsen and Taudal, Sornn-Friese (2015), Meade and Sarkis, (2002), Vaidyanathan, (2005), Tyan, Jonah C., Fu-Kwun Wang, and Timon C. Du, (2003), Jung, H., Chen, F. F., & Jeong, B., (2008), Knemeyer, A, and Murphy, (2004).
Chartering Strategies	Spot Market and Time Chartering. Ship earns freight per ton of cargo transported. Flags of Convenience. Voyage Charter. Mix of strategies.	Lagoudis, Ioannis & Naim, Mohamed & Potter, Andrew, (2010), Androniki A. Triantafylli & Apostolos A. Ballas, (2010), Thanopoulou, (1998), Eriksen, I. E. and V. D. Norman, (1976)
Strategy of Joining a Pool	Building up a fleet comprising many different ship-owners which, under efficient management, will acquire the required "critical mass" that would enable it to bid for contracts, enjoy economies of scale, become visible to charterers by its size and	Haralambides, (1996), Peter Lorange, Øystein D. Fjeldstad, (2012)

	standards and, finally, through its diversification and risk-spreading, enable it to give its members an adequate return on their investment.	
Energy Saving Strategies	Speed reduction, trim optimization, autopilot adjustment, weather routing, and speed control of pumps and fans. These can improve business decisions when prioritizing mitigation strategies under budget constraints.	Jun Yuan, Victor Nian, Junliang He, Wei Yan, (2019)
Regular employee training	Key strategy to deal with human-caused risks in every company. Through frequent employee training courses, companies can decrease human-caused risks in a corporation mainly when employees confront a complex IT system or operate in a risky situation	Richardson, (2000); Elkins et al, (2005), Triantafylli and Ballas, (2010), Theotokas and Katarelos, (2001)
Safety and Security	Increasing the security level in ports is the most important impact of the code. Better control of the port area, restriction of unauthorised access and a better working environment are examples of effects that the implementation of the ISPS code on ports and port activities. Safety Management System (SMS); Formal Safety Assessment (FSA); Health, Safety and Environment (HSE); ISPS Code; safety case regulations; Quantitative Risk Assessment (QRA).	Mokhtari K., Ren J., (2014), Mazaheri A. and Ekwall D., (2009), Sweet, (2006), Closs, D. and McGarrell, E., (2004), Bhattacharya, (2012), Puisa R, McNay J, Montewka J, (2021)
Routing and Scheduling	Strategy offering opportunities to reduce The impact of uncertainties and delays at transport nodes and during transport. Minimisation of impact of port time uncertainty on operational costs.	Chopra, S and Meindl, P, (2010), Fagerholt and Ronen, (2013) Ronen, (1983)

Source: Author

### 3. Methodology

Greener (2008) classified methodology as the general attitude towards research and the strategy chosen to answer research questions. The methodology includes the theoretical analysis of all methods and principles related to knowledge data. It usually includes concepts such as example, theoretical model, phases, and quantitative or qualitative techniques.

A first decision on the methodology to be taken is whether the research will be conducted in a quantitative or qualitative manner. The type of research questions and the objectives set are crucial to this decision (Jonken & Pennink, 2010).

Qualitative research is a broad methodological approach that includes many research methods. The goal of qualitative research may vary depending on the scientific background, such as a psychologist seeking to gain an in-depth understanding of human behaviour and the reasons for such behaviour (Bogdan & Taylor, 1987). Qualitative methods examine why and how decision-making, not just what, where, when or "who" and have a strong sociological basis for understanding government and social programs. Qualitative research is popular with researchers in political science, social work, and special education and training (Stake, 1995). There are a wide variety of methods that are common to quality measurement, such as direct observation, unstructured interviews, and case studies. According to the conventional view of statisticians, qualitative methods produce information only for the specific cases being studied, therefore, it requires both intensive work and effort of months and years and is time consuming.

Quantitative research methods, on the other hand, emphasize objective measurements and statistical, mathematical, or numerical analysis of data collected through surveys, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques (Diriwächter & Valsiner, 2006). Quantitative research focuses on collecting numerical data and generalizing it to groups of people or explaining a specific phenomenon. The goal of conducting a quantitative research study is to determine the relationship between one thing (an independent variable) and another (a dependent variable or a variable result) within a population (Diriwächter & Valsiner, 2006). A closed question that refers to the validity of the existing theory indicates the need for quantitative research while qualitative research is considered more appropriate than open-ended questions. The process of measurement is central to quantitative research because it provides the fundamental link between empirical observation and the mathematical expression of quantitative relations. Quantitative data is all data that is in numerical form such as statistics, percentages and the researcher analyzes the data with the help of statistics. The researcher hopes that the numbers will yield an unbiased result that can be generalized to a larger population (Given, 2008).

According to Saunders et al. (2009) one of the most commonly used methods in studies is research. The latter offers a number of benefits, including the ability to collect large amounts of standardized, comparable data in an economical and efficient manner (Saunders et al, 2009), an advantage that becomes particularly important given the time and resource constraints in this study. A survey is defined as a short interview or discussion with individuals on a specific topic and completes various techniques such as questionnaires, personal interviews and discussions.

Given that the subject of dissertation was conducted during the COVID-19 period, the study is limited to a "snapshot" of the current situation thus making it a contemporary study.

#### 3.1 Research Tools

The questions included were mainly designed to specifically address the requirements and objectives set out in this research, while a small part of them were adapted from similar research. In addition, the self-management of the questionnaire helped to avoid any mistakes and prejudices of observers. The reliability and validity of the questionnaire during its construction also had to be examined.

According to Edwards et al (2002), in order to increase the answers to a questionnaire, the latter must be formulated from short, clearly formulated questions, as they found that shorter questionnaires have better response rates than longer ones. On the other hand, Cook et al. (2000) in their research confirm

the generally lower response rate to web-based questionnaires compared to other research methods and tools. In addition, Handwerk et al. (2000) in their study comparing paper questionnaires with web-based questionnaires found that respondents to the questionnaires consider about 13 minutes as a reasonable time to devote to completing a questionnaire.

On the other hand, the substance of the data generated by web-based questionnaires is equivalent to that generated by paper-based questionnaires and compared to the paper-based equivalents, web-based questionnaires are cheap and fast and can cover wide geographical areas (Denscombe, 2006). They are therefore an attractive proposition for researchers as they have the ability to provide a high level of anonymity (Coomber, 1997) which increases self-esteem while reducing social stress and social desire (Joinson, 1999) and access to larger and more diverse samples.

The study questionnaire was online and included 21 questions. The average time it took to complete was about 7 minutes, as measured in a test by a group of samples. Ensuring anonymity was noted and in response the risk of respondents not giving socially desirable answers was reduced (Saunders et al, 2009).

The self-administered questionnaire was formed using the Google Forms tool, following a neat template and was hosted on the same platform.

### **3.2 Identification and validation of risk mitigation strategies.**

To classify the risk mitigation strategies that bulk shipping companies can employ, an extensive literature review was conducted, followed by a five-point Likert scale to validate the results of the literature review. This will offer substantial information to companies on the strategies presented to decrease the negative impact of risk.

Literature reviews are commonly used in academic research to identify risk mitigation strategies (Mitchell, 1995). With regard to fully identify risk mitigation strategies suitable for the bulk shipping industry, both literatures directly related to the bulk shipping industry and literature in the area of general supply chain risk management were reviewed, as the latter studies may have adopted strategies suitable for bulk shipping.

For example, regular training as a crucial risk mitigation strategy in general supply chain management (Richardson, 2000) (Elkins, D. Handfield, R.B., Blackhurst, J. and Craighead, C, 2005) can also be applied in bulk shipping operations (Theotokas & Katarellos 2001) (Triantafylli & Ballas, 2010).

Therefore, the literature on general supply chain management was consulted to further confirm the applicability of the strategies identified in the literature to bulk shipping operations.

There are risks innate in every key business decision. Even if decision-makers opt out of an opportunity because it seems too risky, that decision can still be risky. Being too timid could lead to issues like new markets not being pursued, new products not being developed, or permitting competitors to obtain the benefit. Therefore, it is crucial to have a detailed, data-backed strategy in place to assess and reduce risk.

Risk identification must include whether the risk is, primarily, avoidable. These risks come from within — they can frequently be managed on a rule-based level, such as applying operational procedures monitoring and employee and manager guidance and training. Strategy risks are those that are taken on voluntarily to accomplish greater incentives. External risks stem from the exterior and are not in the businesses' control, such as natural disasters. Furthermore, they are not preventable or desirable.

Cost, performances, and schedules are some of the business variables that any type of risk may affect. Factors of risks included in the evaluation should include those that may affect current and potential customers and those that impact resources required to accomplish internal practices successfully.

Thirteen important strategies were chosen to assess their relative significance of three risk effects (financial, safety and security, incident-related loss). Only a few numbers of studies have holistically examined risk mitigation strategies in relation to the three risk outcomes (financial loss, reputation loss, and safety and security loss). This thesis attempts to offer a review of risk mitigation strategies in the

bulk shipping industry and an evaluation of the effectiveness of the classified strategies. Notably, some of the shipping risks are closely inter-relative, and thus, the risk mitigation strategies are not intended for just an individual risk.

### **Co-Operation and Strategic Alliances**

Co-Operation and Strategic Alliances between companies aim as a strategy to capture mutual gains in supply networks. It is possible to maximize the attributable joint rewards (through optimizing operations) and allocate the benefits of cooperation based on fairness. Through the coordination of their activities, their competitiveness can be improved.

### **Portfolio Diversification**

A financial risk management strategy is formulated in this case to hedge a well-diversified portfolio of freight rates by taking positions in multiple futures contracts, capturing the correlations and covariance between them, and therefore, minimizing risk more effectively.

Traditional freight rate risk management through portfolio diversification can be an effective risk management solution. Holding Portfolios of ships well diversified in terms of size, age, and type can help spread the financial risk.

### **Remain Independent**

Independence as a choice either of stability or of internal development might offer a few advantages to the companies if it is properly combined with their investment strategy. Differentiating their business activities or integrating vertically, expanding in production of previous stages (backward) and/or subsequent stages (forward).

### **Forward Bunker Contracts**

Market participants gain accurate signals from forwarding rates and use the information generated by these prices to guide their physical market decisions. Shipping operators can apply forward rates as indicators of the future course of bunker prices. The fact that forward prices are unbiased predictors of future settlement prices implies forward contracts can be an efficient and effective instrument for hedging against bunker price fluctuations.

### **Freight Derivatives**

Freight derivatives can include exchange-traded futures, swap futures, forward freight agreements (FFAs), container freight swap agreements, and derivatives. These instruments can help ship-owners and operators manage freight rate risk.

### **Development of Internalising operations**

This is an alternative for those companies that had neither the resources to pursue the strategy of internal development nor the business culture that would allow them to become members of networks. This strategy offers higher reliability for the companies through the increase of HR and SWR. It is also allowed companies to keep their flexibility in the sale and purchase market.

### **Assignment to Ship management Companies**

Assignment of technical management or other ship activities to ship management companies secures the achievement of higher reliability for the companies through the increase of HR and SWR. In that way, companies can preserve their flexibility in the sale and purchase market.

### **Chartering Strategies**

Ship earns freight per ton of cargo transported. Spot market and time chartering, flags of convenience and voyage charter or a mix of strategies can help diversify the risk.

### **The strategy of Joining a Pool**

Building up a fleet comprising many ship-owners which, under efficient management, will gain the required "critical mass" that would enable it to bid for contracts, enjoy economies of scale, become visible to charterers by its size and standards, and, finally, through its diversification and risk-spreading, enable it to give its members an adequate return on their investment.

### **Energy-Saving Strategies**

Speed reduction, trim optimization, autopilot adjustment, weather routing, and speed control of pumps and fans. These can improve business decisions when prioritizing mitigation strategies under budget constraints.

### **Regular employee training**

A key strategy to deal with human-caused risks in every company. Through frequent employee training courses, companies can decrease human-caused risks in a corporation mainly when employees confront a complex IT system or operate in a risky situation.

### **Safety and Security**

Increasing the security level in ports is the most important impact of the code. Better control of the port area, restriction of unauthorized access, and a better working environment are examples of effects that implementing the ISPS code on ports and port activities. Safety Management System (SMS); Formal Safety Assessment (FSA); Health, Safety, and Environment (HSE); ISPS Code; safety case regulations; Quantitative Risk Assessment (QRA).

### **Routing and Scheduling**

Strategy offering opportunities to reduce the impact of uncertainties and delays at transport nodes and during transport. Minimization of the impact of port time uncertainty on operational costs.

## **3.3 Measurement of the effectiveness of risk mitigation strategies**

After identifying the strategies, a large-scale questionnaire survey, namely "Risk Mitigation Strategies in Bulk Shipping" was conducted. This survey was constructed using a five-point Likert scale, with 1 representing "very inefficient" and 5 representing "very efficient". Respondents were asked to rate the level of effectiveness of the strategies based on their work experience. The population was based on a list of bulk shipping companies around the world. When the size of the population was calculated, the effective sample size was 49.

There are numerous means for multiple criteria decision making, yet there are some boundaries for these methods such as some need a large scale of questionnaire replies, some of their purposes are not apt for our research aim, and some of them need high computer language design skills and extensive quantitative data. (Qu et al.,2017).

Three risk categories (i.e., financial risk, reputation risk, and safety and security risk), whereas the criteria in our study are adapted from this structure and revised as reducing financial loss, reducing reputation loss, and reducing safety and security incident-related loss. Thirteen important strategies were chosen to assess their relative significance of three risk effects (financial, safety and security, incident-related loss). Only a few numbers of studies have holistically examined risk mitigation strategies concerning the three risk outcomes (financial loss, reputation loss, and safety and security loss). This thesis attempts to offer a review of risk mitigation strategies in the bulk shipping industry and an evaluation of the effectiveness of the classified strategies. Notably, some of the shipping risks are closely inter-related, and thus, the risk mitigation strategies are not intended for just an individual risk.

According to Davis (2005), a few common methods are used to increase the level of validity, as well as thorough identification of the measurement items from the literature and a questionnaire to validate the identified items. The questions in the mitigation-strategy survey were created based on the literature review and were validated through the questionnaire to confirm a high level of validity. After collecting

the replies from the mitigation-strategy survey, there were acknowledged 13 risk mitigation strategies. The respondents' profiles in the survey are described in the following tables and figures.

After the responses were collected, the ranking of these strategies could then be determined. The SPSS statistic was selected to measure the central tendency and the measure of the dispersion of the respondents' opinions. Mean and standard deviation are used in our analysis to reach a conclusion. Several typical procedures are employed to improve validity, including rigorous identification of measurement objects from the literature. The mitigation strategy survey questions were developed based on a literature review and analyzed using SPSS statistics.

Table 14 shows the results of the different risk mitigation strategies based on the data from the risk-mitigation survey. Based on the mean score, the top strategies include "regular employee training" (mean score: 4.417); "chartering strategies" (mean score: 4.146); and "improvement of some initiatives (ISPS Code, Safety Management System (SMS))" (mean score: 4.000).

The strategy "Assignment to Ship management" (mean score: 2.938) and "Remaining independent" (mean score: 3.250) had the lowest score among all the mitigation strategies. It is interesting to examine since it has been disputed as a subject both in literature and in the industrial field of the shipping industry.

Research has shown that issues like the size, type, and age of the company, as well as the overall and explicit environment in which a firm functions, can have a major effect on the separation of ownership and management and therefore on the employment or not of professional, independent ship management companies. It has been debated that big public corporations and firms in their later stages of development, when the second or third generations are in control, are more likely to employ outside professional managers.

On the other hand, the environment can play a two-fold role, varying each time on the circumstances concerned. For example, technological advancements, shortages in specialized labor, and an improved regulatory system are some aspects that encourage the growth of professional ship management.

## 4. Data Analysis

### 4.1 Respondent's profile and ranking of risk mitigation strategies.

It is observed that 41.7% of the respondents belong to the age group 35-44 years and 27.1% of the respondents belong to the age group 21-34 years. Thirteen (13) respondents belong to the age group 45-54 years (27.1%) and only two respondents (4.2%) belong to the age group above 55 years making 31.3% above 45 years.

**Table 2: Age**

	Frequency	Percent	Valid Percent	Cumulative Percent
21-34	13	27.1	27.1	27.1
35-44	20	41.7	41.7	68.8
Valid 45-54	13	27.1	27.1	95.8
55+	2	4.2	4.2	100.0
Total	48	100.0	100.0	

Source: Author

**Table 3: Age after grouping of the two last categories**

	Frequency	Percent	Valid Percent	Cumulative Percent
21-34	13	27.1	27.1	27.1
35-44	20	41.7	41.7	68.8
Valid 45+	15	31.3	31.3	100.0
Total	48	100.0	100.0	

Source: Author

The results show that about 54.2% of the respondents belong to C-levels and Managers (C-level, General managers, Senior managers) while 22.9% of the respondents are Executives and 22.9% are Junior-Assistant Managers. It is therefore argued that the majority of participants (54.2%) have an increased capacity to contribute to decision making.



**Table 4: Company Position**

	Frequency	Percent	Valid Percent	Cumulative Percent
Assistant Manager	6	12.5	12.5	12.5
C-Level	3	6.3	6.3	18.8
Executive	11	22.9	22.9	41.7
Valid General Manager	5	10.4	10.4	52.1
Junior	5	10.4	10.4	62.5
Senior Manager	18	37.5	37.5	100.0
Total	48	100.0	100.0	

Source: Author

**Table 5: Company Position based on decision making.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Junior - Assistant Manager	11	22.9	22.9	22.9
Executive	11	22.9	22.9	45.8
Valid C-level and Managers	26	54.2	54.2	100.0
Total	48	100.0	100.0	

Source: Author

Regarding years in their current position, 52.1% have 0-5 years of experience and 47.9% have 6 or more years of experience. More specifically, only three participants (6.3%) have less than one year of experience in their current position, 22 participants (45.8%) have 1-5 years of experience, 9 participants (18.8%) have 6-10 years of experience, and 14 participants (29.2%) have more than 11 years of experience.

**Table 6: Years in current position**

	Frequency	Percent	Valid Percent	Cumulative Percent
1-5 years	22	45.8	45.8	45.8
11 years+	14	29.2	29.2	75.0
Valid 6-10 years	9	18.8	18.8	93.8
Less than a year	3	6.3	6.3	100.0
Total	48	100.0	100.0	

Source: Author

**Table 7: Years in current position after category grouping**

	Frequency	Percent	Valid Percent	Cumulative Percent
0-5 years	25	52.1	52.1	52.1
Valid 6 years+	23	47.9	47.9	100.0
Total	48	100.0	100.0	

Source: Author

Regarding the highest level of education, most of the respondents, about 10.4%, have a high school degree, 2.1% have a degree from a technical institute, 27.1% have a university degree, 58.3% have an MSc degree, and 2.1% have a Ph.D. degree.

**Table 8: Level of education**

	Frequency	Percent	Valid Percent	Cumulative Percent
MSc	28	58.3	58.3	58.3
PhD	1	2.1	2.1	60.4
Senior high school	5	10.4	10.4	70.8
Valid Technological institute degree	1	2.1	2.1	72.9
University degree	13	27.1	27.1	100.0
Total	48	100.0	100.0	

Source: Author

Table 9 and Table 10 show whether the owner of the company is also the president or CEO and in which year the company was founded. As shown in Table 9, for most of the participating companies (56.3%), the owner of the company is not the president/CEO. In addition, the years in which the companies were founded range from 1840 to 2018, with eleven participants (22.9%) employed in companies founded in 1921, four participants (8.3%) employed in companies founded in 1987, three participants (6.3%) employed in companies founded in 2005, two participants (4.2%) employed in companies founded in 1974, two participants (4.2%) employed in companies founded in 1991, two participants (4.2%) employed in companies founded in 1995, and two participants (4.2%) employed in companies founded in 2009.

**Table 9: Is the company's owner the President/CEO as well**

	Frequency	Percent	Valid Percent	Cumulative Percent
No	27	56.3	56.3	56.3
Valid Yes	21	43.8	43.8	100.0
Total	48	100.0	100.0	

Source: Author

**Table 10: Year in which company was established**

	Frequency	Percent	Valid Percent	Cumulative Percent
1840	1	2.1	2.1	2.1
1850	1	2.1	2.1	4.2
1858	1	2.1	2.1	6.3
1871	1	2.1	2.1	8.3
1875	1	2.1	2.1	10.4
1884	1	2.1	2.1	12.5
<b>1921</b>	<b>11</b>	<b>22.9</b>	22.9	35.4
1932	1	2.1	2.1	37.5
1945	1	2.1	2.1	39.6
1951	1	2.1	2.1	41.7
1974	2	4.2	4.2	45.8
1978	1	2.1	2.1	47.9
<b>1987</b>	<b>4</b>	<b>8.3</b>	8.3	56.3
1989	1	2.1	2.1	58.3
Valid 1991	2	4.2	4.2	62.5
1993	1	2.1	2.1	64.6
1995	2	4.2	4.2	68.8
1998	1	2.1	2.1	70.8
2001	1	2.1	2.1	72.9
<b>2005</b>	<b>3</b>	<b>6.3</b>	6.3	79.2
2007	1	2.1	2.1	81.3
2008	1	2.1	2.1	83.3
2009	2	4.2	4.2	87.5
2011	1	2.1	2.1	89.6
2014	1	2.1	2.1	91.7
2015	1	2.1	2.1	93.8
2016	1	2.1	2.1	95.8
2017	1	2.1	2.1	97.9
2018	1	2.1	2.1	100.0
Total	48	100.0	100.0	

Source: Author

In addition, firm size was examined because it is evident that the returns and risks of smaller firms are greater than those of larger firms. The so-called "size effect". Risk and hedging are two related issues, as one presupposes the other and the second is a response to the first.

The distribution of the number of vessels operated by the companies is shown in the following table. It can be seen that 50% of the companies in the sample operate more than 50 vessels, but there is a significant variation in the companies that operate less than 50 vessels. Specifically, only 4 companies (8.3%) operate 1 to 3 vessels, 4 companies (8.3%) operate 4 to 7 vessels, 2 companies (4.2%) operate 8 to 10 vessels, 6 companies (12.5%) operate 11 to 15 vessels, 4 companies (8.3%) operate 16 to 30 vessels and 4 companies (8.3%) operate 31 to 50 vessels.

**Table 11: Number of vessels**

Number of vessels	N	%
1-3	4	8.3
4-7	4	8.3
8-10	2	4.2
11-15	6	12.5
16-30	4	8.3
31-50	4	8.3
51+	24	50
Total	48	100

Source: Author

In order to adequately examine the relationship between the number of vessels and the perception of risk management strategies, a new categorical variable was created to distinguish between companies with up to 50 vessels and companies with more than 50 vessels. In this framework, the sample was divided equally between the two groups, i.e. 24 (50%) of the participating companies have up to 50 ships and 24 (50%) have more than 50 ships. From a statistical point of view, larger samples can provide higher power for statistical tests (Field, 2016).

**Table 12: Number of vessels under operation by company**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid up to 50	24	50.0	50.0	50.0
Valid 50+	24	50.0	50.0	100.0
Total	48	100.0	100.0	

Source: Author

For a better understanding, a categorical variable for the type of bulk commodity was created based on the participants' answers about the types of vessels and capacities of their companies. As you can see, 27% of the companies belong to Dry Bulk Sector, 13% to Wet and 8% to both Wet and Dry Sector.

**Table 13: Types of bulk commodity.**

	Frequency	Percent	Valid Percent	Cumulative Percent
Wet	13	27.1	27.1	27.1
Dry	27	56.3	56.3	83.3
Wet & Dry	8	16.7	16.7	100.0
Total	48	100.0	100.0	

Source: Author

## 4.2 Ranking of risk mitigation strategies.

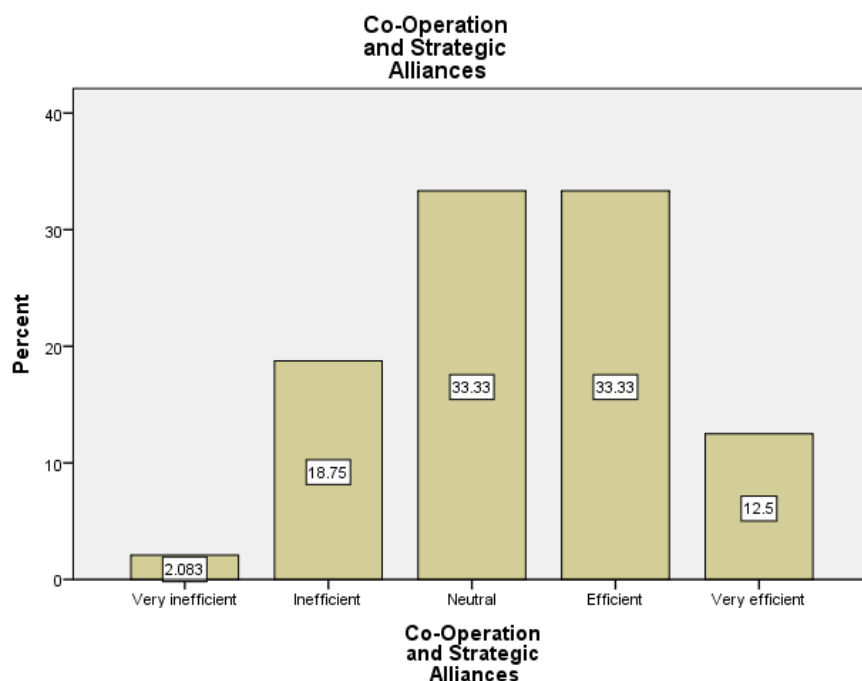
Means and standard deviations were calculated for all variables in the 5-point Likert scale used to evaluate the effectiveness of each risk mitigation strategy to account for the average trend of the sample. Based on the means, the most efficient risk mitigation strategies were as follows: Chartering strategies (Mean Score= 4.15, Standard Deviation = 0.77), regular staff training (Mean Score= 4.42, Standard Deviation = 0.82) and improvement of some initiatives (ISPSS Code, Safety Management System (SMS)) (Mean Score= 4.00, Standard Deviation = 0.95). Assignment to ship management (Mean Score= 2.94, Standard Deviation = 0.98) and maintaining independence (Mean Score= 3.25, Standard Deviation = 0.98) are considered the least effective strategies.

**Table 14: Risk Mitigation Strategies in Bulk Shipping**

	Mean	Std. Deviation
Co-Operation and Strategic Alliances	3.354	1.000
Portfolio Diversification	3.708	0.922
Remaining independent	3.250	0.978
Forward bunker	3.646	0.978
Freight derivatives	3.375	0.959
Development of Internalising	3.625	0.841
Assignment to Ship management	2.938	0.976
Chartering Strategies	4.146	0.772
Joining a Pool	3.313	1.055
Regular employee training	4.417	0.821
Improvement of some initiatives (ISPSS Code, Safety Management System (SMS))	4.000	0.945

Source: Author

**Figure 1: Co-Operation and Strategic Alliances as a Risk Mitigation Strategy.**



Source: Author

Co-Operation and Strategic Alliances is generally considered as an efficient strategy (45.8%) to mitigate risk in the bulk shipping industry, while 33.3% of participants is neutral and 20% recognizes this strategy as inefficient (Table 15).

According to the literature review, collaborations and strategic alliances can maximize the allocation and sharing of profits (through operational optimization) and achieve benefits. However, it should be noted that the use of limited infrastructure resources (at least in the short term) is shared and must be shared by all users

Capitalization levels are high, and it is easy to incur excessive costs. Individual companies can take advantage of these resources. In addition, each firm will seek to achieve economies of scale; it will do so in an operating environment with a significant degree of variability and mutual adjustment. (Robinson, 2015).

It is worth noting that the alliance is based on mutual management and decision making (Papadakis, 1999). This fact may deprive ship-owners to manage their vessels commercially and to use the strategy of buying and selling vessels consciously. By merging, they can combine their core competencies, i.e., their commercial and technical management, while taking advantage of economies of scale to develop their manpower and software and improve their reliability.

A key factor in the success of this decision is the corporate philosophy of the ship-owner and the overall organizational culture of the company, which can lead to differences in power and control. However, since the merger is based on equality, these complications can be eliminated. Greece's experience shows that equal cooperation agreements that go beyond power and control disputes have an overall positive impact on the partners. The prior suspension agreement also promotes the development of the partners (Theotokas, 1997).

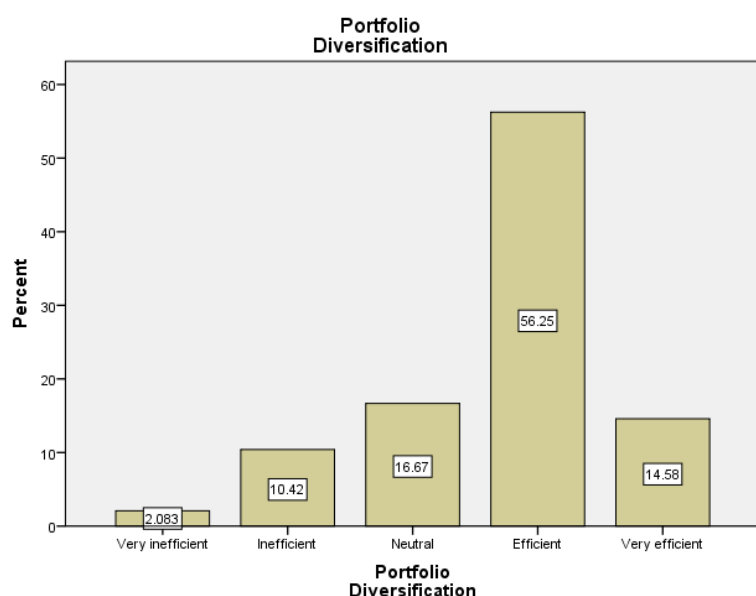
Harlaftis and Theotokas (2004) studied that cooperation and networks of different companies increased the sources of information; using the best available services and knowledge rather than relying on their applications is considered a strategic decision of each shipping company. A point that should be noted.

Lorange (2001) emphasized the importance of network organization and strategic partnerships to mitigate risk. Relying on the best available service and knowledge is clearer than relying solely on

internal applications. He supports the fact that outsourcing and strategic partnerships are becoming increasingly important.

It is noted that the survey reflects the findings of the literature review. Considering the degree of uncertainty exists and can be assumed in critical situations. There is evidence that shipping companies achieve better risk mitigation when companies have a higher level of collaborative relationships with partners.

**Figure 2: Portfolio Diversification as a Risk Mitigation Strategy.**



Source: Author

Portfolio diversification is considered efficient by 70.83% of the respondents, 16.67% answered neutral and only 2% consider it inefficient. The portfolio risk of ship owners can be hedged by using derivatives such as futures (Table 16).

This particular contract involves equities. In the event that the stock price is expected to fall, it is possible to buy futures contracts to hedge. This is done by securing higher prices in the market. When the contract expires, the ship-owner has an advantage if the stock price falls.

Since there is a reference to trading futures contracts, whenever the ship-owner thinks the situation is reasonable, he has the option to sell his shares and close his position. The opposite is true if he believes that stock prices will rise. The fundamental advantage of futures is that a portfolio can be hedged against fluctuations in the prices of securities without the need to liquefy stocks, and market trends can be exploited without incurring the cost of the contract value. Alexandridis et al (2018) studied financial risk management strategies in the context of portfolio diversification.

The results show that portfolio diversification reduces the volatility of freight rates by up to 35% for mixed portfolios of container, bulk, and tanker freight routes. In addition, the results of using transportation forward contracts according to the portfolio approach show a reduction in freight rate risk of up to 23%. The constant rate models outperform the time-varying models in most cases studied, both in-sample and out-of-sample, suggesting that hedging positions do not need to be updated. This methodology applies portfolios of container, bulk, and crude oil futures and their respective physical freight rates to improve the effectiveness of risk diversification for traders in the shipping market. (Alexandridis et al. , 2018)

The empirical results of their study have important implications for overall trading, trading and hedging strategies in the shipping industry as they may lead to a market. Cullinane (1991) is the first study to use

the investor's efficiency function to investigate the risk-return relationship of investments in the shipping industry. It confirms that risk attitude must be considered in shipping investment decisions.

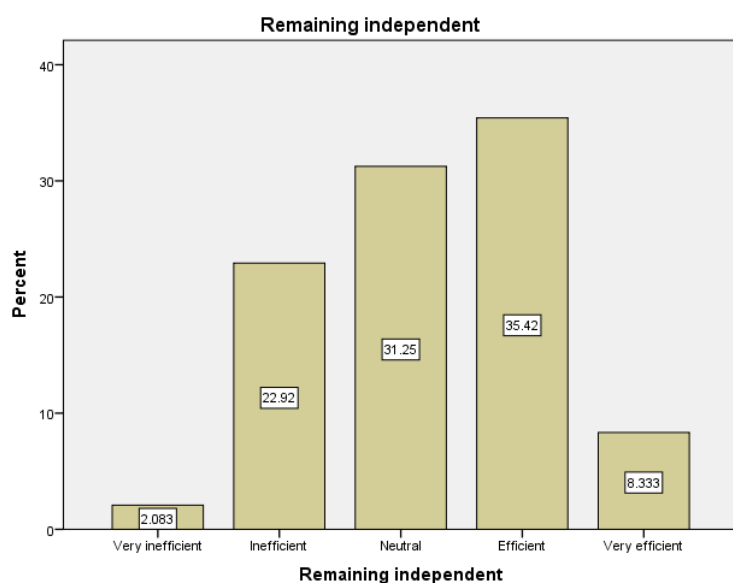
Alizadeh and Nomikos (2006, 2007) study the profitability of tactical trading strategies in shipping investments and use models to optimize risk and return in shipping investment strategies. This typically involves holding portfolios of vessels that are well diversified in terms of size, type or age.

However, due to the favorable correlation between the prices of diverse types of ships, as shown by Alizadeh and Nomikos, this form of risk management is unlikely to have much impact (2009). Moreover, this method of diversification, although theoretically sound, may not be economical and applicable to the shipping market due to the lack of liquidity and market depth, high transaction costs and brokerage commissions, and the long time required to complete a purchase and sale transaction due to inspections, surveys, and preparation of documentation.

Harlaftis and Theotokas (2004) mention the importance of diversification of investments as an essential business method to reduce the risk of shipping companies and to cope with the volatility of freight markets. Diversification in domestic and international business is a customary practice of shipping entrepreneurs. Another principal factor for the successful business strategy of tramp shipping companies is a systematic method for buying and selling.

The findings of the study are consistent with the literature review as it is considered an important risk mitigation strategy in bulk shipping.

**Figure 3: Remaining Independent as a Risk Mitigation Strategy.**



Source: Author

The results for remaining independent as a risk mitigation strategy (Table 17), indicate that 43.72% of the respondents consider it efficient, 31.25% as neutral, and 25% as inefficient. Independence, as a stabilizing or in-house development option, can offer a number of advantages to companies if it is well incorporated into their investment strategy.

Independent ship-owners make quicker decisions due to the lack of bureaucracy, especially when ordering new vessels. Such orders are mainly placed during periods of high freight rates, this drives independent ship-owners to increase their share of the global oil tanker fleet (Lyridis and Zacharioudakis, 2012).

As a stabilizing or internal development option, independence can offer companies a number of benefits if it is well integrated into their investment strategy. As a risk mitigation strategy, it is easier to overcome



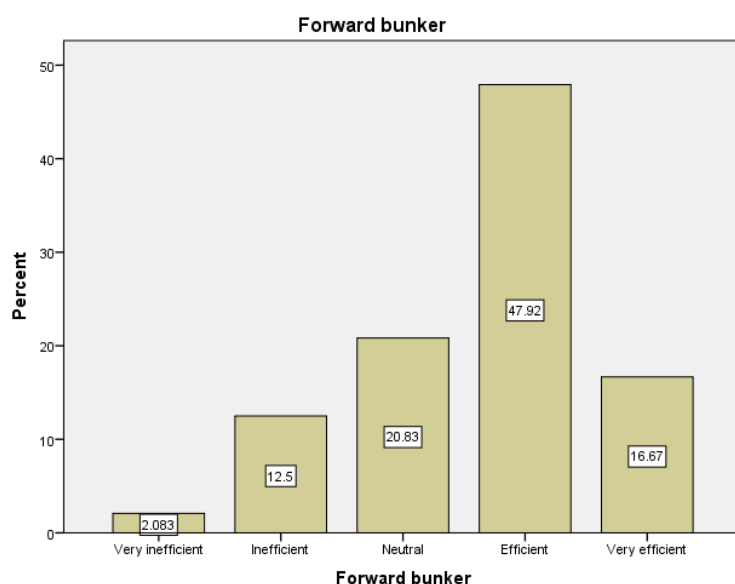
the difficulties of the new shipping environment unless internal development is used as a method to achieve critical mass. As mentioned earlier, small shipping companies cannot develop economies of scale to reduce their costs because of their status. In addition, their reliability and therefore their competitiveness decreases, especially during periods of low demand.

Nevertheless, independence as an option for stability or internal development could offer companies some advantages if properly combined with their investment strategy (Theotokas and Katarellos, 2001).

Triantafylli and Ballas (2010) refer to some strategies such as adopting long-term time charter contracts as the main investment strategy, but also laying up the fleet or selling it back as an alternative strategy when the freight market has low performance levels. Refraining from outsourcing and maintaining absolute control of the business at strategic and operational levels are seen as core competencies and sources of competitive advantage.

It is noticeable that a significant percentage of respondents do not consider this strategy to be as effective, although it is generally considered to be an effective risk mitigation strategy.

**Figure 4: Forward Bunker Contracts as a Risk Mitigation Strategy.**



Source: Author

The use of forward bunker contracts as a risk mitigation strategy in the bulk shipping industry is rated as efficient by 64.60%, neutral by 31.25%, and inefficient by 25% (Table 18).

Alizadeh and Nomikos (2004) study the price efficiency of the forward bunker markets in different geographical locations and for different maturities. With the recent increase in the use of derivatives on bunker fuel derivatives for risk management in the shipping industry, it is important to examine whether these instruments meet the needs of market participants.

The results show that market participants can obtain accurate signals from forward prices and use the information generated by these prices to guide their decisions in the physical market; therefore, shipping companies can use forward prices as indicators of future bunker price developments. The fact that forward prices are unbiased predictors of future settlement prices also means that forward contracts can be an efficient and effective tool for hedging against bunker price fluctuations.

The cost of operating a ship can have a significant impact on the ship owner's cash flow and profit. Price risk is joined by cash flow risk, the risk that arises from the uncertainty of a certain inflow. If an investor knew anew that he had a secure income, he would not take cash flow risk.

Bunker prices are one component that has a significant impact on the cost side of a ship owner's business. The problem is that without them no ship can sail and at the same time bunker prices can make the shipping business unprofitable. Bunker prices account for 50% of voyage costs and have the following characteristics. Bunker prices usually follow trends in the oil market, which are unpredictable. They can be subject to extreme volatility in input costs and revenues.

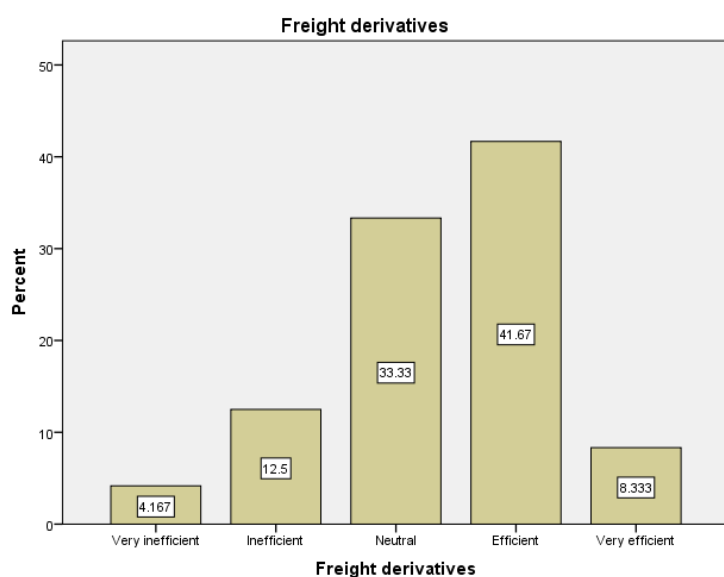
However, there is no futures contract that matches spot prices for this commodity. In the absence of tradable futures contracts, hedging against adverse bunker price fluctuations through futures contracts results in cross-hedging in homogeneous products such as gasoil traded in Houston and crude oil traded in Rotterdam and Singapore on the IPE in London.

The main markets where bunkering activity takes place are Singapore, Rotterdam and Houston. Few financial institutions offer customized derivative products such as swaps and options. There are three basic types of option exercise. American Option, an option that can be exercised at any time during its life until maturity. European option, option that can be exercised only on the maturity date itself. Asian option, option that is selected at maturity against an average price for the underlying commodity.

Any option on the New York Mercantile Exchange (NYMEX) and the International Petroleum Exchange (IPE). The underlying commodity for futures contracts traded on IRE is Brent with delivery at North Sea and for NYMEX is WTI with delivery at Cushing Oklahoma (Alizabath et al, 2003). The "Asian" option is the most popular in bunker hedging because the averaged settlement mitigates short-term fluctuations (Bunkerworld, 2004).

Both the results of the study and the literature review can clearly be considered consistent.

**Figure 5: Freight Derivatives as a Risk Mitigation Strategy.**



Source: Author

Freight derivatives as a risk mitigation strategy are rated as efficient by 50%, neutral by 33.3% and inefficient by 16.66% (Table 19).

Fluctuations in freight rates affect revenues and thus operating income. Freight rates fluctuate widely, for example, from month to month. If a ship-owner takes a position in the market in a particular month, he can make significant profits or losses depending on what happens in the following months. A ship-owner faces different types of risks when he puts his ship on the spot or TC market. It is generally agreed that spot rates lead to higher profits but are more volatile and therefore riskier than time charters.

Time charters have lower volatility as they commit a shipping activity for a longer period at a pre-agreed freight rate, but they deprive the investor of exceptional profits. Time charters are preferred by ship-owners who need to repay loans. Banks also grant premiums for time charters to ensure full repayment of their loans. Not to mention the technical imbalances in the market caused by cartels or large trading companies that affect freight rates.

Freight rate risk is considered to be the greatest risk compared to other risks in shipping. The best time for a ship-owner to order a new building is when freight rates are falling, as it takes 1-2 years for the ship to be delivered and tradable when freight rates are likely to be higher. On the other hand, a ship-owner might decide to buy a second-hand vessel when the freight market is at its peak to take advantage of good rates. It has been observed that the purchase value of ships is related to the state of the freight market.

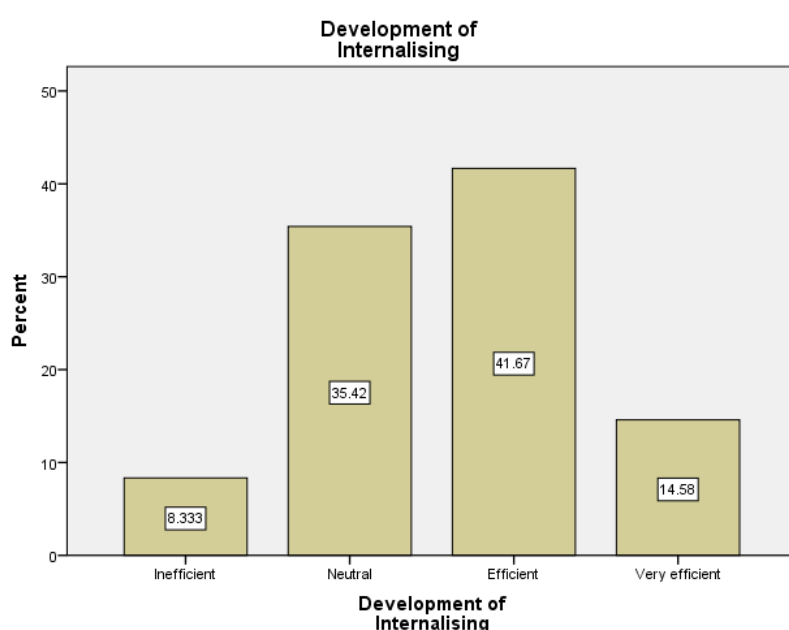
According to Amir H. Alizadeh, Nikos K. Nomikos (2004), managing ship price risk is a compelling factor for ship-owners not only because it affects the value of their company's balance sheet, but also because the loss of value of ships affects the solvency and ability of ship-owners to provide their services. Ships are considered as collateral in transactions financing debt securities for ships. Therefore, participants in the shipping market tend to monitor fluctuations in ship prices and use this information in their decision-making.

I-Masry, Ahmed and Olugbode, Mojisola, and Pointon (2010) suggest that financial directors, corporate treasurers, and portfolio managers often use risk management to reduce corporate risk. The purpose of risk hedging is to minimize the volatility of corporate earnings or cash flow, thereby reducing the volatility of corporate value.

If the company is exposed to risks from changes in exchange rates, interest rates, or oil prices, hedging can serve as a buffer to protect the company from unexpected cash flow losses. Forwards, futures, options, and swaps can reduce residual risk, albeit at a cost. To ensure the survival of industries that are critical to the country's sustainability, growth, and economic development, it is advisable to continuously monitor the impact of residual risks.

The findings of the study are consistent with the literature review as it is considered an important risk mitigation strategy in bulk shipping.

**Figure 6: Development of internalizing operations as a Risk Mitigation Strategy.**



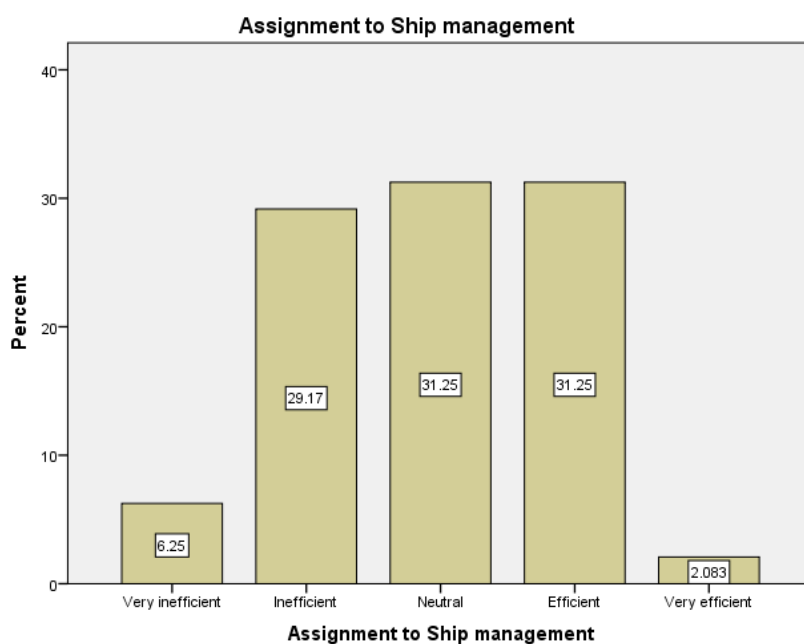
Source: Author

The development of internalization operations is an alternative for companies that do not have the resources to pursue the strategy of internal development, nor the corporate culture that would allow them to become members of networks. Increasing reliability for companies by increasing HR and SWR allows companies to maintain their flexibility in the sales and purchasing market.

As can be seen, 56.25% consider the development of internalization of operations efficient, 35.42% neutral, and 8.33% inefficient (Table 20).

It should be noted that the development of internalization of operations, the maintenance of independence and the transfer of technical management or other shipping activities to ship management companies are closely linked.

**Figure 7: Assignment to ship Management companies as a Risk Mitigation Strategy.**



Source: Author

Another risk mitigation strategy is to transfer technical management or other ship activities to ship management companies. Table 21 shows that 33.3% think that outsourcing management to a third-party company is efficient, 31.25% are neutral and 35.42% are inefficient.

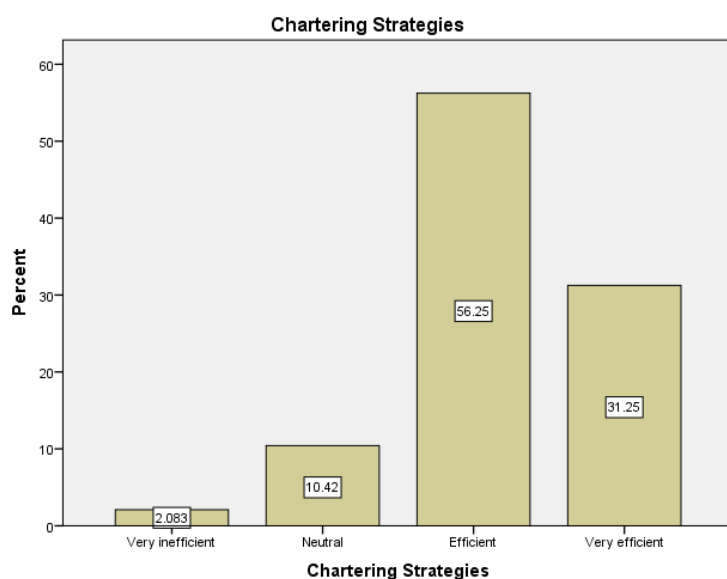
This strategy ensures higher reliability to the companies by increasing HR and SWR. It also enables the companies to maintain their flexibility in the sales and purchasing market. However, this decision does not drastically reduce the cost level as it is achieved by paying fees to the ship managers. The fees and all other costs incurred will not be less than their current technical management costs.

In addition, it will force them to assign an element related to one of their core competencies that is their cost-effective technical management. (Theotokas, 1998) (Theotokas and Katarellos, E., 2001) (Lorange, 2001) (Lyridis and Zacharioudakis, 2012).

According to Tyan et al. (2003), by outsourcing management to a third party, a ship-owner with one or a few vessels can be spared the disproportionate costs of an internal organization. The manager managing a large fleet will be able to accommodate additional vessels benefiting from the advantages of a large fleet (better prices for supplies, fuel and repairs, technical support, strict line organization and procedures). The benefits of delegating ship management to a third party in the shipping industry are much greater than perhaps in any other industry where an agency is used.

Overall assignment to ship management companies is considered inefficient in the bulk shipping industry.

**Figure 8: Chartering Strategies as a Risk Mitigation Strategy.**



Source: Author

Table 22 shows that 87.5% think that chartering strategies are efficient risk mitigation strategies, 10.42% are neutral and 2% think they are inefficient. Chartering strategies are among the top three efficient risk mitigation strategies in bulk shipping.

Lagoudis, Naim and Potter (2010) referred to the chartering strategies and the mix of strategies adopted by a company operating a fleet of vessels depending on the current and expected freight rate market level and the degree of its customer orientation.

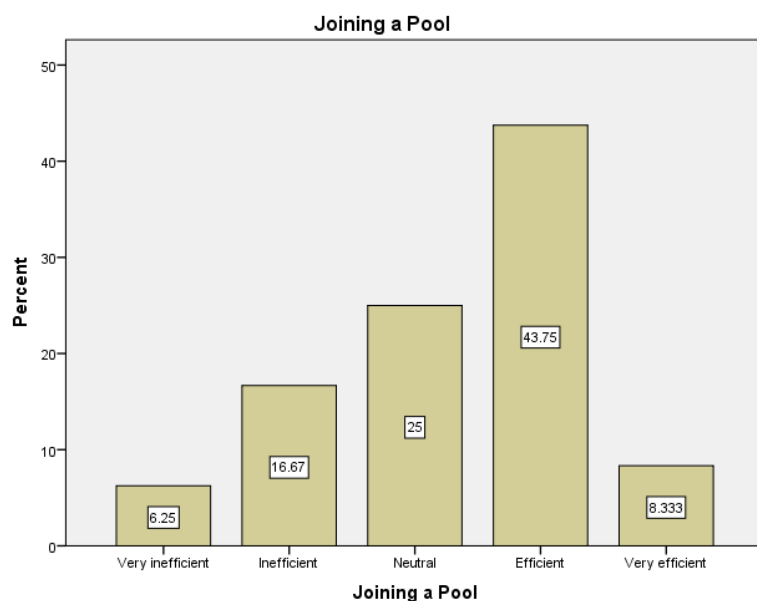
Freight rate fluctuations bring both opportunities and threats that can be offset by a company's internal and external flexibility. A combination of strategies allows the shipping company to achieve a high degree of flexibility in the utilization of its capacity by switching between spot, time charter and pool strategies.

Triantafylli and Ballas (2010) refer to some strategies such as adopting long-term time charter contracts as the main investment strategy, but also using fleet decommissioning or shellbacks as an alternative strategy when the freight market has low performance levels. Rejecting outsourcing and maintaining absolute control of the business at strategic and operational levels is seen as a core competency and source of competitive advantage.

Eriksen and Norman (1976) argue that operating in the spot market entails higher risk for the ship-owner and lower risk for the charterer since charterers can cover peaks in their transportation needs without resorting to long-term contracts. Therefore, the authors suggest that ship owners need a freight rate premium to commit their vessels to voyage charters rather than securing revenue from a time charter. This would imply a negative risk premium in the charter market.

Thanopoulou, (1998), Lyridis and Zacharioudakis, (2012) have mentioned the strategy of reducing administrative costs by raising a flag of convenience. These flags have adopted a more relaxed attitude towards taxes and regulations, especially on issues of crew nationality. States such as Panama and Liberia have attracted many vessels under their flags, although the benefits of oil tanker ownership are enjoyed by ship owners from countries such as Greece, the US and Japan.

**Figure 9: Joining a Pool as a Risk Mitigation Strategy.**



Source: Author

Table 23 shows that 52.08% consider joining a pool as an efficient risk mitigation strategy, 25% as neutral and 22.92% as inefficient.

Haralambides, (1996), Lorange and Fjeldstad, (2012) have analyzed the strategy of joining a pool. Building a fleet of many different ship-owners that, under efficient management, achieve the necessary "critical mass" that allows it to compete for orders, exploit economies of scale, become visible to charterers through its size and standards, and, finally, achieve a reasonable return for its members through its diversification and risk spreading.

A shipping pool is a joint venture in which ship owners market their vessels as a unit and share the revenue. The main objective is to increase capacity in order to take on large cargo contracts (CoAs), but motivations also include the use of improved capacity and technology sharing (Haralambides 1996).

By purchasing a portfolio of CoAs, the pool can adjust fleet requirements, minimize ballast bags and waiting times, etc. Most pools have restrictions on the vessels they allow to operate. They systematize in terms of size, age, speed, quality routines, etc. There are large pools in various segments of bulk carriers and smaller, specialized wet cargo types; pools are also common in reefer vessels. However, there are no pools for large standard tankers such as VLCCs, large bulk carriers, gas tankers or car carriers. (Haralambides, The economics of pools in bulk shipping, 1996).

**Figure 10: Regular Employee Training as a Risk Mitigation Strategy.**



Source: Author

Table 24 shows that regular employee training is 87.5% efficient, 8.33% neutral and 4.16% inefficient. This strategy was found to be the most efficient risk mitigation strategy in the bulk shipping industry.

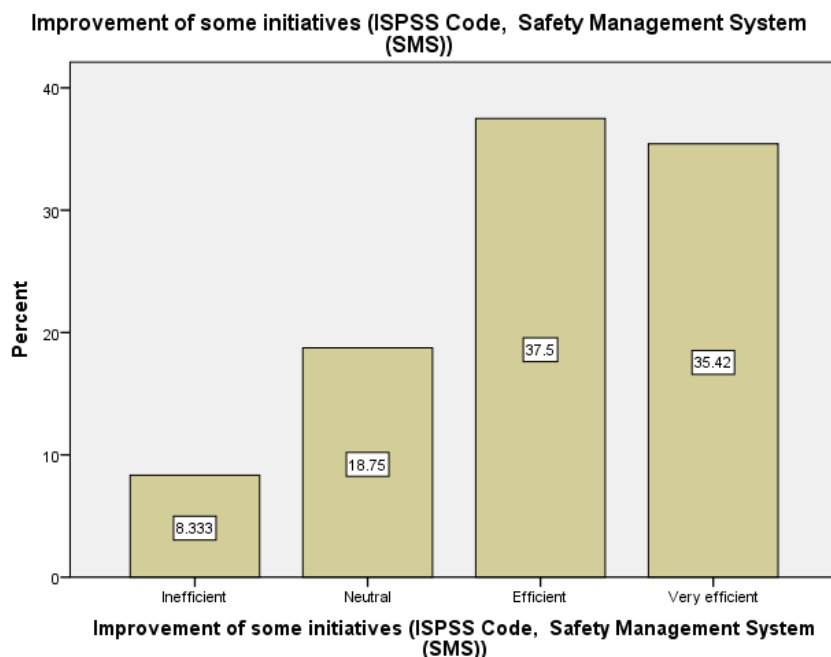
Regular employee training is an important risk mitigation strategy in general supply chain management. (Richardson, 2000; Elkins et al, 2005), can also be applied in bulk shipping operations (Triantafylli and Ballas, 2010), (Theotokas and Katarelos, 2001). Consequently, the literature on general supply chain management was used to investigate the applicability of the strategies identified in the literature to bulk shipping operations.

Employee training is an important strategy in almost every company to manage human induced risks. Through regular employee training, companies can significantly reduce human-caused risks in an organization, especially when employees are faced with a complex IT system or work in a hazardous environment.

Therefore, it is important that employees are well trained in managing the various hazardous materials they may come in contact with, as required by federal and international laws. A good training system must be structured and well planned.

It was found that the literature review and the survey results were in complete agreement.

**Figure 11: Improvement of some initiatives (ISPS Code, Safety Management System (SMS)) as a Risk Mitigation Strategy.**



Source: Author

Table 25 shows the results of improving some initiatives in the bulk shipping industry such as ISPS code and safety management systems (SMS). This strategy was ranked among the top of risk mitigation strategies in bulk shipping. Results indicate that 73% consider this strategy as efficient, 18.75% as neutral and 8.33% as inefficient.

The literature review examines these physical boundaries and risk-based activities within the shipping industry and recommends an appropriate risk management methodology that allows industry users to first become familiar with the idea of risk management on a holistic level, in addition to the evolving role of risk managers. These four areas of supply chain security clearly argue for internationally regulated solutions such as the ISPS Code, but depending on local differences in security needs, the international supply chain security program may provide either excessive (costly) or inadequate (inappropriate) levels of security (Closs and McGarrell, 2004).

This suggests that there is a lack of a coherent risk management framework or methodology in various sectors of the shipping industry, such as logistics and shipping, to make risk-based decisions, especially for the strategy, construction, operation, management and even decommissioning of shipping-related applications. (Mokhtari K., Ren J., 2014)

Mazaheri A. and Ekwall D. (year) summarize several changes in the way supply chain security should be addressed. The implementation of the ISPS code has had a significant impact on the port and port activities, including better control of port property, restriction of access by unauthorized persons, and a much-improved working environment.

All of these studies should shed light on future security regulations and practices in the industry. The study draws on broader research on occupational safety and health management to determine whether the users and social conditions that support effective implementation of self-regulation are present in the maritime context. Mokhtari K. and Ren J. (2014) highlight that in the maritime industry, most assessments, methodologies, and frameworks for dealing with hazards, risks and safety issues are for evaluation rather than management. The results of this case study show that the main impact of the code is a much higher level of safety in the port. In summary, security is no longer just an internal company



issue but affects all actors within the supply chain (Closs and McGarrell, 2004). Seven FSA studies have been commissioned to investigate risk control options and their cost effectiveness in mitigating risk.

The findings of the study are consistent with the literature review as it is considered an important risk mitigation strategy in bulk shipping.

**Table 15: Analysis of variance (ANOVA) results for the differences between bulk type categories on the efficiency of risk mitigation strategies**

Risk mitigation strategies	wet		Bulk type dry		wet & dry		p-value*
	M	SD	M	SD	M	SD	
Co-Operation and Strategic Alliances	3.62	1.193	3.30	.912	3.13	.991	.507
Portfolio Diversification	3.77	.725	3.59	1.083	4.00	.535	.536
Remaining independent	3.15	.987	3.11	1.013	3.88	.641	.140
Forward bunker	2.69	.947	4.07	.675	3.75	.886	<b>.000</b>
Freight derivatives	2.54	.967	3.81	.622	3.25	1.035	<b>.000</b>
Development of Internalising	4.00	.816	3.41	.844	3.75	.707	.100
Assignment to Ship management	2.85	.987	3.00	.920	2.88	1.246	.884
Chartering Strategies	4.00	1.080	4.33	.620	3.75	.463	.124
Joining a Pool	3.69	.751	3.22	1.050	3.00	1.414	.280
Regular employee training	4.31	.751	4.37	.926	4.75	.463	.451
Improvement of some initiatives (ISPSS Code, Safety Management System (SMS))	3.77	1.235	4.04	.854	4.25	.707	.513

\*Analysis of variance (ANOVA) results for the differences between bulk type categories on the efficiency of risk mitigation strategies

Source: Author

Means and standard deviations of risk mitigation strategies' efficiency perception per bulk type are presented in Table 26, along with One-Way ANOVA results relative to the statistical significance of the differences (significance level  $p < 0.05$ ). One -Way ANOVA has been utilized since the independent variables (bulk type) has more than two groups (Field, 2016). No significant differences ( $p\text{-value} > 0.05$ ) are detected between bulk types for the efficiency of co-operation and strategic alliances, portfolio diversification, remaining independent, development of internalizing, assignment to ship management, chartering strategies, joining a pool, regular employee training and improvement of some initiatives (ISPSS Code, Safety Management System (SMS)). Yet, forward bunker and freight derivatives strategies are considered more efficient in the dry bulk sector compared to the wet bulk sector ( $p < 0.05$ ).

**Table 16: Means and standard deviations of risk mitigation strategies' efficiency per number of vessels**

Risk mitigation strategies	Number of vessels				p-value*
	up to 50		50+		
	M	SD	M	SD	
Co-Operation and Strategic Alliances	3.58	1.018	3.13	.947	.113
Portfolio Diversification	3.96	.550	3.46	1.141	.062
Remaining independent	3.25	.847	3.25	1.113	1.000
Forward bunker	3.13	.900	4.17	.761	.000
Freight derivatives	2.92	.881	3.83	.816	.001
Development of Internalising	3.75	.737	3.50	.933	.308
Assignment to Ship management	3.08	1.018	2.79	.932	.306
Chartering Strategies	4.00	.885	4.29	.624	.193
Joining a Pool	3.67	.917	2.96	1.083	.018
Regular employee training	4.54	.658	4.29	.955	.296
Improvement of some initiatives (ISPS Code, Safety Management System (SMS))	4.04	1.042	3.96	.859	.764

\*Independent samples t-test results for the differences between numbers of vessels on the efficiency of risk mitigation strategies  
Source: Author

Means and standard deviations of risk mitigation strategies' efficiency perception per number of vessels are presented in Table 27, along with t-test results relative to the statistical significance of the differences (significance level  $p < 0.05$ ). Independent samples t-test has been utilized since the independent variables (number of vessels) has only two groups (Field, 2016). No significant differences ( $p\text{-value} > 0.05$ ) are detected between bulk types for the efficiency of co-operation and strategic alliances, portfolio diversification, remaining independent, development of internalizing, assignment to ship management, chartering strategies and regular employee training and improvement of some initiatives (ISPS Code, Safety Management System (SMS)). Yet, forward bunker and freight derivatives strategies are considered more efficient for companies operating over 50 vessels ( $p < 0.05$ ), while joining a pool is considered a more efficient strategy for companies operating less than 50 vessels ( $p < 0.05$ ).

## 5. Discussion and Conclusions.

Bulk shipping companies deal with various risks with numerous outcomes that are important to be mitigated. Limited empirical research has been done on categorizing and assessing risk mitigation strategies in bulk shipping with various risk consequences. This research intends to detect the suitable risk mitigation strategies and assess the comparative importance of these strategies.

Researchers have addressed various strategies in the literature such as cooperation and networking, diversification of portfolio and fleet, remaining independent, delegating tasks to external management companies, forming strategic alliances, and merging with small companies, various investment strategies, energy-oriented strategies, internalization of operations, chartering strategies.

The paper attempts to provide a systematic overview of risk mitigation strategies in the bulk shipping industry and analyse the efficiency of the identified strategies. It is largely based on the selection of effective risk mitigation strategies in container shipping by Chang, Xu, Dong and Yang (2019). It was decided to pick up, acknowledge and confirm these themes for the bulk cargo industry as well. In particular, some of the shipping risks are closely interrelated, so the mitigation strategies are not proposed only for a specific risk.

To sort the risk mitigation strategies that bulk shipping companies can utilize, an extensive literature review was completed, followed by a five-point Likert scale to verify the results of the literature review. This will present substantial information to companies on the strategies presented to decrease the negative impact of risk. With regard to fully identify risk mitigation strategies suitable for the bulk shipping industry, both literatures directly related to the bulk shipping industry and literature in the area of general supply chain risk management were studied, as the latter studies may have adopted strategies suitable for bulk shipping.

After detecting the strategies, a large-scale questionnaire survey, namely "Risk Mitigation Strategies in Bulk Shipping" was conducted. This survey was constructed utilizing a five-point Likert scale, with 1 representing "very inefficient" and 5 indicative of "very efficient". Respondents were requested to assess the level of effectiveness of the strategies based on their work experience. The population was based on a list of bulk shipping companies around the world. When the size of the population was determined, the effective sample size was 49.

The study questionnaire was online and included 21 questions. The average time it took to complete was about 7 minutes, as measured in a test by a group of samples. Ensuring anonymity was noted and in response the risk of respondents not giving socially desirable answers was reduced (Saunders et al, 2009). The self-administered questionnaire was formed using the Google Forms tool, following a neat template, and was hosted on the same platform.

Using the questionnaire survey on mitigation strategies was possible to rank the mitigation strategies according to their overall effectiveness. The results show that the top three strategies are "Regular employee training, "Chartering Strategies" and "Improvement of some initiatives (ISPS Code, Safety Management System (SMS))" while outsourcing management to a third-party company had the lowest score among all mitigation strategies.

It was noted that the bulk shipping industry tends to place more emphasis on regular employee training, but also on chartering strategies. It is consequently suggested that bulk shipping companies pay more attention to managing man-made risks in each company. Chartering strategies such as spot market, time charter, flags of convenience and voyage charter play an important role in risk mitigation.

Improving some initiatives in the bulk shipping industry such as ISPS code and safety management systems (SMS) was ranked among the top of risk mitigation strategies in bulk shipping. The implementation of the ISPS code has had a significant impact on the port and port activities, including better control of port property, restriction of access by unauthorized persons, and a much-improved working environment.

ANOVA has been utilized in the study and showed no significant differences between bulk types are observed in the efficiency of collaborations and strategic alliances, diversification of the portfolio, remaining independent, development of internalization, assignment to ship management, chartering strategies, joining a pool, regular employee training and improvement of some initiatives (ISPSS Code, Safety Management System (SMS)).

However, forward bunker and freight derivatives strategies are considered more efficient in the dry bulk sector than in the wet bulk sector.

As it is noticed no noteworthy differences are found between bulk types in the efficiency of co-operation and strategic alliances, portfolio diversification, remaining independent, internalization development, assignment to ship management, chartering strategies and regular employee training, and improvement of some initiatives (ISPSS Code, Safety Management System (SMS)).

Nevertheless, forward bunker and freight derivatives strategies are considered more efficient for companies operating more than 50 vessels, while joining a pool is considered a more efficient strategy for companies operating less than 50 vessels.

It is therefore suggested that bulk carriers pay more attention to regular employee training, chartering strategies and thus improving some ISPSS Code or Safety Management System (SMS) initiatives. It is often the case that a company has limited resources to implement all the identified strategies. It is important to agree on control strategies as a priority. Therefore, following the example of selecting effective risk mitigation strategies in container shipping operations by Chang, et al. 2019, this study examined the most important strategies to prioritize for recommendation and how the remaining strategies are further evaluated by most shipping companies to satisfy their own needs.

It is believed that the results would be more accurate if it could also be included an interview and a fuzzy AHP survey. As this study would be related to empirical research, using AHP as method would be more suitable to evaluate the relative importance of risk mitigation strategies. AHP proposed by Saaty (1988) has been widely used to evaluate the relative importance of decision criteria/alternatives in various industries including maritime and port (Ha et al.2017).

Through this paper, managers in the bulk shipping industry can have more options to deal with risk management, and to understand how to prioritise strategies with respect to different types of risk consequences.

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## Appendix

### Risk mitigation strategies in bulk shipping

This questionnaire is part of an MSc Thesis project conducted at University of Piraeus under the supervision of Dr. Ioannis N. Lagoudis. The purpose of this survey is to investigate the risk mitigation strategies in bulk shipping. You are kindly requested to answer all questions following the instructions included under each section of the questionnaire. Any information obtained in connection with this study you will remain confidential. The duration of this task will not exceed 7 minutes.

---

\* Required

#### Section

A

General information

1. Age \*

*Mark only one oval.*

21-34

35-44

45-54

55+ older

2. Company Department \*

*Mark only one oval.*

- Legal
- Finance and Accounting
- IT
- Safety and Quality
- Crew
- Technical
- Chartering
- Operations
- Other

3. Company Position \*

*Mark only one oval.*

- Executive
- C-Level
- General Manager
- Senior Manager
- Assistant Manager
- Junior

4. Years in current position \* *Mark only one oval.*

- Less than a year
- 1-5 years
- 6-10 years
- 11 years+

5. Highest level of education \* *Mark only one oval.*

- Senior high school
  - University degree
  - Technological institute degree
  - MSc
  - PhD
-

Please indicate

### Company's general information

6. Year your company was established: \*
7. The company's owner is the President/CEO as well? \*

*Mark only one oval.*

Yes

No

8. State the number of vessels under operation by your company \*

*Mark only one oval.*

1-3

4-7

8-10

11-15

16-30

31-50

51+

Please mention number of vessels in each category

### Fleet structure

#### Wet Bulk Carriers

9. Handy \*  
Tankers

---

10. Product Tankers \*

---

---

11. Panamax \*  
Tankers

12. Aframax \*  
Tankers

---

13. Suezmax \*  
Tankers

---

14. VLCC \*  
Tankers

---

15. ULCC \*  
Tankers

---

16. Tankers (dwt) \*  
Please mention total capacity of your fleet

---

### Dry Bulk Carriers

17. Handy \*  
Bulk Carriers

---

18. Handymax \*

Bulk Carriers

---

19. Supramax \*

Bulk Carriers

---

20. Panamax \*

Bulk Carriers

---

21. Kamsarmax \*

Bulk Carriers

---

22. Capesize \*

Bulk Carriers

---

23. VLOC \*

Bulk Carriers

---

24. Bulk carriers (dwt) \*

Please mention total capacity of your fleet

---

## Section B

Please answer the questions on a scale from 1=very inefficient to 5=very efficient.

25. How efficient is Co-Operation and Strategic Alliances as risk mitigation strategies in bulk shipping? \* *Mark only one oval.*

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

26. To what extent is Portfolio Diversification efficient as a risk mitigation strategy in bulk shipping? \*

*Mark only one oval.*

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

27. Is remaining independent an efficient risk mitigation strategy in bulk shipping? \*

*Mark only one oval.*

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28. To what extent is forward bunker contracts an efficient risk mitigation strategy in bulk shipping? \* *Mark only one oval.*

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

29. Are freight derivatives efficient risk mitigation strategy in bulk shipping? \*

*Mark only one oval.*

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

30. Is Development of Internalising operations An efficient risk mitigation strategy in Bulk shipping? \*

Mark only one oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31. Is Assignment to Ship management Companies efficient risk mitigation strategy in Bulk Shipping? \* Mark only one oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

32. To what extend is Chartering Strategies efficient Risk mitigation strategy in Bulk Shipping? \*

Mark only one oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

33. To what extend is the Strategy of Joining a Pool Efficient as Risk mitigation strategy in Bulk Shipping? \* Mark only one oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

34. Is regular employee training efficient as a risk mitigation strategy in Bulk shipping? \*

Mark only one oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

35. Can the improvement of some initiatives (ISPSS Code, Safety Management System (SMS); Formal Safety Assessment (FSA); Health, Safety and Environment (HSE);) be an effective risk mitigation strategy in Bulk shipping? \* *Mark only one oval.*

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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