Chair of Industrial Logistics

Master's Thesis

# Factors influencing the Purchasing Process of Maritime Transport Services: a Delphi Study

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# Kurzfassung

Weltweit ist Seefracht die am häufigsten verwendete Transportart. Maritimer Verkehr wirkt sich daher auf die Wirtschaft, das Wirtschaftswachstum, die globalen Märkte und die Leistung der Lieferketten aus. Vorfälle in jüngster Vergangenheit, wie die Corona-Pandemie oder die Blockade des Suezkanal zeigen aber, dass Lieferketten so fragil wie wichtig sind. Erhebliche Unterbrechungen durch diverse Disruptionen bringen die maritime Industrie und den Containerverkehr in eine kritische Situation. In Kombination mit steigendem Bewusstsein für den Klimaschutz und dem damit einhergehenden Einsatz von neuen Technologien sind die Transportkosten auf einem Allzeithoch und Angebot und Nachfrage sind nicht mehr im Gleichgewicht. In Zeiten steigender Marktinstabilität ist der erfolgreiche Transport für den Import und Export – und somit die Wettbewerbsfähigkeit von Ländern und Unternehmen – von großer Bedeutung. Transportdienstleister, als die Glieder in der Kette, die Transporte ermöglichen müssen, stehen demzufolge unter ständigem Druck, sich an die veränderten Umstände anzupassen, um nicht die Leistung der gesamten Lieferkette zu beeinträchtigen. Damit auf solche Umstände proaktiv und früh genug reagiert werden kann, müssen Entwicklungen in der Industrie rechtzeitig erkannt, analysiert und Transportprozesse dahingehend optimiert werden. Produzierende Unternehmen, als eine der wichtigsten Käufer von maritimen Transportdienstleistungen, legen schlussendlich in ihrer Funktion als Verlader die Zielgrößen des Transports fest. Das Ziel dieser Arbeit ist es, maritime Transportentwicklungen in der Inbound-Logistik produzierender Unternehmen zu identifizieren, analysieren und hinsichtlich deren Bedeutung für zukünftige Transportdienstleistungen zu interpretieren. Nach einem Überblick über die theoretischen Grundlagen global Supply Chains werden relevante Einflussfaktoren auf den Einkaufsprozess von Transportdienstleistungen aus der wissenschaftlichen Literatur herausgearbeitet. Anhand einer Delphi-Studie wird die Frage, wie sich 19 gefundene Faktoren auf die Kaufentscheidung maritimer Transportdienstleistungen auswirken, quantitativ untersucht und beantwortet. Ein Expertengremium bewertet dafür die Faktoren, welche Umwelt-, Qualitäts-, Kosten- und Zeitaspekte der Transportdienstleistung sowie andere wesentliche Leistungsmerkmale beinhalten. Um tiefe Einblicke zu gewinnen und zukünftige Trends in vorgelagerten Lieferketten zu prognostizieren, werden weiters drei Kernthemen qualitativ untersucht. Ergebnisse dieser Fragestellungen zeigen die Veränderung der berücksichtigten Aspekte, wenn Verlader Seetransportdienstleistungen kaufen, sowie wesentliche Merkmale für Spediteure, um auf zukünftigen Märkten wettbewerbsfähig zu sein.

# Abstract

Maritime transport is the most common form of transport and therefore directly impacts on economy, economic growth, global markets and supply chain performance. However, recent incidents such as the Corona pandemic or the Suez Canal traffic jam show that supply chains are as fragile as they are important. Various disruptions put the maritime industry and container traffic into a critical situation. In combination with increasing environmental awareness and the associated use of new technologies, transport costs are at an all-time high and supply and demand are no longer in balance. In times of increasing market instability, successful transport of import and export – and thus the competitiveness of countries and companies – is of great importance. Transport service providers, as the links in the chain that have to facilitate the transport, are therefore under constant pressure to adapt to changing conditions and to not hinder the performance of the entire supply chain. In order to be able to react proactively and early enough to shifting circumstances, industry developments must be recognized and analysed as soon as possible and transport processes need to be optimized accordingly. Manufacturing companies, as one of the most important buyers of maritime transport services, ultimately determine the target values of transport processes in their function as shippers. The aim of this work is to identify and analyse maritime transport developments in the inbound logistics of manufacturing companies and to interpret them regarding their importance for future transport services. After a theoretical overview of global supply chains and supply chain management, relevant influencing factors on the purchasing process of transport services are identified in a systematic literature research. Based on a Delphi study, the questions of how 19 factors affect the purchasing decision of maritime transport services is examined and answered. A panel of experts evaluates the factors that include environmental, quality, cost and time aspects of the transport service as well as other essential performance characteristics. In order to gain deep insights and to forecast future trends in upstream supply chains, three key topics are investigated. Findings from these questions show the changing aspects considered when shippers purchase maritime transport services, as well as essential characteristics for freight forwarders to be competitive in future markets.

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# 1 Introduction

This thesis addresses the main factors affecting transport processes in maritime supply chains. A pending recession, inflation and environmental awareness make global transport decisions crucial and therefore maritime transport processes need optimization. Since the beginning of the Corona pandemic, shipping and container traffic has increasingly become the focus of the media due to the logistics business profiles undergoing a global shift. Never before has successful transport of imports and exports been of more significance as global market instability rises. Vessels are larger in capacity than previous years and the cost of transportation is at an all–time high. An incident which occurred in August 2021 in Ningbo, the second largest Chinese port demonstrates how crucial the situation has become. Due to a corona outbreak, the mentioned container terminal had to be shut down and just one week later there were 50 container ships waiting to be unloaded and cleared causing logistical disruptions affecting the flow of goods. Prices are rising due to an increasing demand for the available number of ships. If the shipping of a container from Shanghai to Rotterdam cost 2000 US dollars in January 2020, the price for the same procedure in September 2021 is 614% higher, resulting in huge profit gains for carriers and increased challenges for shippers.[1]

Maritime shipping finds itself presently in a critical situation. Price inflation and the logistical overloads resulting in traffic jams in front of the world's largest ports create supply delays. The blockade of the Suez Canal comes to mind as only one example occurring in the past years. The fluctuating maritime transport processes constantly affect global supply chains and are therefore having a significant impact on the flow of all goods, as 90% of all industrial and consumer goods are transported by sea.[2,3]

For supply chain management to be successful, specific products need to reach markets in time and in the right quantities to avoid a product glut or shortages. However, at a time where the entire world markets and trade are increasingly dynamic, companies are facing numerous new challenges.[4] The collaboration between all parts of a supply chain has never been more important than under these

[1] Müller, J. (2021), p.2f.
[2] N.N., https://dispo.cc/artikel/folgen-der-suezkanal-blockade-bis-zum-sommer/ (Retrieved: 30.01.2022)
[3] Müller, J. (2021), p.2f.
[4] N.N., https://www.wlw.de/de/inside-business/praxiswissen/einkaeufer-ratgeber/supply-chain-trends-der-zukunft (Retrieved: 30.01.2022)

volatile circumstances.[5] If an important supplier cannot deliver a product or raw materials, or if the delivery is defect, the entire supply chain is disrupted. Smooth and optimised cooperation in the supply chain and the effective networking of all parties are therefore of crucial importance in terms of competition.[6]

Focus on environmental awareness increases the logistical challenges for all transport. Especially ocean freight, which remains an unpredictable sector, plays a vital role in global supply chains. Circumstances can change rapidly, and disruptions have major consequences, making international business operations complex. For example, container availability and bunker surcharges directly impact the shipping costs of businesses. Costs are not the only major concerns when choosing a freight partner, their capacity and reliability are of significance for success of the process too. This is why shippers need to consider all options when working with a freight forwarder or combining cargo volumes while continually keeping up with contract terms. Vigilance as well as market intelligence or awareness and sourcing of creative solutions, while considering all potential costs are necessities for shippers when mastering the challenging situations in today's market.[7,8]

## 1.1 The Initial Situation

Global supply chains have become increasingly sophisticated and interlinked over the past years and therefore prove more vulnerable to disruptive risks. The Corona pandemic strained supply chains as well as logistics networks, clearly showing the fragility of existing global supply chains.[9,10] The vulnerabilities and lack of resilience inherent to present maritime supply chains were highlighted in these exceptional times of global crisis.[11] Disruptions lead to changing dynamics as well as challenges for all parties in the maritime supply chain operations. Maritime consultant Drewry claims that the relationship between carriers and shippers hit a record low as carriers tend to be opportunistic focusing mainly on profit instead of long-term cooperation. This is possible in the existing under-supplied global markets where upsurging freight rates are a result of cargo demand surpassing maritime capacity. It leads, however, to a broken

[5] Pieringer, M., https://logistik-heute.de/news/supply-chain-management-das-sind-die-zehn-top-trends-im-jahr-2021-32431.html (Retrieved: 30.01.2022)
[6] Wannenwetsch, H. (2014), p. 499.
[7] iBanFirst, https://blog.ibanfirst.com/en/how-to-gain-the-upper-hand-over-ocean-freight-shipping (Retrieved: 01.03.2022)
[8] N.N., https://ec.europa.eu/growth/smes/sme-definition_de (Retrieved: 01.03.2022)
[9] Görg, H.; Mösle, S. (2020), p.7 ff.
[10] LOGISTICS, D. O. T. AND. U. N. C. O. T. A. D. (2022), p.48.
[11] Fonseca, L. M.; Azevedo, A. L. (2020), p.8.

relationship between key players in maritime supply chains and proves the short-sighted behaviour of carriers. The problem being that carriers block the business of shippers on whom they in the end depend. Carriers require provided information by shippers to be able to plan their capacities and to ensure consistent logistics planning. It also results in a shift of relevant factors that affect the transport purchasing decision of shippers aside from increased discussions about freight budgets.[12] The changing transportation sourcing situation offers possibilities for researching strategic optimised and informed decision making regarding maritime transport purchases and crucial factors influencing these decisions.

It is not only the shift in the overall operating landscape and changing relationships between cooperating parties that should be considered; due to an expanded need for sustainability and increased environmental awareness, maritime transport needs to focus on establishing future supply chains that are resilient, thus facilitating change and adaption to global market requirements constantly. This is attained by applying accurate and effective risk assessment and management. For maritime transport to improve on their present situation, their processes need to be optimised by remaining vigilant and dynamic.[13] Investigating these modified circumstances provides insights into shippers' current priorities when purchasing maritime transport services. Additionally, it offers an opportunity for all parties of maritime transport processes to swiftly respond to emerging trends in upstream supply chains. Adapting to these trends is of great importance to ensure on-time transportation, security of supply and competitiveness in future markets.

## 1.2 The Objective and Research Questions

Taking into account all the shifts recently happening in maritime supply chains, this thesis identifies and addresses developing inbound logistic trends that influence the purchasing process of maritime transport services. The analysis focuses on maritime transport areas of global supply chains, identifying risk factors and potential problems which may occur. It derives trends from the results and discusses possible measures to improve the response to them. Any alteration in the supply chain directly affects and changes the transport purchasing process and modifies the relationship between carrier, shipper and freight forwarder. These shifts in the operation of maritime supply chains are being assessed in this thesis to answer the foremost research question:

[12] Wackett, M. (2021)
[13] LOGISTICS, D. O. T. AND. U. N. C. O. T. A. D. (2022), p.48.

- *What factors influence the purchasing decision of maritime transport services, and which of these are most relevant?*

Additionally, trends in upstream supply chain are investigated to forecast future maritime supply chains:

- *The market is reflecting a shift from price issues to supply chain security. What priorities are set by the purchaser regarding price versus punctual reliable delivery?*
- *What will the freight forwarder's role in transport be like in 2030?*
- *What is the transport purchaser's opinion regarding environmentally friendly transport in their supply chain?*

This research focuses solely on trends in upstream supply chains of the manufacturing industry. This entails dealing with material movements from suppliers, in ocean transport processes also called shippers, to the production plants. The main focus is laid on transport operations, much of which are carried out via maritime routes, as this represents an interesting research area due to its complexity and relevance. Downstream supply chains, which affect the sales market and the distribution of goods, as well as firm-internal material flows in the production, handling and storage processes are for this study negligent and will not be discussed.

## 1.3 Structure and Research Methodology

In the second chapter of this master thesis, essential definitions and terms related to supply chain management and logistics are explained. The importance of international maritime trade and transport is addressed and risks and disruptions in maritime supply chains are investigated. Additionally, a global market overview depicting key players, major shipping routes and ports completes this chapter providing the theoretical background around the research topic.

In the third chapter, transport service allocation, the purchasing process of transport services is examined and various process models for purchasing services are presented. To establish a foundation for this study, factors influencing the purchasing decision of transport services are identified.

The Delphi method, proven to be an established and suitable research method for factors influencing decision making, is introduced in chapter four. The Delphi technology is used to attain a consensus opinion among selected experts, called the Delphi panel. The research is conducted using a Delphi study of two rounds. The

questionnaires, evaluate factors influencing the purchasing decision of maritime transport services on a Five-Point-Likert Scale. The forecasting part of the questionnaire consists of open-ended questions identifying future trends in upstream supply chains. The Delphi study stopping criterion are dictated by levels of agreement as well as stability before terminating. Appropriate threshold values for stability and consensus are defined.

In the chapter five, results of both questionnaires are shown. The coefficient of variation is chosen for testing stability and the interquartile range for consensus measurement of the factors being evaluated. The forecasting open-ended questions provide a reliable statement representing the group opinion in the second questionnaire.

The conclusion discusses the results, providing possible hypothesis and reasons for the outcome of the research.

# 2 Theoretical Background

In this chapter the theoretical definitions and terms related to supply chain management and logistics are addressed. Maritime supply chains and transport processes are introduced and the importance of international maritime trade is clarified. A summarised market overview depicts key players, major shipping routes and ports. The risks and disruptions in global maritime supply chains are then investigated.

## 2.1 Supply Chain Definitions

The central task of a supply chain is to provide the goods and/or services that the customers require in the right form, time, place, and quantity. In addition to the product flow, there is a flow of money as well as an exchange of further objects such as information about orders and tasks, and social values, which are important because of the interaction and relationship of customers and suppliers.[14]

For Chopra and Meindl, a supply chain comprises all parties that are working together directly or indirectly to fulfil the requests of customers. This means that a supply chain consists of manufacturers and suppliers as well as transporters, warehouses, retailers, and the customers. The main goal of each supply chain is to maximize the value that results from the worth of the finished product compared to the costs occurring in the supply chain when fulfilling the customers' requirements.[15]

Sadler describes a supply chain as a group of companies that source, produce, and deliver goods or services together for the customers. According to Sadler, a supply chain consists of four main parts: first, the focal company that produces the goods or services, the suppliers providing raw materials or components, and the distributers delivering the goods to the end customers. The final part are all modes of transport that are responsible for the movement of products between each location in the supply chain. For companies to survive and to be competitive, it is important that they think of the overall flow of materials and goods alongside the supply chains and therefore, the flow of information that goes through all parties of the supply chain must be always considered. Exchanging information regarding consumer needs is of significance, even if companies are some stages before the final product or service in the supply chain.[16] The parties involved within the supply chain can therefore not be

[14] Quayle, M. R. (2006), p.7.
[15] Chopra, S.; Meindl, P. (2007), p.3ff.
[16] Sadler, I. (2007), p.1f.

viewed as disconnected parts but are related to the entire process of adding value, which contains delivery, production, sales as well as disposal or recycling. This means that supply chains no longer can afford to view these areas separately. The optimisation potential is found at the process linkage located within the company itself and across the entire group of companies that form the supply chain.[17]

For most products, the principal company, suppliers and distributors are in different countries or continents, which requires an international supply chain. In this regard, the location either of the manufacturer, distributors or supplier is found in another country or continent making the dimension a global supply chain. International supply chains are marked by added complexity, these including the areas of language, culture, nationality, currency transactions or distance, which affects the exchange of information as well as the transport processes. Furthermore, factors like uncertainty arising due to extended lead times, the lack of possible risk assessment and fluctuating local markets conditions make global supply chains more complicated. Local government interventions can cause customs and trade barriers.[18]

## 2.1 Logistics and Supply Chain Management

The term Logistics can be traced back to the military industry. For the expansion of Rome, it was essential to transport troops and replenishments from one place to another. Logistics in the modern sense refers to the movement process of material and information inside and outside of a company, which occur before, during and after the production of goods. The goal of logistics is to provide the right product at the right time at the right place in the right quantity in the right quality and for the right place.[19] Logistic processes therefore include all activities that have to do with transport or storage, which also includes loading and unloading, the handling and the picking of logistic objects, which are mainly materials and products in industrial companies but also people and information.[20]

According to Smith, logistics deals with the organization, coordination, and control of the flow of goods in a supply chain. As shown in Figure 1, supply chains can be divided into an inbound and an outbound logistics. Inbound logistics handles the control and organization of product movement in the incoming supply chain. Outbound logistics deals with the responsibility of coordinating and organizing the flow of goods in the

[17] Werner, H. (2020), p.5f.
[18] Sadler, I. (2007), p.99f.
[19] Zsifkovits, H. E. (2013), p.23f.
[20] Arnold, D. et al. (2008), p.3.

outgoing supply chain. An outbound logistics is also called a product distribution system as it defines the flow of goods from the manufacturing company to the end customer.[21]

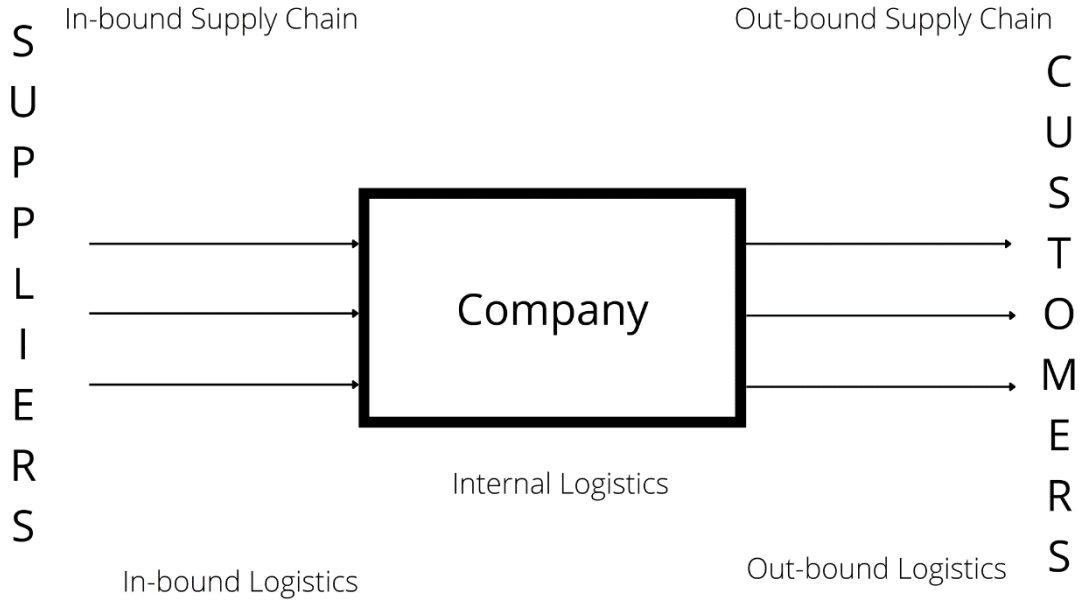


**Figure 1: Representation of a possible Supply Chain with Inbound and Outbound Sector[22]**

The definition of inbound logistics by Sadler is that it contains "all activities of supply and transport to bring materials into a manufacturing company".[23] Smith states that inbound logistics includes procurement, whereby internal logistics, which is also referred to as inhouse logistics, handling the flow of goods in the company itself.[24] Blanchard's definition of inbound logistics comprises of all activities related to receiving, storing and collecting inputs for the product. On the one hand, this includes material handling, warehousing, inventory control and all transportation as well as the returns to the suppliers.[25]

In the 1980s the activities of transport, distribution and materials management merged into one universal term: supply chain management. The term came up in print in 1982 for the first time by Keith Oliver, who was a consultant with the company Booz Allen. Furthermore, Michael Porter, a Harvard professor, shaped the term in his book, Competitive Advantages. This book advises companies to strategically analyse their

[21] Smith, J. M. (2002), p.3f.
[22] Smith, J. M. (2002), p.3f.
[23] Sadler, I. (2007), p.247.
[24] Smith, J. M. (2002), p.3.
[25] Blanchard, D. (2010), p.7.

five primary processes to become more profitable. The five key processes are inbound logistics, operations, outbound logistics, sales and marketing and service. On these activities, the commonly known supply chain framework is constructed.[26]

Although supply chain management uses the term supply, it is not focusing on the supply area only.[27] According to Werner supply chain management is taking material, information and financial flows into consideration and it begins with the source of supply going to the point of consumption.[28] However, not the flows of a single chain are being considered but the flows within a network that results from many customer orders being processed at the same time.[29]

Arnolds describes supply chain management as a network of suppliers and customers that surround a focal company. To be precise, this means that upstream from the focal company is a network of suppliers and downstream a network of customers, as shown in Figure 2 below. All the material and information flows in between these parties must be managed as a unit, which creates interface and coordination problems but on the other side offers the opportunity of gained profit for the whole company chain.[30]

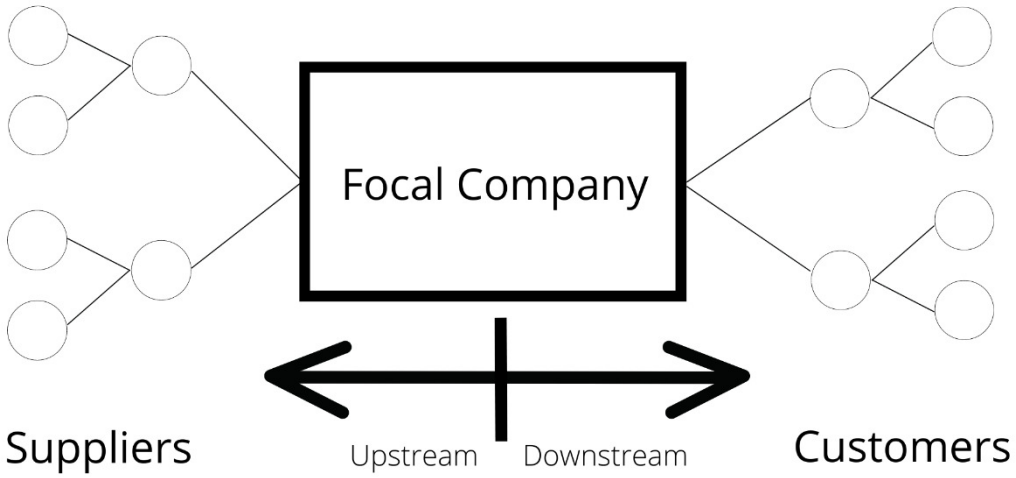


**Figure 2: Example of a Supply Chain Network where a Supplier Network and Customers surround a Focal Company[31]**

## 2.2 Maritime Transport and Supply Chains

In a maritime supply chain, cargo is being moved from one location to another and all related support is handled, using land as well as sea transportation. It can thus be

[26] Blanchard, D. (2010), p.7f.
[27] Arnolds, H. et al. (2013), p.4.
[28] Werner, H. (2020), p.6.
[29] Stadtler, H.; Kilger, C. (2005), p.9.
[30] Arnolds, H. et al. (2013), p.4.
[31] Arnolds, H. et al. (2013), p.5.

said that the maritime supply chain encompasses the entire shipping industry and that it is a global logistics system. Here different systems, such as port terminal operators and land-based logistics systems, are interconnected. Maritime supply chains need to be strategically planned, monitored and - if necessary - rerouted, as delays or disruptions can easily occur due to bad weather or oversaturated ports. The system of global shipping has existed for hundreds of years, however, the maritime supply chain in today's world is more dynamic and complex as it needs to constantly grow and evolve to adapt to new technologies, consumer preferences or global trade patterns.[32]

### 2.2.1 The Significance of Transport in Global Supply Chains

As previously mentioned, transport plays an important role, especially in global supply chains. This is because products are seldom used in the place where they were manufactured. Transport in general means that products are being moved from one location to another.[33] Sadler describes transport as "the geographical movement of materials or goods between two partners, or to a customer".[34] Through transport connections between regions, people and economic activities in the world are being established and therefore value is generated.[35] The success of the supply chain depends on optimized transportation usage as transport expenses are a main consideration when calculating the supply chain cost. International trade is increasingly relevant; therefore, it is necessary to have well-planned transportation facilitating centralize inventories so that fewer facility locations are needed.[36] Transportation influences the efficiency of a supply chain as well as the responsiveness, which can both play a significant role in a company's competitive strategy.[37]

### 2.2.2 International Maritime Trade and Transport

For Rodrigue „international trade is an exchange of goods or services across national jurisdictions".[38] As most nations are not self–sufficient in today's global economy, each country engages in trade at different levels. Countries export their goods and acquire or import what they need. International trade, or as previously was called long-

[32] N.N., https://sinay.ai/en/what-is-the-maritime-supply-chain/ (Retrieved: 11.04.2022)
[33] Chopra, S.; Meindl, P. (2007), p.385.
[34] Sadler, I. (2007), p.253.
[35] Rodrigue, J.-P. (2020), p.8.
[36] Chopra, S.; Meindl, P. (2007), p.385f.
[37] Chopra, S.; Meindl, P. (2007), p.53f.
[38] Rodrigue, J.-P. (2020), p.253.

distance trade, has existed for centuries. The Silk Road is an ideal example of historical international trade existing for over 600 years. International trade today has an even more important role in global economics. Transactions take place when there is a benefit for the involved partners. Trade can be regarded as advantageous providing a greater choice of affordable goods. In some cases, it is a necessity due to unequal regional distribution and shortages of essential products such as energy, minerals or food. Globalization, production and trade prove interdependent as they rely on each other to effectively function. Without maritime shipping, globalization could not have taken place on this scale. International trade depicts the extent of globalization on consumer trends providing the advantage of accessible, affordable products. It has to be considered that this development has been enabled by technical changes in the transport sector, as it has become easier to trade between regions of the world that previously had limited access to international transport systems. The scale, volume and efficiency of international trade has been increasing steadily since the 1970s.[39]

The growing importance of international trade and transport can be underlined when examining the global maritime trade volume, which has more than doubled from 1990 to 2020. As can be seen below in Figure 3, the volume of maritime trade in 1990 was estimated at about 4 billion tons. Compared to this, the volume of goods loaded in ports around the world in 2019 reached 11 billion tons.[40] The decline in 2020 can be explained by the COVID-19 pandemic due to the disrupted global maritime transport.[41] Comparing those volumes with air cargo traffic in 2020 with 62,4 million metric tons before the pandemic highlights the significance of global sea freight and the vast quantities of produce being transported over the ocean annually.[42]

[39] Rodrigue, J.-P. (2020), p.171, p.253f, p.255.
[40] N.N., https://www.statista.com/statistics/264117/tonnage-of-worldwide-maritime-trade-since-1990/ (Retrieved: 11.04.2022)
[41] LOGISTICS, D. O. T. AND. U. N. C. O. T. A. D. (2022).
[42] N.N., https://www.statista.com/statistics/564668/worldwide-air-cargo-traffic/ (Retrieved: 13.04.2022)

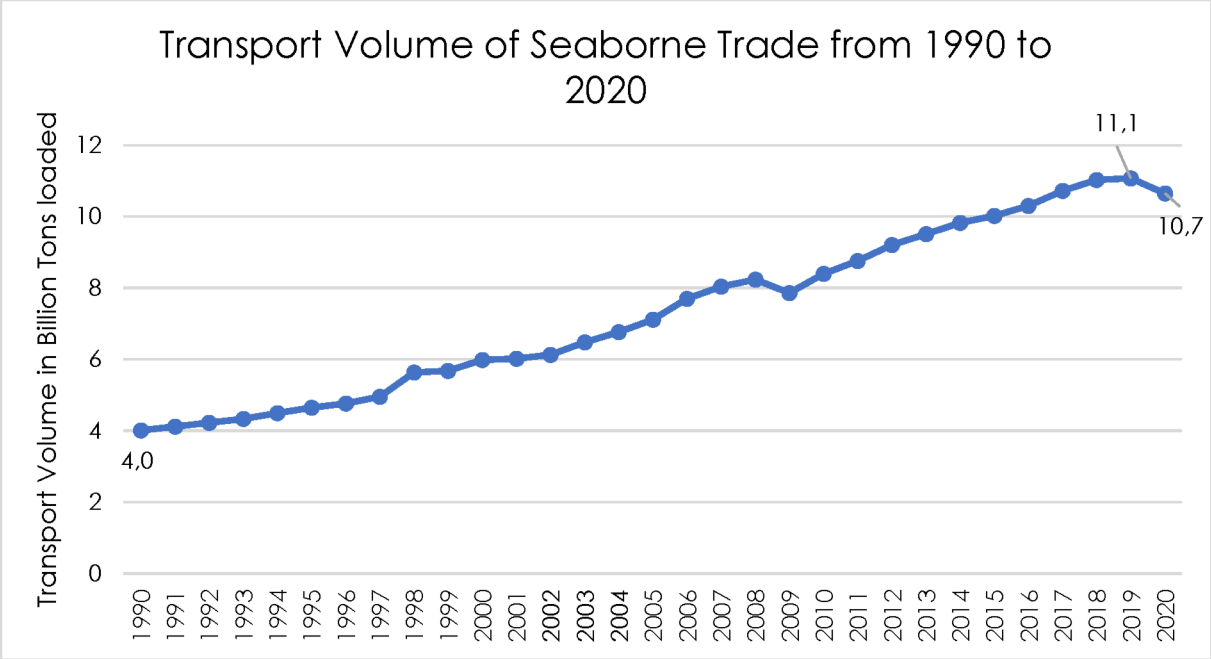


**Figure 3: Transport Volume in Billion Tons loaded from 1990 to 2020.[43]**

As shown in Figure 3, the volume of international seaborne trade increased continuously in the last decades, from 4 billion tons loaded in 1990 to over 10 billion tons loaded in 2020. Cargoes carried out via sea transport are divided into different categories based on the specialized ships they require. General cargo is handled in defined load units. The other category is bulk cargo which is carried loose and in any quantity. The sub-areas of the two main cargo categories, general cargo and bulk cargo, can be seen in Figure 4.

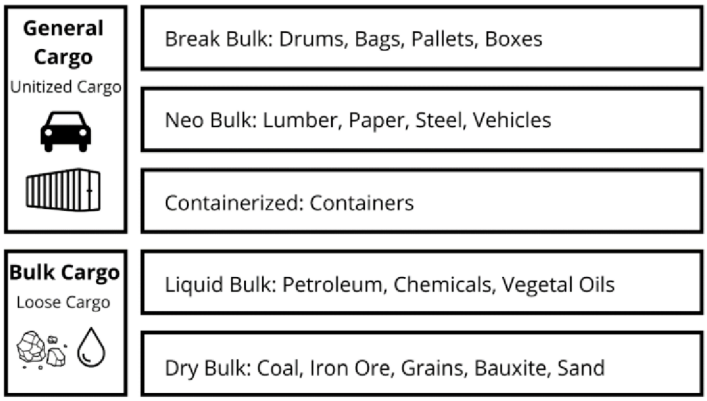


**Figure 4: The Types of Maritime Cargo[44]**

[43] N.N., https://www.statista.com/statistics/264117/tonnage-of-worldwide-maritime-trade-since-1990/ (Retrieved: 11.04.2022)

[44] N.N., https://transportgeography.org/contents/chapter5/maritime-transportation/types-maritime-cargo/ (Retrieved: 19.08.2022)

Cargo types experiencing the most growth are container trade and dry bulk trade, as can be seen in Figure 5.[45] Dry bulk refers to the transport of iron ore, grain and coal while tanker trade (liquid bulk) refers to the transport of crude oil, refined petroleum products, gas, vegetal oils and chemicals.[46] In Figure 5, the cargo-type volumes worldwide are shown:

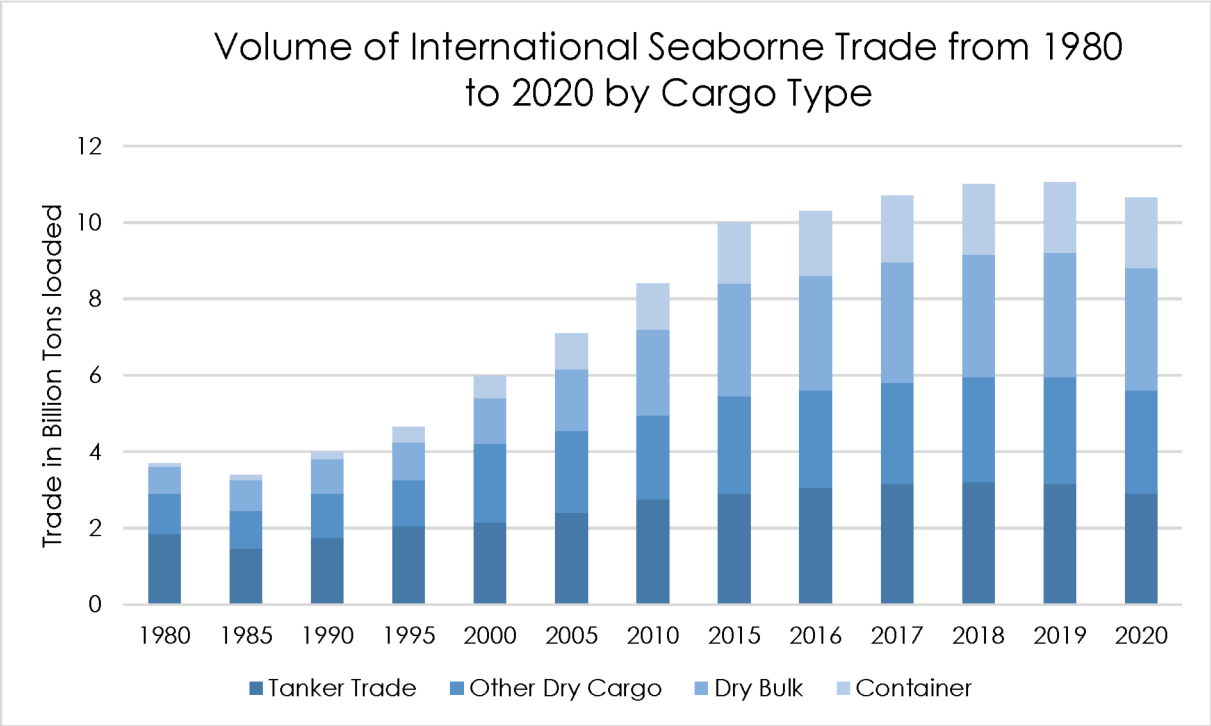


**Figure 5: Volume of International Seaborne Trade from 1980 to 2020, by Cargo Type in Billion Tons Loaded[47]**

## 2.2.3 Containerization

Rodrigue states that containerization "refers to the increasing and generalized use of the containers as a load unit for freight transportation".[48] Before containerization, the loading and unloading process of break–bulk cargo was time and labour intensive, which caused economies of scale to be unattainable. It should be considered that due to recent development, the distinction between bulk and general cargo is blurring as both can be shipped on pallets or containers. For example, it is becoming increasingly common for grain and oil, which both belong to the group of bulk cargo, to be transported in containers. As a result, the amount of containerized goods has

[45] N.N., https://www.statista.com/statistics/1277810/international-seaborne-trade-breakdown-by-cargo/ (Retrieved: 12.04.2022)
[46] UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT (2021), p.4.
[47] N.N., https://www.statista.com/statistics/1277810/international-seaborne-trade-breakdown-by-cargo/ (Retrieved: 12.04.2022)
[48] Rodrigue, J.-P. (2020), p.200.

grown significantly.[49] According to Rodrigue, a container is "a large standard–size metal box into which cargo is packed for shipment aboard specially configured transport modes".[50] It would be inefficient if containers in each country had different sizes, therefore, the International Standards Organization (ISO) made recommendations for standard containers dimensions. They have a rectangular shape, are weatherproof and are handled as unit loads. The advantages in using the standard containers are that they are transhipped without the need for loading and unloading their content. Thus, the content is protected from loss and damage and the containers can be parted from the means of transport.[51]

Since 1968, a standard measurement method for the volume of a container has been used: 20-foot equivalent unit (TEU). Two TEUs therefore represent a 40-foot container and one TEU a 20-foot container.[52] Through the development of the standard container as a unit, the freight transport industry was fundamentally changed as a new transportation system around the container developed. Therefore, containerization is directly related to globalization, economies of scale can be achieved, and the handling speed and throughput has significantly improved.[53]

### 2.2.4 Key Players in the Ocean Transport Process

Initially, the party that requests for goods to be moved is called the shipper. Shippers act as buyers of transportation services because of their need to move goods from one place to another, as in the case for manufacturers or retailers. On the other side of the service process, the carriers are positioned as the sellers of the service, and they are transporting the goods. An example for a carrier is a shipping line offering transportation and shipping containers from one terminal to another.[54,55] Rodrigue's definition is that the shipper is "the company sending goods" and the carrier "the company moving passengers or freight".[56]

Freight forwarders can be involved in maritime supply chains and their task is to organize the shipment of the goods.[57] Rodrigue maintains that a freight forwarder or

[49] Rodrigue, J.-P. (2020), p.175, p.200.
[50] Rodrigue, J.-P. (2020), p.200.
[51] Quayle, M. R. (2006), p.276.
[52] Levinson, M. (2016), p.286.
[53] Rodrigue, J.-P. (2020), p.201.
[54] Chopra, S.; Meindl, P. (2007), p.386.
[55] Lee, C.-Y.; Meng, Q. (2015), p.399.
[56] Rodrigue, J.-P. (2020), p.423, p.446.
[57] N.N., https://sinay.ai/en/what-is-the-maritime-supply-chain/ (Retrieved: 11.04.2022)

forwarding agent is an "intermediary who arranges for the carriage of goods and/or associated services on behalf of the shipper".[58] Freight forwarders provide for example the service of planning the route, arranging payment, document preparation for customs clearance in the country of origin and in the country of destination, insurance requirements and the bills of lading.[59] The ocean bill of lading is "a receipt for the cargo and a contract for transportation between a shipper and the ocean carrier".[60]

Third–party logistics providers, 3PLs, in international trade are specialised multinational corporations that provide door–to–door logistics services due to a trend towards combining intermediate functions such as grouping, storing and handling freight as well as completing the paperwork and financial and legal transactions.[61] A 3PL is "an asset–based company offering logistics and supply chain management services to its customers (manufacturers and retailers). It commonly owns distribution centres and transport modes".[62] Services a 3PL offers are displayed in Table 1.

[58] Rodrigue, J.-P. (2020), p.431.
[59] Lee, C.-Y.; Meng, Q. (2015), p.487.
[60] Rodrigue, J.-P. (2020), p.441.
[61] Rodrigue, J.-P. (2020), p.115.
[62] Rodrigue, J.-P. (2020), p.449.

**Table 1: Services of Third–Party Logistics Providers[63]**

| Service Category | Basic Service | Some Specific Value–Added Services |
|---|---|---|
| **Transportation** | Inbound, Outbound by Ship, Truck, Rail, Air | Tendering, Track/Trace, Mode Conversion, Dispatch, Freight Pay, Contract Management |
| **Warehousing** | Storage, Facilities Management | Cross-docking, in–transit Merge, Pool Distribution across Firms, Pick/Pack, Kitting, Inventory Control, Labelling, Order Fulfilment, Home Delivery of Catalogue Orders |
| **Information Technology** | Provide and maintain advanced Information / Computer Systems | Transportation Management Systems, Warehousing Management, Network Modelling and Site Selection, Freight Bill Payment, automated Broker Interfaces, end– to-end Matching, Forecasting, EDI, Worldwide Track and Trace, global Visibility |
| **Reverse Logistics** | Handle reverse Flows | Recycling, used–asset Disposition, customer return, returnable container management, repair/refurbish |
| **Other 3PL Services** | | Brokering, Freight Forwarding, Purchase–Order Management, Order Taking, Loss and Damage Claims, Freight Bill Audits, Consulting, time–definite Delivery |
| **International** | | Customs Brokering, Port Services, Export Crating, Consolidation |
| **Special Skills/Handling** | | Hazardous Materials, Temperature Control, Package/Parcel Delivery, Food–Grade Facilities/Equipment, Bulk |

Since the globalization of supply chains, customers prefer logistics providers who deal with all aspects of their supply chain. Due to this, there is a new group of providers, fourth-party logistics providers, 4PLs. They offer additional services such as production planning or real–time monitoring as they are not targeting single functions but the entire process.[64,65] For Rodrigues, fourth–party logistics "integrates the resources of

[63] Chopra, S.; Meindl, P. (2007), p.426.
[64] Rodrigue, J.-P. (2020), p.277.
[65] Chopra, S.; Meindl, P. (2007), p.427.

producers, retailers and third–party logistics providers with perspective on establishing a widespread improvement in supply chain management".[66] The key feature is that they are non–asset–based, which means that the expertise they provide is organizational.[67]

A general representation of a trade transaction is illustrated in Figure 6, where the seller is a manufacturer sending the goods, termed a consignor, and the receiver or buyer party is a company running a warehouse, termed the consignee. Once the shipper and carrier have divided responsibilities, the freight forwarding company is being instructed by the shipper to make all necessary arrangements to organize the freight shipment, including the hinterland transport as seen in the Figure 6.[68]

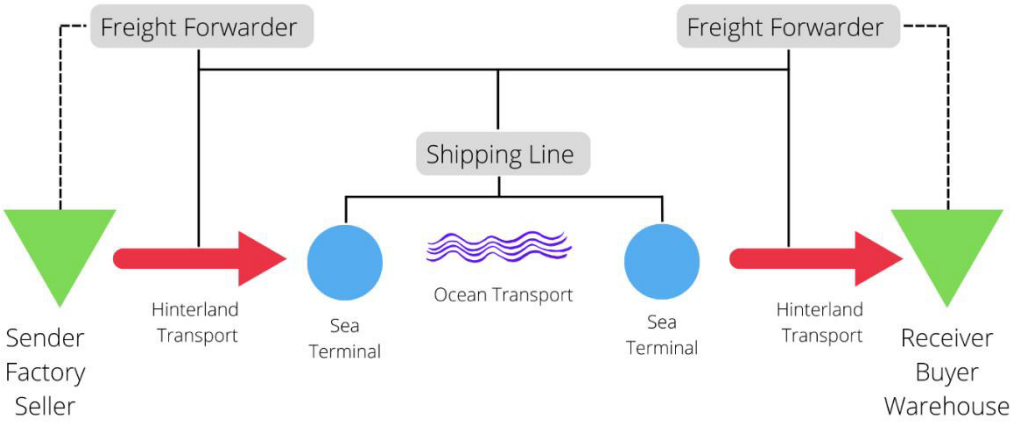


**Figure 6: The Process of an Intercontinental Container Shipment[69]**

Rodrigue describes hinterland as the "land space over which a transport terminal, such as a port, sells its services and interacts with its clients".[70] Hinterland therefore represents the entire area that is being served from the terminal meaning that hinterland transport is the transportation to and from the sea terminal. The means of transport being used are for example barges, trains, or trucks.[71,72] With the growth of intercontinental maritime transport, the container traffic in hinterland has been growing too and trucks and trains have been adapted to handle the transport of containers to and from sea terminal.[73]

[66] Rodrigue, J.-P. (2020), p.431.
[67] Rodrigue, J.-P. (2020), p.431.
[68] Lee, C.-Y.; Meng, Q. (2015), p.431ff.
[69] Lee, C.-Y.; Meng, Q. (2015), p.432, 498.
[70] Rodrigue, J.-P. (2020), p.434.
[71] Lee, C.-Y.; Meng, Q. (2015), p.497.
[72] Rodrigue, J.-P. (2020), p.217.
[73] Lee, C.-Y.; Meng, Q. (2015), p.497f,

As freight is not travelling individually but in batches, terminals are needed as well. Rodrigue argues that a terminal is "any location where freight and passengers either originate, terminate or are handled in the transport process".[74] Transport terminals therefore have three main functions: initially, they offer connectivity within a transport network because it can only be entered or exited through the terminals. Secondly, terminals are interlinked using different modes of transport. A port for example is the area where the transition from ocean transport to land transport occurs. And finally, in case of different capacities and frequencies between transport modes, the terminals provide a transport buffer in forms of extra storage.[75]

## 2.3 Market Overview

Having introduced the various shipment processes, the involved parties and their specific tasks, the following chapter is to provide a general market overview introducing the most significant international trade routes and companies that dominate today's maritime trade. Furthermore, the throughputs of the busiest ports worldwide in 2021 are compared with European ports.

### 2.3.1 Crucial Shipping Routes

One of the main aspects influencing ocean shipping processes are the trade routes. They decide the conditions and time required to traverse from one location to another. The shipping cost depends largely on the chosen route.[76] There are three main transport routes when looking at maritime shipping: Far East (connecting Europe and East Asia), Transpacific (connecting North America and East Asia) and Transatlantic (connecting Europe and North America).[77]

### 2.3.2 The Largest Carriers

With a market share of 17%, the Swiss group Mediterranean Shipping Company, MSC, is the most important container carrier worldwide by February 2022, followed by the Danish company Maersk with 16,9% and the French CMA CGM with 12,7%. The most successful German shipping company is Hapag-Lloyd, with a market share of nearly

[74] Rodrigue, J.-P. (2020), p.208.
[75] Rodrigue, J.-P. (2020), p.210.
[76] Biest, A. van der, https://cargofive.com/main-shipping-trade-routes-across-the-world/ (Retrieved: 23.06.2022)
[77] Schröder, T. (2010), p.172f.

7%.[78] The 10 largest container carriers listed worldwide by market share are shown in Figure 7.

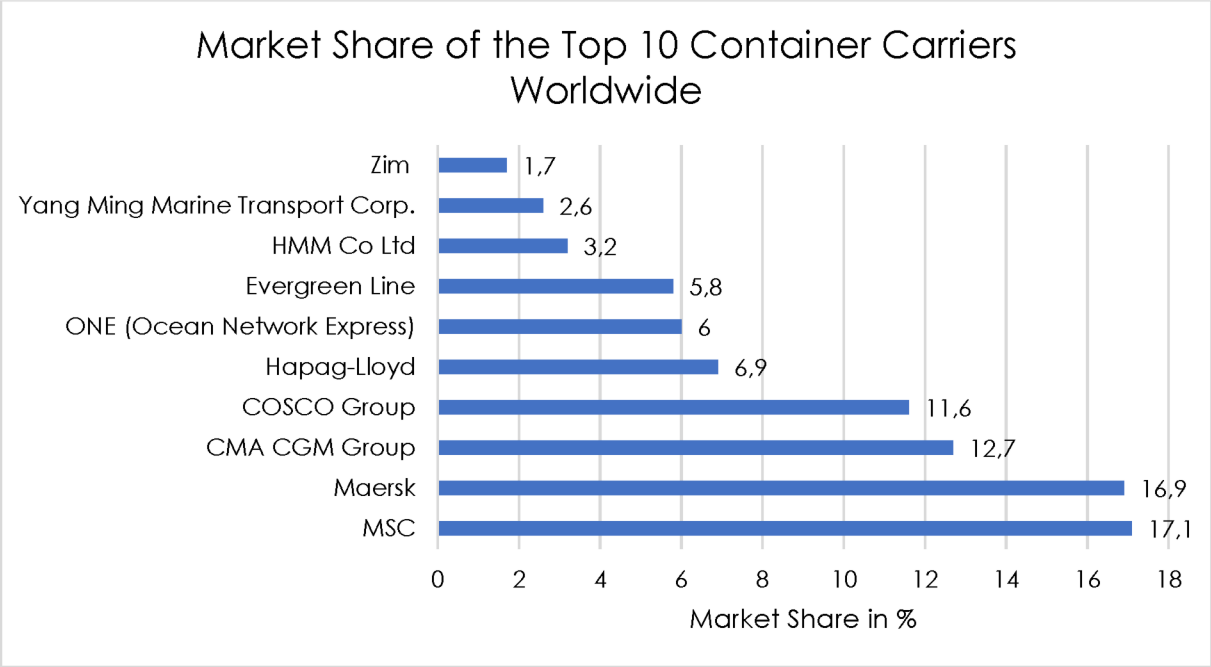


**Figure 7: Market Share of the Top 10 Container Carriers Worldwide[79]**

## 2.3.3 Container Carrier Alliances

Clearly seen, there are a few large carriers dominating the container shipping industry, these are affiliated in three alliances. Container Alliances are groups of container carriers, where the members of the group operate together and offer joint services. Container carriers have always had collaborations with each other for example through slot agreements, however, the relationship of these alliances goes deeper and is more structured.[80] The three global alliances are: 2M, Ocean Alliance and THE Alliance. Carries being part of these three alliances can be seen in Table 2.

[78] N.N., https://de.statista.com/statistik/daten/studie/223205/umfrage/marktanteile-von-container-reedereien/ (Retrieved: 11.04.2022)
[79] N.N., https://de.statista.com/statistik/daten/studie/223205/umfrage/marktanteile-von-container-reedereien/ (Retrieved: 11.04.2022)
[80] N.N., https://www.marineinsight.com/maritime-law/what-are-container-carrier-alliances/ (Retrieved: 06.04.2022)

**Table 2: The three global Alliances in the Container Shipping Industry[81]**

| Alliance | Carriers |
|---|---|
| **2M** | Maersk |
| | MSC |
| **Ocean Alliance** | COSCO |
| | CMA CGM |
| | Evergreen |
| **THE Alliance** | Hapag Lloyd |
| | ONE (Merger of Japanese Carriers NYK, MOL and K-Line) |
| | Yang Ming |
| | HMM |

The capacity shares of the largest shipping alliances per shipping routes are displayed in Figure 8.

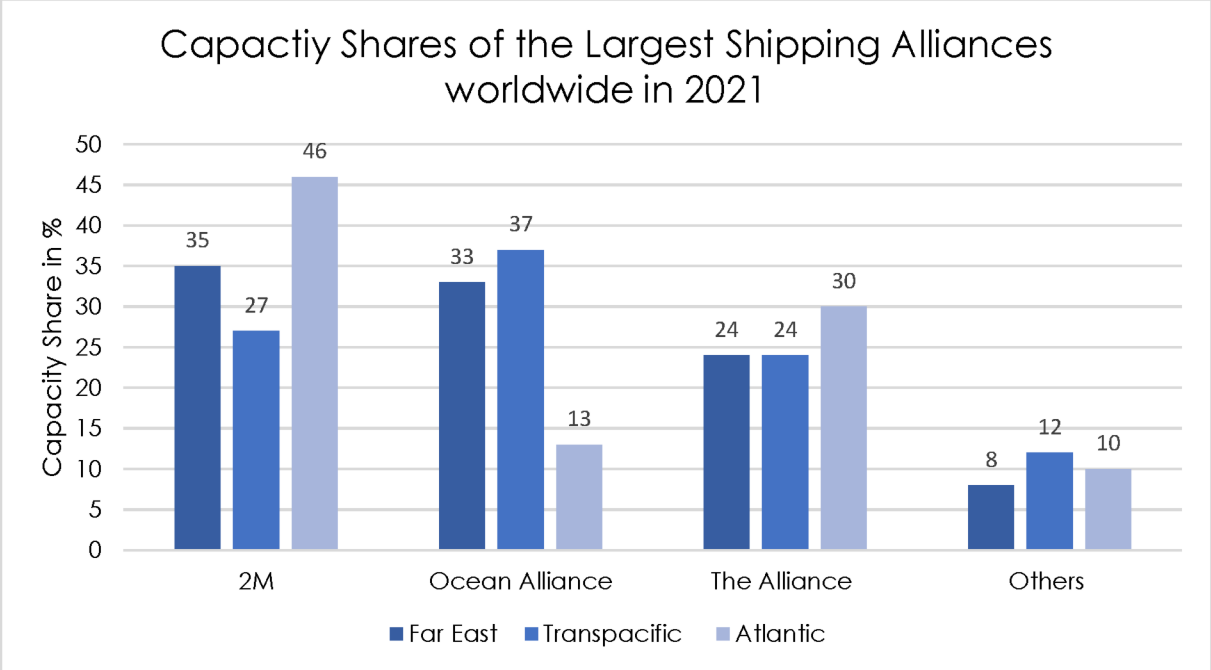


**Figure 8: The Capacity Shares of the Largest Shipping Alliances per Shipping Routes in 2021.[82]**

## 2.3.4 The Largest Container Ports

A list representing the busiest container ports worldwide is provided in Figure 9. The throughput of a container port is defined as the total volume of cargo handled. The

[81] Source: Own Representation Based on: N.N., https://www.marineinsight.com/maritime-law/what-are-container-carrier-alliances/ (Retrieved: 06.04.2022)
[82] N.N., https://de.statista.com/statistik/daten/studie/693205/umfrage/kapazitaetsanteile-der-groessten-schifffahrts-allianzen-weltweit-nach-fahrtgebieten/ (Retrieved: 11.04.2022)

port of Shanghai was the largest container port in 2021, handling capacities of 47 million TEUs. Nine out of the 10 busiest container ports worldwide in 2021 were situated in Asia and only one in North America.[83]

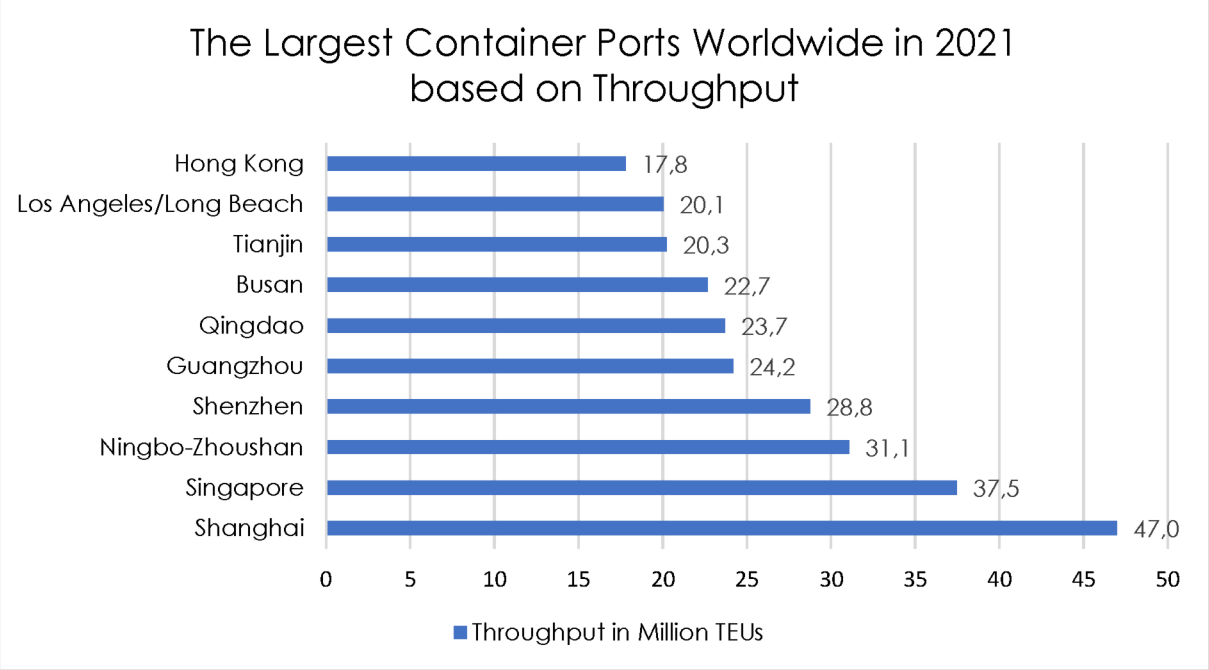


**Figure 9: The Largest Container Ports Worldwide in 2021 based on Throughput in Million TEUs[84]**

When looking at the busiest container ports in Europe, the port with the largest quantity of container handling in Europe is Rotterdam. In 2021, about 15,3 Million TEU have been handled there. The port's success is due to its geographic location on the North Sea and at the mouth of the Rhine. It can also be navigated by ships with a draft of 24 metres.[85] In Table 3, the top five container handling ports in Europe in 2021 are listed, ordered by their TEU handling volume in 2021.

**Table 3: The Top Five Ports in Europe in 2021[86]**

| Ranking | Port | Volume in Mio TEU |
|---|---|---|
| **1** | Rotterdam ((Netherlands) | 15,3 |
| **2** | Antwerp (Belgium) | 12 |
| **3** | Hamburg (Germany) | 8,7 |
| **4** | Valencia (Spain) | 5,6 |
| **5** | Piraeus (Greece) | 5,3 |

[83] N.N., https://www.statista.com/statistics/264171/turnover-volume-of-the-largest-container-ports-worldwide/ (Retrieved: 20.06.2022)
[84] N.N., https://www.statista.com/statistics/264171/turnover-volume-of-the-largest-container-ports-worldwide/ (Retrieved: 20.06.2022)
[85] N.N., https://de.statista.com/statistik/daten/studie/255147/umfrage/haefen-in-europa-nach-containerumschlag/ (Retrieved: 11.04.2022)
[86] Source: Own Representation Based on: N.N., https://www.porttechnology.org/news/top-5-ports-in-europe-2021/ (Retrieved: 06.04.2022)

## 2.4 Maritime Supply Chain Risks and Disruptions

Sea transport is regarded to be worldwide the most significant form of transport, having a direct impact on global revenues. However, the maritime supply chains remain vulnerable due to their complexity. The uncertainty is caused by external environmental factors as well as interpersonal elements. Various risks could occur in maritime supply chains, resulting in serious damage or disruptions of the entire supply chain, leading to subsequent losses. In a study undertaken with logistics experts, risks in maritime supply chains were analysed and grouped into four clusters: "external risk", "cooperation risk", "logistics service risk", and "information risk". Each one of the four risk types is described in Table 4.[87]

[87] Jiang, H. et al. (2017), p.29ff.

**Table 4: Risks in Maritime Supply Chains[88]**

| Risk type | Including Risks | Description and Examples |
|---|---|---|
| External Risk | Natural Environment Risk | Natural Disasters like Earthquake, Tsunami and bad Weather like Storm, Flood, Typhoon |
| | Macroeconomic Risk | Interest Rate Change, Exchange Rate Fluctuation, Economic Crisis, Inflation, Stock Market Risk |
| | Social Instability Factors | War Risks and Social Order Risks such as Strikes, Pirates, Terrorist Attacks or Demonstrations |
| | Policy Risk | Legal Risks and Government Intervention Risks like Tax Laws and Regulations or Financial Regulations |
| | Uncertainty in Market Demands | Downstream Customer Demand Reduction or Interruption Risk, e.g., because of the high Price of the Products or Materials, Expansion of Highway and Railway, Development of the Aviation Industry |
| Cooperation Risk | Interest Distribution Risk | Decline in Partnership Working Enthusiasm |
| | Cooperation Mechanism | Integration of internal and external Supply Chain brings Opportunities to improve the operational Performance as well as the competitive Ability but if the Cooperation is unreasonable, it will affect the Performance |
| | Information Asymmetry | In Production and Distribution, the rapid and accurate Transmission of Information is of great Importance and if there are Problems it will affect the Performance |
| Logistics Service Risk | Personnel Operational Risk | Unskilled Staff, Work is not Enthusiasm, Personnel Mobility |
| | Facility and Equipment Maintenance | Failure in Maintenance of Infrastructure and Equipment |
| | Loss or Damage of Goods | Cargo Loss, common Species are damaged, wet, dirty, rotten and the Number of Average Weight Shortage |
| | Delay in Delivery | Time Delay in Logistics Operation can lead to Failure of whole Logistics Project |
| Information Risk | Speed of Information Transmission, Information Authenticity and Sharing | The Information transmission between different points in the Supply Chain is carried out through Information Systems: Speed of Information Transmission, Information Authenticity and Sharing influence Decisions crucial for the whole Supply Chain |
| | IT System Failure | Problems in Stability of the IT System because of e.g., Hacker or Virus Attacks on the System |

[88] Jiang, H. et al. (2017), p.30f.

Possible measures to prevent and minimize risks in maritime supply chains are to focus on upgraded forecasting systems. Technology improves the possible prediction of natural disasters and service providers need to define alternatives routes thus reducing the loss in cases of natural disasters. Tariffs and trade barriers should be lowered facilitating stability in the global economy. The development of IT technology provides an information system promoting its integration between the supply chain parties.[89] The following examples show how digitalization can be used to minimize risks in maritime supply chains:

### 2.4.1 Seaexplorer Disruption Indicator

The Kuehne and Nagel Seaexplorer Disruption Indicator is an effective tool used by shipping industries to identify supply chain bottlenecks, weather alerts, accurate transit time estimates etc. This knowledge enables strategic transport planning as the indicator shows cumulative waiting times for vessels entering the following nine ports: Prince Rupert, Vancouver/Seattle, Oakland, Los Angeles/Long Beach, New York, Savannah, Hong Kong, Shanghai/Ningbo, Rotterdam/Antwerp. The example demonstrates how the daily total TEU waiting time is composed: a vessel with a capacity of 10.000 TEU waits 12 days to enter a port, which equals 120.000 TEU waiting days. If another vessel with 5.000 TEU waits 10 days to enter the same port, this equals 50.000 TEU waiting days. In summary, the total value is 170.000 TEU waiting days.[90]

### 2.4.2 Flex Pulse

The Flex Pulse is a cloud-based software platform devoted to coordinating every sector of a supply chain from manufacture to delivery. Flex Pulse offers transparency by screening, selecting and displaying relevant data to optimize visibility while increasing the speed, lowering costs and improving the efficiency for the customers of a supply chain. This allows the contract manufacturer Flex to adapt to changes in supply and demand thus taking action and to weakening possible risks.[91]

The most relevant disruptions that have recently occurred, beginning with the Corona pandemic in 2020 are listed in chronological order in Table 5. For each event the risk type from Table 4 has been selected and the timeframe, the location as well as a short

[89] Jiang, H. et al. (2017), p.32.
[90] N.N., https://www.verkehrsrundschau.de/nachrichten/transport-logistik/k-n-stellt-neuen-indikator-fuer-stoerungen-in-der-seefracht-vor-3119692 (Retrieved: 01.05.2022)
[91] N.N., https://www.scmr.com/article/flex_pulse_takes_on_the_supply_chain_and_wins (Retrieved: 21.06.2022)

description is provided. Additionally, the disruptions are represented in a timeline in Figure 10.

All the shown events expose weaknesses in the supply chains demonstrating the need for diversification of supply chains as well as improved perception of bottlenecks and nodes in supply chains.[92]

[92] N.N., https://www.agcs.allianz.com/news-and-insights/expert-risk-articles/shipping-safety-21-supply-chain.html (Retrieved: 02.05.2022)

**Table 5: Supply Chain Disruptions listed chronologically since the Beginning of the Coronavirus**

| Type of Disruption | Title | Timeframe | Location | Short Description (Source) |
|---|---|---|---|---|
| External Risk: Natural Environment Risk | Coronavirus outbreak | February 2020 | China | Port Workers under Quarantine caused reduced Terminal Capacities in some Chinese ports[93] |
| External Risk: Natural Environment Risk | Coronavirus officially declared as a Pandemic | March 2020 | Worldwide | WHO declares the Coronavirus as a Pandemic, Demand for Masks and personal Protective Equipment from Asia surges around the World[94] |
| External Risk: Uncertainty in Market Demands | China reopens its Economy "Post – Covid", whereof the "Container Crisis" emerges | June 2020 | China | As China was the Epicentre of the Coronavirus Pandemic, it locked down first, but also reopened again first, causing a huge Demand in empty Containers being stuck at European and North American Ports, Inland Terminals, or Companies that are still locked down[95,96] |
| External Risk: Policy Risk | Australian Coal Ban | October 2020 | Australia | Australian Coal was unofficially banned for Import[97] |
| Logistics Service Risk: Facility and Equipment Maintenance | Fire in Asahi Kasi Semi-conductor Plant | October 2020 | Japan | A Fire in an Asahi Kasi Semiconductor Plant reduces Availability of Chips for Electronics[98] |
| External Risk: Policy Risk | End of Brexit Transition Period | January 2021 | UK | Brexit, and, connected, UK's Exit from EU's Customs Union, force long Border Waiting |

[93] Marketa, P. (2020)
[94] Cucinotta, D.; Vanelli, M. (2020)
[95] Dollar, D. (2020)
[96] N.N., https://www.hillebrand.com/media/publication/where-are-all-the-containers-the-global-shortage-explained (Retrieved: 07.07.2022)
[97] N.N., https://www.agcs.allianz.com/news-and-insights/expert-risk-articles/shipping-safety-21-supply-chain.html (Retrieved: 02.05.2022)
[98] N.N., https://www.theverge.com/2021/8/31/22648372/willy-shih-chip-shortage-tsmc-samsung-ps5-decoder-interview (Retrieved: 07.07.2022)

| | | | | |
|---|---|---|---|---|
| | | | | Times and Truck Queues at UK–France Border[99] |
| External Risk: Natural Environment Risk | Severe Winter Storms in Texas | February 2021 | Texas | Icy Storms force Carriers to idle thousands of Trucks, which leads to Disruptions in the Food Supply Chain as well as NXP's and Samsung's Semiconductor Factory to shut down[100,101] |
| Logistics Service Risk: Facility and Equipment Maintenance | Fire in Renesas Electronics Semi-Conductor Plant | March 2021 | Japan | A Fire in a Renesas Electronics factory, a major Chip Supplier, adds to the Chip Shortage, especially in the Automotive Industry[102] |
| External Risk: Natural Environment Risk or/and Logistics Service Risk: Personnel Risk | Blocking of Suez Canal | March 2021 | Egypt | The Containership Ever Given blocked the Suez Canal and the Shipping Route was therefore totally closed for six days[103] |
| External Risk: Social Instability Factors | Piracy Attack Red Seaport Yanbu | April 2021 | Saudi Arabia | A Boat loaden with Explosives was found and it was thought to be targeting an Oil Tanker[104] |
| External Risk: Natural Environment Risk | Coronavirus Outbreak Port of Shenzhen | May 2021 | China | Covid Outbreak in Port of Shenzhen/Futian more than halves Port Capacity for Weeks[105] |
| External Risk: Natural Environment Risk | Severe Draught in Taiwan | May/June 2021 | Taiwan | A severe Draught and the therefore regulated Water Consumption in Hsinchu threatened to affect TSMC, a large Semiconductor Producer[106,107] |

[99] Triebe, B. (2021)
[100] N.N., https://www.supplychaindive.com/news/winter-storm-texas-food-grocery-heb-supply-chains-logistics/595354/ (Retrieved: 07.07.2022)
[101] N.N., https://www.theverge.com/2021/8/31/22648372/willy-shih-chip-shortage-tsmc-samsung-ps5-decoder-interview (Retrieved: 07.07.2022)
[102] Kelion, L. (2021)
[103] N.N., https://www.agcs.allianz.com/news-and-insights/expert-risk-articles/shipping-safety-21-supply-chain.html (Retrieved: 02.05.2022)
[104] N.N., https://www.agcs.allianz.com/news-and-insights/expert-risk-articles/shipping-safety-21-supply-chain.html (Retrieved: 02.05.2022)
[105] tagesschau.de, https://www.tagesschau.de/wirtschaft/weltwirtschaft/container-krise-101.html (Retrieved: 07.07.2022)
[106] N.N., https://www.reuters.com/world/asia-pacific/taiwan-lifts-toughest-water-curbs-rain-eases-drought-2021-06-06/ (Retrieved: 07.07.2022)
[107] N.N., https://fortune.com/2021/06/12/chip-shortage-taiwan-drought-tsmc-water-usage/ (Retrieved: 07.07.2022)

| | | | | |
|---|---|---|---|---|
| External Risk: Natural Environment Risk | Coronavirus Outbreak port of Yantian | June 2021 | China | Covid Outbreak in Port of Yantian leads to its partial Closing for three Weeks[108] |
| External Risk: Natural Environment Risk | Coronavirus Outbreak Port of Ningbo | August 2021 | China | Covid Outbreak in Port of Ningbo leads to its Closing, Cargo Terminal at Shanghai Airport also reduces Capacity[109,110] |
| External Risk: Natural Environment Risk | Hurricane Ida | August 2021 | US | Hurricane Ida forces ports and railway operators to shut down[111] |
| External Risk: Instability Factors | Russia's Invasion of Ukraine | February 2022 | Ukraine | Invasion as well as associated Sanctions affecting many Industries[112] |
| External Risk: Natural Environment Risk | Coronavirus Outbreak Port of Yantian | March 2022 | China | Covid Outbreak in Port of Yantian leads to Delays in landside Logistics, but Ports operate normally[113] |

[108] N.N., https://us.leman.com/news/largest-port-in-south-china-partly-closed/ (Retrieved: 07.07.2022)
[109] N.N., https://industriemagazin.at/artikel/chinas-industrietaetigkeit-stark-gedrueckt/ (Retrieved: 07.07.2022)
[110] N.N., https://industriemagazin.at/artikel/china-laesst-sorge-um-lieferengpaesse-wieder-wachsen/ (Retrieved: 07.07.2022)
[111] N.N., https://www.supplychaindive.com/news/hurricane-ida-supply-chain-freight-port-rail/605759/ (Retrieved: 07.07.2022)
[112] Simchi-Levi, D.; Haren, P. (2022)
[113] N.N., https://www.seatrade-maritime.com/ports-logistics/shenzhen-lockdown-ports-operational-warehouses-closed (Retrieved: 07.07.2022)

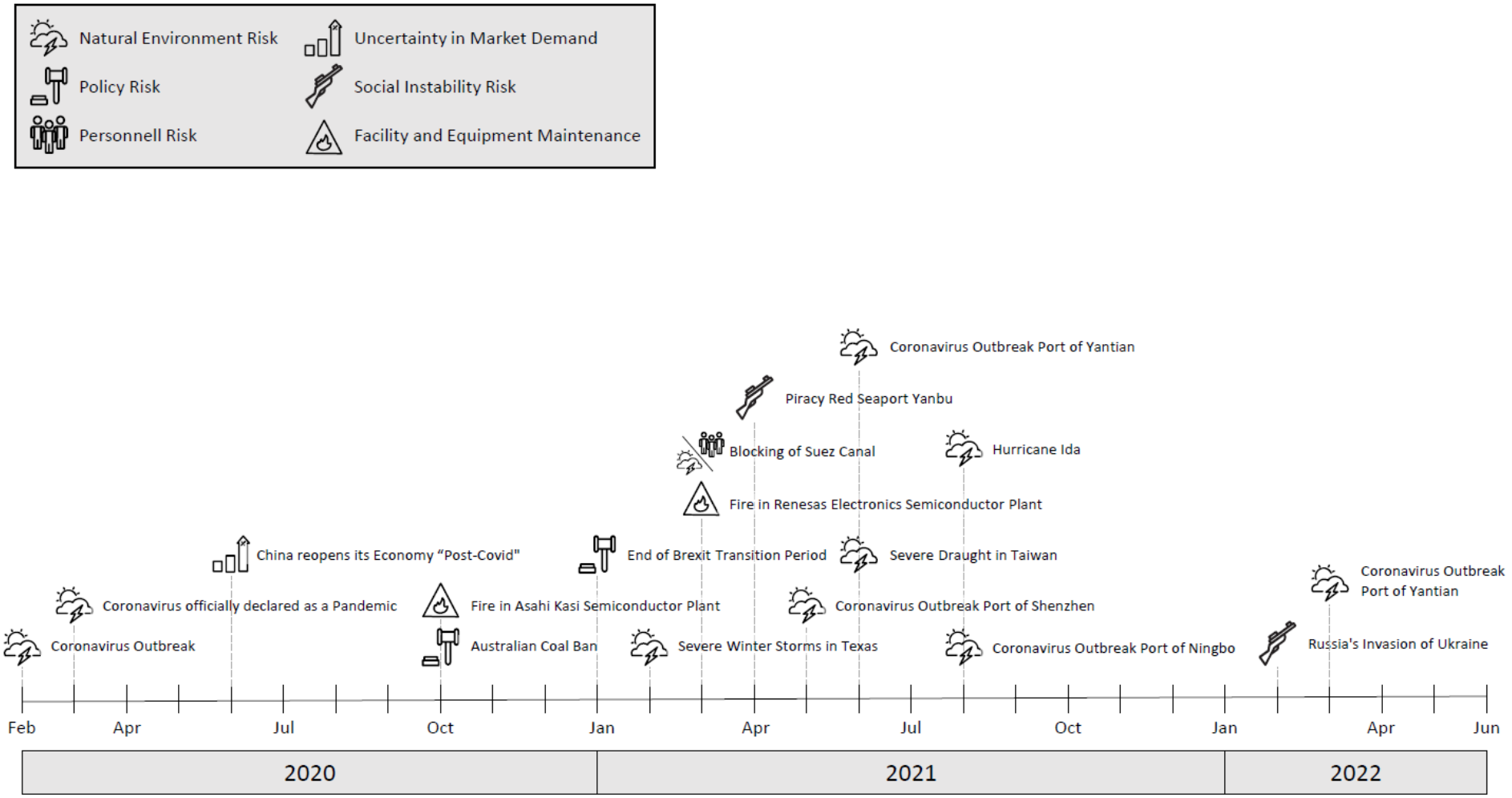


**Figure 10: The most relevant Disruptions that recently happened beginning with the Covid Pandemic in 2020[114]**

[114] Source: Own representation.

# 3 Transport Services Allocation

In this chapter, the purchasing process of transport services is explained and its complexity and unpredictability are discussed. Based on the following literature research, various process models for purchasing services are shown. Factors influencing the maritime transport service purchasing process are explored. Finally, the relevance of the results is discussed, possible hypotheses are established, and their relevance and accuracy are questioned.

## 3.1 Purchasing Process of Transport Services

When considering the different facets of the purchasing process, transport remains one of the most critical aspects of any successful supply chain. When transport is managed independently, it could result in being the weakest link in the chain. The basic transport task has evolved to meet the increasing demand and market expectations. Transport's goal is no longer solely about achieving low operational costs or a high level of service but strives to attain strategic advantages by combining high service levels as well as low costs. If transport decisions are made in cooperation with other functions in the process, risks are further reduced. Transport decisions need to be strategic and decisions should be made focusing on the overall supply chain transportation system. By acknowledging information about supply chain planning, such as resource availability and delivery requirements in order to take advantage of carrier consolidations routes, become more efficient.[115]

From a manufactures' perspective, purchasing transport services differs from purchasing goods. The purchasing process is more complex due to the nature of the service being less accessible and this can increase the time in each stage of the purchasing process as well as the level of detail, the number and type of disciplines involved in the process and the amount of exchanged information between buyers and suppliers.[116]

### 3.1.1 Purchasing Process Models

There is not that much literature and research on the topic of purchasing processes for transport services. Literature on the subject of purchasing logistics services is therefore

[115] Stank, T. P.; Goldsby, T. J. (2000), p.71f.
[116] Rogerson, S. (2013), p.2.

taken into consideration when analysing purchasing process models, as logistics services comprise of transport services.[117]

A model that is commonly found in literature addressing purchasing processes is the model from van Weele. This general purchasing process model is focusing on the purchasing process of goods. It can also be accurately applied to the acquisition of freight transport services. The purchasing process model by van Weele has six different stages, as can be seen in Figure 11.[118]

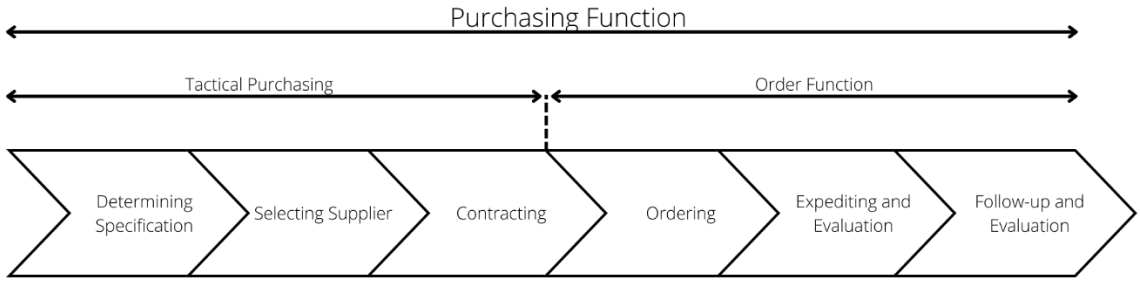


**Figure 11: The Six Stages of a General Purchasing Process[119]**

Observing the stages in detail, the specifications include the needed quantity as well as quality of goods or services being purchased. The selection of the right supplier is important, as chosen suppliers should meet defined specifications optimally. The last step of tactical purchasing is to decide for a specific contract and to prepare the negotiations required to reach a suitable agreement in form of a legal contract. Expediting refers to the monitoring and control of the order. The final step or follow–up includes transaction claims, disputes, the update of all documents and the supplier rating and ranking.[120]

In comparison to the generic model of van Weele, Björklund developed a model following specified process activities for the purchase of freight transport:

1. Needs specification
2. Suppliers' identification
3. Information and offers request
4. Suppliers' information
5. Potential suppliers' evaluation
6. Suppliers' negotiations

[117] Rogerson, S. (2013), p.4, p.23.
[118] Rogerson, S. (2013), p.11.
[119] Weele, A. J. van (2018), p.8.
[120] Weele, A. J. van (2018), p.7.

7. Suppliers' selection
8. Suppliers' contracting[121]

Sink and Langley provide a five-stage model focusing on choosing an appropriate third-party logistics provider:

1. Identifying the need to outsource
2. Developing alternatives
3. Evaluating and selecting suppliers
4. Implementing services
5. Providing ongoing services assessment[122]

These three models clearly can be included in the van Weele generic model. Rogerson proposes a representation of freight transport purchasing processes which contain three main steps, as seen in Table 6. The last steps, ordering, expediting and evaluating, from the generic process model by van Weele are taking place within the contract agreement with the transport service providers and are therefore not listed as individual stages.[123] In the second purchasing process stage, supplier selection, the RFI (request for information) contains general information about the capacities and services of potential suppliers. After the RFI a request for quotation (RFQ) follows. RFQs provide a detailed description of the service and are used to learn more about suppliers' prices for the requested service.[124]

**Table 6: A Representation of a Purchasing Process[125]**

| **Purchasing Process** | | |
|---|---|---|
| **Define Specification** | **Select Supplier** | **Contract Agreement** |
| • List Needs<br>• Understand currently bought Volume<br>• Specify Requirements for Transport Provider | • Identify Providers<br>• Send Requests for Information (RfI)<br>• Send Requests for Offers (RfQ)<br>• Compare Providers<br>• Negotiate with Providers | • Negotiate with selected Provider(s)<br>• Agree to Contract |

[121] Rogerson, S. (2017), p.3.
[122] Rogerson, S. (2013), p.12.
[123] Rogerson, S. (2017), p.3.
[124] N.N., https://www.coupa.com/blog/beschaffung/wie-unterscheiden-sich-rfi-rfq-und-rfp (Retrieved: 17.10.2022)
[125] Rogerson, S. (2017), p.4.

## 3.2 Factors influencing the Purchasing Decision

Since the late 1960s, important factors influencing the choice and selection of a freight service have been researched. The motivation for these studies was the realisation that transport costs for manufacturing companies were becoming increasingly important. It was also understood that transport costs were not the only decisive factor for the freight transport service selection.[126]

Numerous studies investigated which mode of transport customers prefer. Roberts states in one of these that demand, transport length and characteristics of goods being transported are significant factors influencing the transport mode choice. Cunningham's research mentions that factors such as special offers, speed of transport, damage to goods and reliability of the carrier influence buyers.[127] This research, however, focuses on which factors are prioritised when choosing maritime transport processes and therefore the choice of transport mode is not addressed.

An empirical study carried out by Sucky and Haas in 2012 and 2013 studies which criteria proved significant when selecting a logistics service provider and if there is a willingness to pay more for $CO_2$-neutral transport services. The finding were that expertise and price are the central factors when buying logistics services.[128] Another publication in 2010 deals with the hypothesis that environmental issues prove a selecting criterion when choosing a 3PL service provider. The results show that although 3PLs report more interest in environmental issues, criteria such as price, quality and punctuality are still in the foreground when making purchasing decisions. Environmental issues are not conclusive in the purchasing decision and are at best a minimum requirement for cooperations.[129] The resulting hypothesis is that green aspects were not to be considered as significant but could play a role in the early selection process for logistics services providers. This could take place in the stage of supplier pre-selection, due to environmental aspects being seen as a competitive advantage where customer awareness plays a role.[130] If the $CO_2$ -neutral transport is only slightly elevated, the fulfilment of green criteria for logistics service providers could represent a competitive advantage.[131]

[126] Matear, S.; Gray, R. (1993), p.26.
[127] Matear, S.; Gray, R. (1993), p.26.
[128] Sucky, E.; Haas, S. (2014), p.25ff.
[129] Wolf, C.; Seuring, S. (2010), p.84.
[130] Sucky, E.; Haas, S. (2014), p.25ff.
[131] Sucky, E.; Haas, S. (2014), p.29.

Two studies carried out by Lammgård and Andersson investigating the freight purchasing process of Swedish manufacturing and wholesale companies demonstrate that the importance of environmental factors has remained stable from 2003 to 2012. The more significant factors when selecting a transport provider have been the reliability and quality of the transport as well as geographic coverage and price, being the most important. In the surveys made, the participants had to attribute from the sum of 100% the worth of the following: price, transport time from door–to-door, time precision and environmental efficiency represented by $CO_2$. In 2003 (n = 365) as well as in 2012 (n = 168) price was rated as most significant. Environmental efficiency was placed last as seen in Figure 12. The second most important factor in the surveys was time precision followed by transport time.[132]

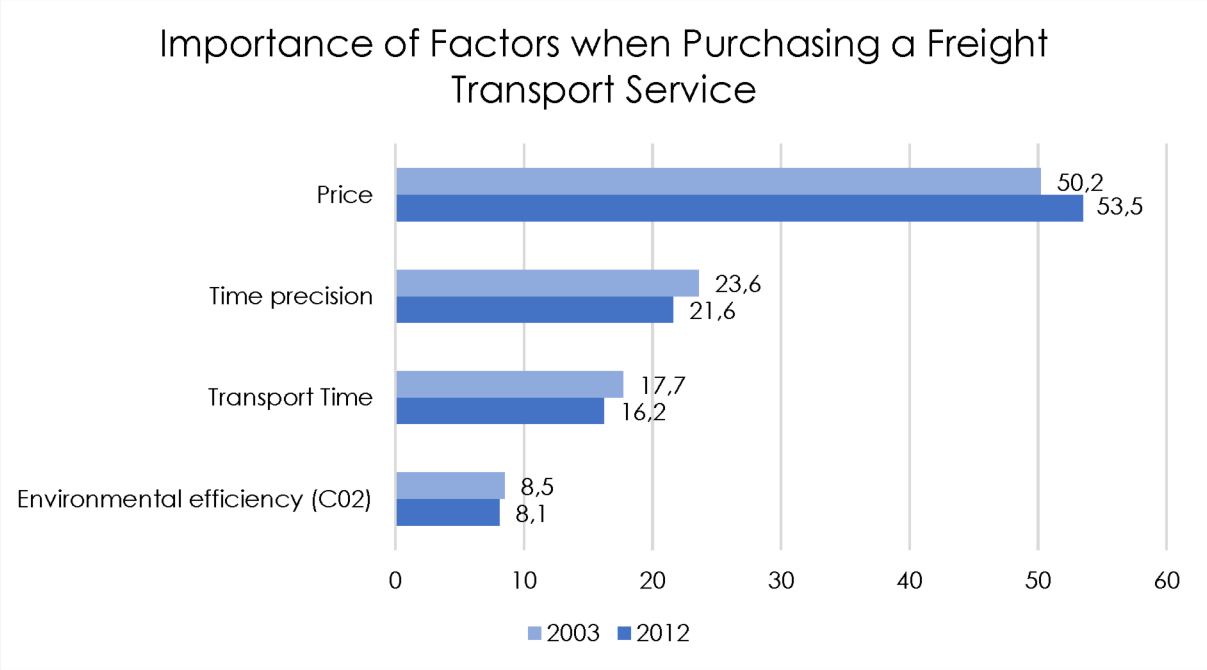


**Figure 12: The Shippers' Average Distribution when Selecting Transport Solutions[133]**

A recent study by Jazairy and Haartman conducted in 2020 is based on Swedish shippers and LSPs. Results show that the shippers are becoming increasingly interested in environmental aspects when purchasing logistics services. Costs and classic performance targets such as lead time or geographic coverage tend to be the top priorities. Additionally to this, it can be said that LSPs are in general putting more value on environmental sustainability than shippers during the process of logistics purchasing and some of them have interests in green engagement even if the shippers are not

[132] Lammgård, C.; Andersson, D. (2014), p.1ff.
[133] Lammgård, C.; Andersson, D. (2014), p.4.

demanding it.[134] Overall, a more environmentally friendly logistics service depends on both parties, this means that for the factors to change, also the shipper, as buyer of the logistics services, has to take action.[135] The effort of both, the shipper as well as LSP is important, as the decision of the shipper has impacts on the environment and the LSP has to develop environmental sustainable ways to operate.[136]

In Finland, a case study from 2017 with eight case companies who purchase logistics services once again confirms that price remains a crucial factor when selecting a LSPs or a subcontractor. The focus, however, is more on the ratio of price versus quality than on the cheapest offer. All companies stated that environmental and social conformity is a fundamental condition for cooperation. The implication of this is that green criteria are taken into consideration when shippers select a LSP. Another finding is that especially big LSPs perform more responsible regarding the environment than shippers expect them to while small LPs have less sustainability orientation.[137]

In another case study conducted by Jazairy in 2020, results from studying three shippers and five LSPs, show that a conflict of interests in contractual periods between the shipper and LSP can hinder green progress awareness and investments. This shows that green criteria are crucial factors when shippers select an outsourcing strategy. Besides that, Jazairy says that "a lack of follow–up efforts from shippers on green measures that were specified pre–contract" has been noticed.[138]

These studies imply that logistics and transport service providers are under constant pressure attempting to minimize the environmental impact of their operations, as 23% of all global $CO_2$ emissions are attributed to the logistics industry.[139] When looking at the shipping industry, sea freight is responsible for around 2,6% of global $C0_2$ emissions.[140] Therefore, green factors seem to be gaining increased focus, however, practical implementation is often lacking. When choosing a LSP, certain aspects are required or a prerequisite for a cooperation, although the final decision when purchasing a service is not made based on sustainability issues but on traditional factors such as price ratio and service quality.

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[134] Jazairy, A.; von Haartman, R. (2020a), p.3ff.
[135] Bajec, P.; Tuljak-Suban, D. (2016), p.34f.
[136] Bask, A. et al. (2018), p.2.
[137] Multaharju, S. et al. (2017), p.9, p.11, p.14.
[138] Jazairy, A. (2020), p.1, p.20.
[139] Jazairy, A.; von Haartman, R. (2020a), p.1.
[140] Umweltbundesamt, https://www.umweltbundesamt.de/themen/wasser/gewaesser/meere/nutzung-belastungen/schifffahrt (Retrieved: 17.10.2022)

As a solution, Bask et al. suggest ways of providing green measures without additional cost by combing sustainability efforts with increased operational efficiency. Proposed methods include route optimization, reduction and recycling of packaging waste, energy efficiency or effective shipment consolidation.[141]

In a study from 1993 based on the Irish Sea Market, the significance of service attributes for shippers purchasing sea service and for freight services suppliers is confirmed. In this study, freight suppliers are the freight forwarders or the carriers and the shippers are, as previously mentioned, the companies purchasing the transport service, meaning they are the owners of the goods. The shippers cited are companies in Ireland and Great Britain that send and or receive goods from the other country. The freight services suppliers are companies offering freight transport services between those two countries. The companies were asked to rate the service attributes on a scale from 1 to 5, 5 being "very important" and 1 "very unimportant".[142] The results from the survey can be seen in Table 7 and Table 8 below:

**Table 7: Shippers Mean Scores for Service Attributes[143]**

| Service Attribute | Mean Score |
|---|---|
| Fast Response to Problems | 4,7 |
| Avoidance of Loss or Damage, etc. | 4,6 |
| On–time Collection and Delivery | 4,6 |
| Value for Money - Price | 4,5 |
| Good Relationship with Carrier | 4,3 |
| Ability to perform unanticipated urgent Deliveries | 4,2 |
| Short Transit Time | 4,0 |
| Low Price | 4,0 |
| Ability to handle Shipments with special Requirements | 3,7 |
| Arrival Time at Destination | 3,7 |
| High Frequency of Service | 3,7 |
| Documents completed by Carrier | 3,3 |
| Departure Time from Origin | 3,0 |
| Special Offers or Discounts for Transport | 3,0 |
| Transport Preference of Trading Partner | 2,9 |
| Proximity of Port/Airport to Destination of Goods | 2,9 |
| Proximity of Port/Airport to Origin of Goods | 2,4 |
| Knowing which Port/Airport is used | 2,4 |

[141] Bask, A. et al. (2018), p.22.
[142] Matear, S.; Gray, R. (1993), p.26f.
[143] Matear, S.; Gray, R. (1993), p.28.

**Table 8: Freight Suppliers Purchasing Sea Services Mean Scores for Service Attributes[144]**

| Service Attribute | Mean score |
|---|---|
| Punctuality of Sea Service | 4,7 |
| Availability of Freight Space | 4,6 |
| High Frequency of Sea Service | 4,4 |
| Fast Response to any Problems | 4,2 |
| Value for Money Freight Rate | 3,9 |
| Arrival Time of Sea Crossing | 3,9 |
| Departure Time of Sea Crossing | 3,9 |
| Short Time taken for Sea Crossing | 3,9 |
| Low Freight Rate | 3,8 |
| Good Relationship with Sea Carrier | 3,4 |
| Proximity of Port to Destination of Goods | 3,0 |
| Proximity of Port to Origin of Goods | 3,0 |
| Special Offers or Discounts for Sea Service | 3,0 |
| Transport Preference of Shipper | 2,5 |

It is clear to see that the most important service attributes for freight shippers are a swift response to problems thus assuring on-time collection and delivery and minimising loss and damage. For freight suppliers purchasing sea service the most important service attributes are availability of freight space, punctuality, and high frequency of service.[145]

Research regarding factors affecting the purchasing process of transport services shows that price, punctuality and quality of the transport are key factors. The expertise and reliability of the service providers are in the foreground influencing the purchase decision. The interest in environmental aspects and the pressure to minimize $CO_2$ emissions is steadily growing but the practical application is still lacking. Nevertheless, the resulting hypothesis is that green factors were not considered as significant when making purchase decisions for transport services. They may however prove a crucial selecting criterion when choosing a service provider. This could mean that environmental factors are frequently a prerequisite for collaboration and therefore considered in earlier stages like the supplier pre-selection.

[144] Matear, S.; Gray, R. (1993), p.29.
[145] Matear, S.; Gray, R. (1993), p.28f.

# 4 Research Methodology

After investigating the purchasing process of transport services in a systematic literature research and discussing factors that influence the purchasing decision, a qualitative study is undertaken in the empirical part of this thesis. The goal is to examine purchasing priorities of selected companies choosing maritime transport services in repetitive questionnaires, where the selected experts rate the factors identified in the conducted literature research. Additional to that, trends and shifts in the inbound logistics of manufacturing companies are explored. Before initiating this research, a suitable analysis method has to be found. Due to the accessibility and forecasting advantages, the Delphi method is decided on. The approach and the process steps of the Delphi study are explained in the following chapter.

## 4.1 Choosing The Appropriate Evaluation Method

Most research methods in qualitative studies base their results on a single participant interview. When using the Delphi method, statistics are collected from two or more interviews taken from the same group of experts.[146] The initial research undertaken using the Delphi method took place as a military project where the goal was to estimate bombing requirements in the 1950s. It was sponsored by the United States Air Force.[147] Dalkey and Helmer maintain that the Delphi method goal is to "obtain the most reliable consensus of opinion from a group of experts".[148] Von der Gracht's definition is that "the Delphi technique is a survey method facilitating an efficient group dynamic process".[149] Using the Delphi method, a series of questionnaires containing controlled opinion feedback are conducted, where experts in their field are questioned with more than one interview. The four fundamental elements defining the Delphi method are: anonymity, iteration or repetitions, controlled feedback and statistical group response in the form of a numerical or graphical representation.[150]

The first questionnaire results are analysed, and the consensus is included in the second and consecutive interview rounds. The consecutive questionnaires are modified so that the researcher can investigate how the experts understood the questions and if the general opinion influences their responses. The Delphi rounds thus minimize the variable of individual subjectivity, which can influence the research results. The

[146] von der Gracht, H. A. (2012), p.1526.
[147] Dalkey, N.; Helmer, O. (1963), p.1.
[148] Dalkey, N.; Helmer, O. (1963), p.1.
[149] von der Gracht, H. A. (2012), p.1526.
[150] von der Gracht, H. A. (2012), p.1526f.

questionnaires are sent to a selected study group without direct discussion or contact between each other. This avoids face-to-face group discussions where a dominant participant may lead opinions resulting in conformity.[151,152]

The Delphi method has proven effective in various fields, researching aspects influencing decision-making on specific topics.[153,154] Anderhofstadt and Spinler investigated "Factors affecting the purchasing decision and operation of alternative fuel-powered heavy-duty trucks in Germany".[155] MacCarthy studied "Factors affecting location decisions in international operations"[156] and Giunipero et. al. identified the drivers and barriers when adapting sustainability in purchasing and supply management.[157]

The Delphi process being used in this research is implemented in the same method used by Anderhofstadt and Spinler[158] using the following Delphi process phases from von der Gracht and Darkow[159], seen in Figure 13.


**Figure 13: The Steps of the Delphi Process[160,161]**

The Delphi process steps being followed to carry out the study for this thesis are explained in the following.

## 4.2 Research Method

The various aspects influencing the purchasing process factors of maritime transport services have been researched and discussed as well as the choice of a research method. The chosen Delphi research method begins with formulating an appropriate interview first round, choosing a panel of experts prepared to participate in more than one round of questionnaires and the subsequent analysis of the results. After the first round, the second questionnaire is modified based on the initial rounds' results.

[151] Anderhofstadt, B.; Spinler, S. (2019), p.90.
[152] Ogden, J. A. et al. (2005), p.31.
[153] Kembro, J. et al. (2017), p.79.
[154] Anderhofstadt, B.; Spinler, S. (2019), p.90.
[155] Anderhofstadt, B.; Spinler, S. (2019)
[156] MacCarthy, B. L.; Atthirawong, W. (2003)
[157] Giunipero, L. C. et al. (2012)
[158] Anderhofstadt, B.; Spinler, S. (2019)
[159] von der Gracht, H. A.; Darkow, I.-L. (2010)
[160] Anderhofstadt, B.; Spinler, S. (2019), p.90.
[161] von der Gracht, H. A.; Darkow, I.-L. (2010), p.49.

### 4.2.1 Research Questions

The foremost research question motivating this study is:

- *What factors s influence the purchasing decision of maritime transport services, and which of these are most relevant?*

Therefore, various factors that might influencing the purchasing process of maritime transport services are considered. Factors being examined are among others environmental aspects, quality and time precision of the transport, cost and the service attributes of the selected transport provider.

Additional topics being explored are the shifts in these purchasing factors. Projections and forecasting for the future of maritime transport services are added in form of open-end questions.

- *The market reflects a shift from price issues to supply chain security. Is the space on a vessel becoming more important than the price and how is this reflected in a supply chain?*
- *What will the freight forwarder's role in transport be like in 2030?*
- *What is your opinion regarding environmentally friendly transport in your supply chain? Under which circumstances would you be prepared to pay more for their implementation?*

### 4.2.2 Factor Identification

Preparing the application of the Delphi method involved a thorough research of the significant factors influencing the purchasing decision of transport services. As previously mentioned, purchasing of logistics services was also taken into consideration because logistics services comprise transport services. 19 factors were identified as can be seen in Table 9.

**Table 9: Factors influencing the Purchasing Decision**

| No. | Factors | Source |
|---|---|---|
| 1 | Lowest Price | Sucky, E.; Haas, S. (2014), Multaharju, S. et al. (2017) |
| 2 | Ratio Price versus Quality | Multaharju, S. et al. (2017) |
| 3 | Transport Service Provider's Expertise | Sucky, E.; Haas, S. (2014) |
| 4 | Environmental Concerns | Wolf, C.; Seuring, S. (2010), Lammgård, C.; Andersson, D. (2014) |
| 5 | Punctuality and Time Precision | Wolf, C.; Seuring, S. (2010), Lammgård, C.; Andersson, D. (2014), Matear, S.; Gray, R. (1993) |
| 6 | Service Provider's Reliability | Matear, S.; Gray, R. (1993) |
| 7 | Geographic Coverage | Jazairy, A.; von Haartman, R. (2020) |
| 8 | Transport Duration | Lammgård, C.; Andersson, D. (2014), Matear, S.; Gray, R. (1993) |
| 9 | Conformity of Social and Environmental Norms | Multaharju, S. et al. (2017) |
| 10 | Fast Response to any Problems | Matear, S.; Gray, R. (1993) |
| 11 | Minimizing Loss and Damage | Matear, S.; Gray, R. (1993) |
| 12 | Established Shipper-Carrier Relationship | Matear, S.; Gray, R. (1993) |
| 13 | Flexibility to perform unanticipated urgent Delivers | Matear, S.; Gray, R. (1993) |
| 14 | Ability to handle Shipment with special Requirements | Matear, S.; Gray, R. (1993) |
| 15 | High Frequency of Service | Matear, S.; Gray, R. (1993) |
| 16 | Completion of Documents by Carrier | Matear, S.; Gray, R. (1993) |
| 17 | Special Offer or Discounts for Transport | Matear, S.; Gray, R. (1993) |
| 18 | Knowledge of used Ports | Matear, S.; Gray, R. (1993) |
| 19 | Freight Space Availability | Matear, S.; Gray, R. (1993) |

### 4.2.3 Selection of Experts

Literature studies give no exact information regarding how many experts necessitate a reliable result in a Delphi study. Giunipero et. al. state that 10 to 15 experts are sufficient when the group is homogenous and in specific circumstances even four participants may deliver reasonable results.[162] On the other hand, Ogden et. al. say that past studies questioned between five to 30 experts and even 70 to 75 experts can deliver ample feedback for meaningful results.[163] Kembro argues that "the panel size should not exceed 30 experts since larger groups tend to generate few additional insights as well as limit the exploration of emerging results in the study".[164] Based on this information the number of experts joining this research was set to ten, making sure to get conclusive results by including a diverse set of opinions. Therefore, soliciting participants was stopped when the group size of 10 was reached.

To access companies dealing mainly in maritime transport purchasing processes, one of the largest logistics firms in Europe was contacted. The company Dachser Austria Air & Sea GmbH provided a list of regular customers using maritime transport processes. From this list, a random company selection was made thus avoiding structural similarities and bias. The common norm being that these companies regularly contract maritime transport processes service providers and that the expert participants in the study are regularly involved in purchasing maritime transport and therefore have the required industry experience. The final Delphi expert panel consisted of 10 experts, who agreed to participate in all rounds of the research. An overview of the participating experts including their position and the company's business sector is provided in Table 10.

**Table 10: The Final Delphi Expert Panel**

| Business Sector | Position |
|---|---|
| Manufacturing Company in the Industrial Sector | Manager Logistics & Shipping |
| Electronics Manufacturer | Logistics Supervisor |
| Manufacturing Company in the Engineering Industry | Team Leader Shipping Department |
| Metal Industry | Team Leader Customer Service Technical Chains |
| Manufacturing Company of Consumer Goods | Purchasing |

[162] Giunipero, L. C. et al. (2012), p.264.
[163] Ogden, J. A. et al. (2005), p.32.
[164] Kembro, J. et al. (2017), p.80.

| | |
|---|---|
| Retailing Company | Warehouse Manager |
| Pharmaceutical Industry | Team Leader Purchasing and Warehouse Management |
| Agriculture Industry | Head of Logistics Department |
| Logistics Warehouse | Inventory Manager |
| Food Industry | Company Owner |

The business sectors of participating experts vary but the experts are directly involved in the logistics or purchasing processes of the company and therefore have the necessary expertise. All experts participated in both Delphi rounds returning the questionnaires, resulting in an optimal dropout rate of 0,0%. The high participation rate in both rounds and the feedback indicated a dynamic interest in the research topic. The size of the participating companies can be seen in Figure 14, where it is evident that the different company sizes were well distributed. This means that small and medium-sized (SMEs) business and large businesses, employing more than 250 people, took part in about the same extend.

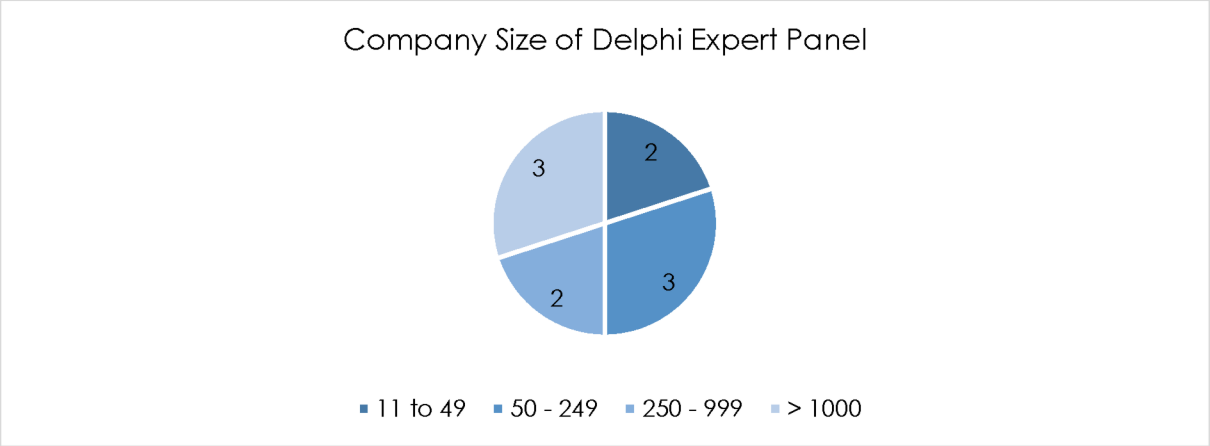


**Figure 14: Company Size of Participating Delphi Panel**

### 4.2.4 First Delphi Round

For the first round of the Delphi study a three-page survey and an information sheet, inviting the experts to participate in the study was prepared. An email was sent to the expert panel in the last week of July 2022 with instructions on how to complete the survey. The survey was organized in two sections:

The first being an evaluation, where the importance of the factors identified before was examined. The participants were to evaluate the 19 factors on a Likert scale of five, from (1) unimportant to (5) extremely important. As Okoli and Pawlowski suggest, the experts also were encouraged to comment why they ranked the factor as they did or justify their rankings.[165]

The second section consisted of three open-ended questions researching the shifts in purchasing decisions allowing the expert panel to express their opinions independently.[166] These questions were carefully designed to provide a forecasting for the global maritime supply chain industry. They addressed the shift from price significance versus supply chain security. Furthermore, the role of environmental transport and that of the freight forwarder in global supply chains of the future was investigated. The first questionnaire can be seen in the Appendix.

### 4.2.5 Interim Analysis and Second Delphi Round

The completed surveys from the first Delphi round were received in August 2022. The interim analysis was completed and the statistical group response of the rating section was presented in form of graphs for each factor. The results from the first section of the survey were analysed and the mean as central tendency was calculated. The resulting histograms interpreting the frequency distributions were added to the modified questions in the second survey. The second survey therefore provided each participant with the possibility to choose the same evaluation as initially chosen or change their previous answer.[167]

The answers of the three open-ended questions of the Delphi study were assessed, clustered and summarized providing a collective statement representing the group opinion for each question. In the second questionnaire, the participants were offered the opportunity to confirm that the group response was correctly interpreted and they were asked to provide a comment should they disagree with the group response.[168]

The second survey was sent to the panel via email at the beginning of September 2022. The experts were asked to confirm or contradict the collective group statement interpreted by the Delphi facilitator. Having read the group statement and seeing the representation of the histogram and mean for each purchasing factor, the

[165] Okoli, C.; Pawlowski, S. D. (2004), p.26.
[166] Anderhofstadt, B.; Spinler, S. (2019), p.92.
[167] von der Gracht, H. A. (2012), p.1527.
[168] Okoli, C.; Pawlowski, S. D. (2004), p.25.

participants were requested to evaluate the factors again. The second questionnaires' structure can be seen in the Appendix.

### 4.2.6 Final Analysis and Consensus

The finished survey of the second and last Delphi round were received in mid-September 2022. The aim of the Delphi method is to reach expert consensus in the rating of examined factors.[169] The decision to terminate the Delphi study is a crucial point for the researcher. Therefore, the definition of a statistically proven stopping criterion for the Delphi study is needed. Although in some cases time constraints and budget limitations can close the study, in most research experts decide on consensus as a criterion to terminate the Delphi method.[170] Von der Gracht recommends testing the stability of expert responses as well. A specific level of agreement alone is not always profound enough.[171] As defined by Dajani et. al. "stability refers to the consistency of responses between a study's successive rounds."[172] In this Delphi study, the stability and consensus of expert responses were chosen as stopping criteria and tested in the evaluation. In the forecasting or projections section, the open-ended questions were once more reviewed and then summarized in a final collective group statement.

Following the same approach as Anderhofstadt and Spinler, the coefficient of variation (CV) was chosen to test stability of responses and the interquartile range (IQR) for testing consensus (the level of agreement) was used.[173] The CV is "defined as the standard deviation divided by the mean".[174] For the stability measurement an absolute CV difference for each purchasing factor was calculated and the maximum change for stability was set to 0,1 because this threshold value was proved sufficient in recent studies.[175,176] To calculate the absolute CV change, the CV value from the first Delphi round was subtracted from the CV value of the second Delphi round.[177] The "IQR is the absolute value of the difference between the 75$^{th}$ and 25$^{th}$ percentiles, with smaller values indicating higher degrees of consensus".[178] Consensus is reached if the

[169] Okoli, C.; Pawlowski, S. D. (2004), p.25.
[170] Anderhofstadt, B.; Spinler, S. (2019), p.92.
[171] von der Gracht, H. A. (2012), p.1527.
[172] Dajani, J. S. et al. (1979), p.84.
[173] Anderhofstadt, B.; Spinler, S. (2019), p.93.
[174] Kwiatkowski, K. P.; Chinowsky, P. S. (2017), p.50.
[175] Anderhofstadt, B.; Spinler, S. (2019), p.93.
[176] Kwiatkowski, K. P.; Chinowsky, P. S. (2017), p.50.
[177] Anderhofstadt, B.; Spinler, S. (2019), p.93f.
[178] Persai, D. et al. (2016), p.5.

IQR has a maximum threshold value of 1,0. [179] This means that a IQR of 0 indicates a high group agreement while a value of 2 shows that the replies and therefore the opinion of the Delphi panel is dispersed.[180]

All formulas that were applied are to be found in the Appendix.

A Delphi study has a minimum of two rounds thus facilitating an initial assessment after the first interview and a subsequent revision for the next round. As mentioned previously, in the revision round, the Delphi facilitator shares the previous group opinion with the participants and evaluates whether they reassess their answers.[181] Melander researched the application of the Delphi technique and found that most surveys used two rounds.[182] Anderhofstadt and Spinler state "it would be difficult to achieve a high response rate for several additional Delphi rounds due to personal time constraints".[183]

The lengthy aspects of this research method can result in experts losing motivation and interest in the subsequent interview rounds. The Delphi study in this thesis revealed a high level of stability and consensus in the evaluation section of the initial questionnaire. The group statements for the forecasting and projections sections were relevant and detailed after the second round. Considering these aspects, this Delphi study was concluded after the modified second round.

## 4.3 Research Results

In the following the results of both parts of the Delphi study are presented, starting with the evaluation of factors influencing the maritime transport process and then the forecasting part with the three open-ended questions follows.

### 4.3.1 Factor Evaluation

The outcomes of both Delphi rounds are shown in Table 11. As mentioned, the coefficient of variation (CV) was used to test stability and the interquartile range (IQR) to test consensus, the level of agreement. Additional to that the mean score of each round is provided, showing the central tendency.

The answers from each expert for each question of both questionnaires can be found in the Appendix.

[179] von der Gracht, H. A. (2012), p.1529.
[180] Persai, D. et al. (2016), p.5.
[181] Anderhofstadt, B.; Spinler, S. (2019), p.90.
[182] Melander, L. (2018), p.73.
[183] Anderhofstadt, B.; Spinler, S. (2019), p.93.

**Table 11: Evaluated Factors influencing the Purchasing Decision of Maritime Transport Services**

| Factor | Round 1 (n = 10) | | | Round 2 (n = 10) | | | CV Change[2] | Consensus | Stability |
|---|---|---|---|---|---|---|---|---|---|
| | IQR | CV | Mean | IQR[1] | CV | Mean | | | |
| 1. Lowest Price | 1,75 | 0,27 | 3,80 | 1,50 | 0,32 | 3,10 | 0,05 | no | yes |
| 2. Ratio Price versus Quality | 1,00 | 0,12 | 4,50 | 1,00 | 0,12 | 4,50 | 0,00 | yes | yes |
| 3. Transport Service Provider's Expertise | 1,00 | 0,22 | 4,20 | 0,75 | 0,15 | 4,20 | 0,07 | yes | yes |
| 4. Environmental Concerns | 1,75 | 0,29 | 3,20 | 1,00 | 0,20 | 3,30 | 0,08 | yes | yes |
| 5. Punctuality and Time Precision | 0,00 | 0,06 | 4,90 | 0,00 | 0,00 | 5,00 | 0,06 | yes | yes |
| 6. Service Provider Reliability | 0,00 | 0,06 | 4,90 | 0,00 | 0,00 | 5,00 | 0,06 | yes | yes |
| 7. Geographic Coverage | 1,50 | 0,28 | 3,40 | 0,75 | 0,22 | 3,70 | 0,06 | yes | yes |
| 8. Transport Duration | 0,00 | 0,22 | 3,90 | 1,00 | 0,16 | 4,30 | 0,07 | yes | yes |
| 9. Conformity of Social and Environmental Norms | 1,00 | 0,25 | 3,20 | 1,00 | 0,18 | 3,70 | 0,06 | yes | yes |
| 10. Fast Response to any Problems | 0,00 | 0,14 | 4,70 | 0,00 | 0,00 | 5,00 | 0,14 | yes | no |
| 11. Minimize Loss and Damage | 0,75 | 0,19 | 4,50 | 0,00 | 0,09 | 4,80 | 0,10 | yes | yes |
| 12. Established Shipper-Carrier Relationship | 1,50 | 0,20 | 4,00 | 0,75 | 0,15 | 4,20 | 0,05 | yes | yes |
| 13. Flexibility to perform unanticipated urgent Delivers | 1,00 | 0,11 | 4,60 | 0,75 | 0,10 | 4,70 | 0,01 | yes | yes |
| 14. Ability to handle Shipment with special Requirements | 1,00 | 0,16 | 4,30 | 1,00 | 0,19 | 4,20 | 0,03 | yes | yes |
| 15. High Service Frequency | 0,00 | 0,10 | 4,20 | 1,00 | 0,12 | 4,40 | 0,02 | yes | yes |
| 16. Completion of Documents by Carrier | 1,00 | 0,21 | 3,40 | 1,00 | 0,20 | 3,30 | 0,00 | yes | yes |
| 17. Special Offers or Transport Discounts | 0,00 | 0,16 | 3,00 | 0,00 | 0,18 | 3,10 | 0,03 | yes | yes |
| 18. Knowledge of used Ports | 1,00 | 0,22 | 3,70 | 2,00 | 0,24 | 4,00 | 0,01 | no | yes |
| 19. Freight Space Availability | 1,00 | 0,16 | 4,50 | 0,00 | 0,09 | 4,80 | 0,07 | yes | yes |

[1] Consensus is reached if IQR of the second Delphi round has a maximum value of 1,0[184]

[2] Stability is reached if the absolute CV difference between the first and the second round has a maximum value of 0,1[185]

[184] von der Gracht, H. A. (2012)
[185] Anderhofstadt, B.; Spinler, S. (2019)

Table 11 indicates that a consensus was reached for 15 factors in the first round. The IQR of these factors was below the threshold value of 1,0. After the second round the level of agreement improved further and 17 factors of 19 (89,5%) reached a consensus, indicating a convergence of the experts' opinions for most factors. A high level of consensus with an IQR of 0,0 was achieved for six factors: *Punctuality and Time Precision*, *Service Provider's Reliability*, *Fast Response to any Problems*, *Special Offer or Discount for Transport* and *Freight Space Availability*. Factors that did not reach consensus after the second round and therefore had a IQR higher than 1,0 where *Lowest Price* (IQR = 1,5) and *Knowledge of used Ports* (IQR = 2,00).

The table also shows that after the second round all factors but one (94,7%) met the threshold value of 0,1 for stability. The one factor with a higher CV range than the predefined threshold value was *Fast Response to any Problems* with a CV range of 0,14. Stability of answers was especially high for two factors, where the CV range was 0,0: *Ratio Price versus Quality* and *Completion of Documents by Carrier*. With a CV range of 0,1 stability was also high for *Knowledge of used Ports* and *Ability to handle Shipment with special Requirements*.

After the second Delphi round, the three highest rated factors with a mean of 5,0 were *Punctuality and Time Precision*, *Service Provider Reliability* and *Fast Response to any Problem*. On the other hand, factors with the lowest mean and therefore seemingly the least relevant transport purchasing factors were *Lowest Price* (3,1) and *Special Offer or Discounts for Transport* (3,1) followed by *Environmental Aspects* (3,3) and *Documents completed by Carrier* (3,3).

### 4.3.2 Open-Ended Questions

When addressing developing inbound logistics trends in maritime supply chains the participants expressed their opinions independently in open-ended questions. These three questions were compiled into collective group statement representing the Delphi panels' opinions. The statements were then integrated in the second questionnaire, where the participating experts were to agree or disagree with the presented statement. All participating experts approved of the summarized statement in the second Delphi round, providing a probable forecast for future maritime supply chains.

The first forecasting question addressed the maritime transport services purchasing decisions in these volatile times where inflation and disruptions impact global supply

chains and the shipping industry. Increasing uncertainties make it difficult to plan transport processes. The whole Delphi panel prioritised space on vessels and punctual production supply compared to cost. To avoid supply chain disruptions, all experts stated that confirmed vessel space is worth significantly higher freight rates. These additional costs are passed on to customers as far as possible. One expert added that higher costs cannot be passed on to customers if the products have a preliminary lead time of more than a year. Another participant argued that if the costs cannot be passed on to customers, it could also lead to a dissolution of certain products.

An investigation regarding the shifting dynamic of key players in maritime supply chains was undertaken in the second question. All experts maintained that freight forwarders play an essential part in global supply chains. The interviews confirmed that freight forwarders continue to be a vital part of supply chains in the coming decade.

To be competitive in future markets and without being passed over by shipping companies the following requirements would have to be met:

1. Offering integrated end-to-end service as an all-round service provider. Door-to-door logistics services combining transport and all intermediate functions like grouping, storing and handling freight as well as completing necessary documents and financial and legal transactions would be the main focus.
2. A high degree of flexibility in solving problems and troubleshooting, attempting to ensure short delivery times.
3. Considering the shippers' relevant environmental goals by e.g., avoid empty runs and $CO_2$ emissions.

One expert added that freight forwarders should provide an international transport network including alternative transport routes. They should be a link between the shipper and carrier as well as customs, officials and other authorities. One of the participants summed up that customer satisfaction relies on the reliability, competence and flexibility of the freight forwarders.

The last question dealt with the use of environmentally friendly means of transport. This topic increasingly arising in global supply chains is generally supported by all experts. Considering the future's need for $CO_2$ reduction, companies agreed to "acceptable" additional costs for environmentally friendly transport if the logistics performance remains the same. This means that companies do not lose their competitiveness edge in the market. A motivation for some of the participants would be a certificate of

official acknowledgement for more $CO_2$ friendly transport. This certificate is supposed to lead to market advantages compared to competing companies. No transport mode offers the same options as maritime, and this is why many experts have little option regarding choice of transport mode. A shift to rail, as one participant claimed, would be more environmentally friendly but is only possible with regularly processed quantities. Another interjected saying that a shift to rail would not run as efficiently as road transport. The reason is that rail traffic has frequent breakdowns, defective cranes at terminals or required rail repairs after storms. Another expert maintained that the rail transport infrastructure has immense potential for the future. If other transport capacities were increasingly limited or expensive, rail transport may gain logistical significance. One participant argued that environmentally friendly means of transport are already considered an important aspect when choosing freight forwarders.

# 5 Summary and Discussion of Results

In the following chapter the results of the conducted Delphi study are discussed. Factors directly affecting the purchasing decision of maritime transport services are focused on and future trends in the upstream supply chain are assessed. Finally, possible implications for practice and research are presented.

The result evaluation showed that three factors seem especially crucial when making a transport service decision, as they were rated extremely important by all 10 experts. These factors were *Punctuality and Time Precision*, *Service Provider's Reliability* and *Fast Response to any Problems*. The *Minimize Loss and Damage* and *Freight Space Availability* reached a final mean of 4,8, thus to be considered to be another key factor when making purchasing decisions. The factors with the lowest mean were *Lowest Price* (3,1) and *Special Offers or Discounts for Transport* (3,1) followed by *Environmental Concerns* (3,3) and *Completion of Documents by Carrier* (3,3). This reveals that factors that were rated highly concern the performance and the reliability of the transport service provider. It was interesting that factors regarding price and environmental awareness proved low relevance. These results were underlined by the answers the open-end question, where the shift from price issues to supply chain security was investigated. When asked if freight space on vessel is becoming more important than price, the Delphi panel's response was affirmative. The experts argued that in order to meet delivery times and ensuring on-time supply of production, higher freight rates are accepted in the demanding global markets of todays. Availability for freight space is today and will remain a challenge faced by all key players involved in maritime transport processes, who are under constant pressure to ensure punctual delivery.

The required Delphi consensus or level of agreement was reached for all factors after the second round except for *Lowest Price* and *Knowledge of used Ports*. This is of significant interest when analysing the ratings for price, as the answers vary from slightly important to extremely important. It is noticeable that in the second round, a consensus is reached for the importance of *Freight Space Availability* in contrast to the factor *Lowest Price*, where no consensus is found. Meaning that the participants demonstrated contrasting views regarding the importance of price when purchasing maritime transport services. Considering the mentioned importance of vessel space, it seems the expert panel is more concerned for the efficiency and continuance of their supply chain than what may be regarded in comparison a negligible price difference.

This view evidently differs from the findings of the conducted literature research, where price is considered most important when making a maritime transport purchasing decision.[186,187]

Environmental aspects were considered moderately important on average by the Delphi panel. This insight was similar to various research results considered in the third chapter of this thesis were the purchasing process for transport services and factors influencing the purchasing decision were investigated. The experts' opinion was intensifying the hypothesis that green aspects were not to be considered as most significant and that criteria such as price, quality and punctuality are in the foreground when making the purchasing decision.[188,189] Environmental concerns may play a role in the early selection processes for possible LSPs as the pressure to reduce the environmental impact is increasing. [190] Environmental aspects therefore are often a prerequisite for a cooperation but the purchasing decision itself is not based solely on sustainability.[191,192,193,194] The participants' opinion regarding an environmentally friendly mean of transport was investigated further to gain deeper insights, the question being, *what is the transport purchaser's opinion regarding environmentally friendly transport in their supply chain?* Results were that green factors are a consideration in the early choice of a freight forwarder and that this significance will increase in future supply chains. All participating experts generally support the use of environmentally friendly transport accepting reasonable additional costs for its use. The condition to this would be that the logistics performance remains the same and that the additional costs do not detrimentally affect their company's market competitiveness. One expert confirms that environmentally friendly means of transport are considered an important aspect when choosing freight forwarders. The experts might however also promote the use of more environmental transport because of increasing pressure to minimize environmental impact. Additionally, a few experts claim that a shift to rail would be more environmentally friendly but is only possible for regularly processed quantities while also not running as efficient as maritime transport. Maritime transport as the

[186] Lammgård, C.; Andersson, D. (2014)
[187] Sucky, E.; Haas, S. (2014)
[188] Sucky, E.; Haas, S. (2014)
[189] Lammgård, C.; Andersson, D. (2014)
[190] Sucky, E.; Haas, S. (2014), p.25ff.
[191] Wolf, C.; Seuring, S. (2010)
[192] Multaharju, S. et al. (2017)
[193] Jazairy, A.; von Haartman, R. (2020)
[194] Jazairy, A. (2020)

largest global transport form is therefore irreplaceable, offering the most transport capacity for covering vast distances with comparatively low cost. Reviewing these results, it can be said that environmental aspects are becoming increasingly crucial in global supply chains although green factors are not yet decisive in the purchasing of maritime transport services. They may be considered as a significant requirement in earlier LSPs selection and therefore not show in factors directly affecting the purchasing decision.

In the systematic literature research, it was emphasised that service attributes for freight forwarders prove vital for the purchasing process of transport services. [195] The analysis and clustering of the experts' statements listing freight forwarder qualities necessitated to prove competitive in future maritime supply chain markets was unanimous. Responses showed that the freight forwarder of the future should offer an integrated end-to-end service. This would include door-to-door transport and intermediate functions such as grouping, storing and handling freight as well as completing the paperwork and financial and legal transactions.[196] The advantage for shippers in this scenario is that only one contract and single point of contract is needed. The consideration of the relevant environmental goals of the shippers was also mentioned. Examples for that are the avoidance of empty runs and the reduction of $CO_2$ emissions. Freight forwarders stay a crucial link, acting as mediator between shippers, carriers as well as authorities. One expert argued that a reliable, experienced and flexible freight forwarder will remain of significant now as in 2030.

## 5.1 Research Limitations

At this point it can be observed that the study is not without limitations. Due to time constraints and the Delphi technique proving to be time-consuming, a third questionnaire round has not been used. Conducting another round would have provided the opportunity to gain a deeper understanding from the third consensus and stability analysis. Therefore, these insights may have differed slightly from the attained results after another Delphi round. Another possible limitation of the study is that the reason for not reaching consensus could not be found by the qualitative answers. Future research could extend the Delphi panel to investigate the reasons for this.

[195] Matear, S.; Gray, R. (1993)
[196] Rodrigue, J.-P. (2020), p.115.

Additional to that, the Delphi research method uses a rating scale in the questionnaire construction. The Five-Point-Likert scale is used as analysis of quantitative data within the target sample.[197] This facilitates well-informed opinions gathered from the expert panel regarding the factors influencing the purchasing decision. All the mentioned hypothesis and assumptions based on the rating of the factors are to be considered indications, as a ranking of the factors has not been topic of the research. Further standardized questionnaire design would minimize subjectivity and make quantitative research possible. This would go however beyond the scope of the present research.

## 5.1 Implication of Results and further Research

**For Practice:** The results of the conducted survey show that shippers are increasingly opting for one-stop procedures. This means that shippers submit decisions that require specific transport expertise, for example segments like customs, liability or law. Further research for practice could be to explore who will provide these door-to-door services in the future. Will it be the freight forwarders, who bring all the different links of the maritime transport service together or will it perhaps be the shipping companies or shipping alliances, who are already trying to combine transport with added functions like hinterland traffic.

Further research could also focus on the changing price dynamic when purchasing transport services. Where there used to be more room for negotiation and price discussions, today there is a clear service portfolio being offered. For shippers this portfolio is no longer negotiable. The argument that price is secondary or not so significant when making the transport service decision probably stems from the need to do the job. Meaning that if on-time transport is guaranteed and supply chain security can be maintained, the price is not that important. More reasons for this shifting dynamic could be explored.

**For Research:** What cannot be analysed from the research results is what difference in cost would affect the evaluation of how significant freight space is. Investigating this would provide further research possibilities. Based on the research findings, shippers support the use of environmentally friendly means of transport, however, the implementation is lacking. Further research could therefore be to study possible motivators for shippers to increase the use of environmentally friendly means of transport in their supply chains.

[197] N.N., https://www.questionpro.com/blog/what-is-likert-scale/ (Retrieved: 25.10.2022)

Another implication for research could be to investigate the reason for not reaching a consensus among the factors *Lowest Price* and *Knowledge of used Ports,* next to the question why *Lowest Price* is rated one of the most irrelevant factors in this study while it appears rather important in other literature. This could be explored further in future research.

Additionally, for deeper insights in the purchasing priorities, a ranking of the factors affecting the purchasing decision of maritime transport services would provide an order of the purchasing priorities, as only one factor could occupy each rank. This could be implemented e.g., by utilizing the Best-Worst Method in further research studies, while including more experts to identify possible differences across various industries.

# 6 Conclusion

Global transport processes and the shipping industry are constantly affected by various disruptions, such as the pandemic, environmental restrictions or price inflation. Therefore, maritime transport services need optimization to not affect the performance of the whole supply chain. This thesis explores factors influencing the purchasing process of maritime transport services and emerging inbound logistics trends.

Influencing purchasing factors are identified and considered a foundation for the empirical study investigating the main research question: *what factors influence the purchasing decision and which are the most relevant?* The Delphi method is chosen as an appropriate research method. It is applied in form of repetitive, anonymous questionnaires, where an expert panel evaluates the discovered factors according to their relevance. Results of the Delphi study show that factors regarding service provider's reliability and transport service performance have the highest rating. *Punctuality and Time Precision*, *Service Provider's Reliability* and *Fast Response to any Problems* seem most decisive when making a maritime transport purchasing decision, followed by *Freight Space Availability and Minimizing Loss and Damage*. This focus is further underlined by the forecasting questions, exploring future trends and shifts in maritime supply chains. Considering the question regarding price versus vessel availability, the experts state that the focus lies on freight space and punctual delivery. This is giving an insight into how critically overloaded ports and vessels are after various disruptions, starting with the Corona pandemic.

The observation of a freight forwarder's future role in transport results in an integrated end-to-end service as priority, providing a high level of flexibility while ensuring short delivery times. The ideal conception of a freight forwarder's services includes door-to-door logistics services, combining transport and all intermediate functions like grouping, storing and handling freight as well as completing all needed documents and financial and legal transactions. Further findings of this study show that all experts support the use of environmentally friendly transport in their supply chains. Although environmental factors are not rated very important and therefore seem less decisive when making a transport purchasing decision, they could play a role in earlier stages of the purchasing process, e.g., the pre-selection of logistics service providers.

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# Appendix

The exact evaluations and answers of both questionnaires as well as the structure of both questionnaires are presented in the following. The necessary formulas for the calculations have been added too.

The absolute coefficient of variation difference between the two conducted rounds has been used to test stability. The formula to calculate the CV is:

$$CV = \frac{Standard\ Deviation}{Mean}$$

The interquartile range for consensus measurement has been used. The interquartile range is the absolute difference between the 75$^{th}$ percentile and the 25$^{th}$ percentile, which can be found as explained in the following steps:

1. Ordering the data from least to greatest
2. Finding the median (value exactly in the middle of the data)
3. Calculating the median of both the lower and upper half of the data
4. The IQR is the difference between the median of the upper half (Q3) and the median of the lower half (Q1)

$$IQR = Q3 - Q1$$

The factor evaluation of the first Delphi round:

| Faktor (Bewertung 1) | Wert 1 | Wert 2 | Wert 3 | Wert 4 | Wert 5 | Wert 6 | Wert 7 | Wert 8 | Wert 9 | Wert 10 | Mean | Standard Deviation | CV1 | Q1 | Q3 | IQR1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| billigster/niedrigster Preis | 4 | 4 | 2 | 4 | 5 | 3 | 3 | 5 | 3 | 5 | 3.8 | 1.033 | 0.27 | 3 | 4.75 | 1.75 |
| Verhältnis von Preis und Qualität | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4.5 | 0.527 | 0.12 | 4 | 5 | 1 |
| Expertise des Dienstleisters | 2 | 4 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 4.2 | 0.919 | 0.22 | 4 | 5 | 1 |
| Umwelteffizienz/Umweltaspekt | 2 | 4 | 4 | 4 | 2 | 3 | 4 | 2 | 3 | 4 | 3.2 | 0.919 | 0.29 | 2.25 | 4 | 1.75 |
| Pünktlichkeit/Zeitgenauigkeit | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4.9 | 0.316 | 0.06 | 5 | 5 | 0 |
| Zuverlässigkeit des Dienstleisters | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4.9 | 0.316 | 0.06 | 5 | 5 | 0 |
| Geographische Abdeckung | 2 | 4 | 2 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 3.4 | 0.966 | 0.28 | 2.5 | 4 | 1.5 |
| Transportzeit/kurze Transitzeit | 4 | 5 | 5 | 4 | 2 | 4 | 4 | 4 | 3 | 4 | 3.9 | 0.876 | 0.22 | 4 | 4 | 0 |
| Umwelt- u. Sozialkonformität | 2 | 4 | 4 | 3 | 2 | 3 | 4 | 3 | 3 | 4 | 3.2 | 0.789 | 0.25 | 3 | 4 | 1 |
| Schnelle Reaktion auf Probleme | 3 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4.7 | 0.675 | 0.14 | 5 | 5 | 0 |
| Vermeiden von Verlust u. Schäden | 4 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 4.5 | 0.850 | 0.19 | 4.25 | 5 | 0.75 |
| Beziehung zu Dienstleistern | 3 | 3 | 4 | 4 | 3 | 4 | 5 | 5 | 4 | 5 | 4 | 0.816 | 0.20 | 3.25 | 4.75 | 1.5 |
| Fähigkeit, unvorhergesehene dringende Lieferungen durchzuführen | 4 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 5 | 4.6 | 0.516 | 0.11 | 4 | 5 | 1 |
| Fähigkeit, Sendungen mit besonderen Anforderungen abzuwickeln | 4 | 4 | 5 | 4 | 3 | 4 | 5 | 5 | 4 | 5 | 4.3 | 0.675 | 0.16 | 4 | 5 | 1 |
| hohe Servicefrequenz | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4.2 | 0.422 | 0.10 | 4 | 4 | 0 |
| vom Dienstleister ausgefüllte Dokumente | 3 | 4 | 4 | 2 | 3 | 3 | 4 | 3 | 4 | 4 | 3.4 | 0.699 | 0.21 | 3 | 4 | 1 |
| Sonderangebote/Rabatte | 3 | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 0.471 | 0.16 | 3 | 3 | 0 |
| Wissen, über angefahrene Häfen | 3 | 3 | 5 | 3 | 4 | 3 | 5 | 4 | 3 | 4 | 3.7 | 0.823 | 0.22 | 3 | 4 | 1 |
| Verfügbarkeit von Frachtraum | 4 | 5 | 4 | 4 | 5 | 3 | 5 | 5 | 5 | 5 | 4.5 | 0.707 | 0.16 | 4 | 5 | 1 |

The open-ended questions of the first Delphi round:

| *The market reflects a shift from price issues to supply chain security. Is the space on a vessel becoming more important than the price and how is this reflected in a supply chain?* | *What will the freight forwarder's role in transport be like in 2030?* | *What is your opinion regarding environmentally friendly transport in your supply chain? Under which circumstances would you be prepared to pay more for their implementation?* |
|---|---|---|
| man wird gezwungen den verfügbaren Schiffsplatz zu völlig überteuerten Summen zu nehmen, wenn man nicht alternativ die Ware per Luftfracht versendet, und man versucht die Kosten an den Kunden weiterzugeben | flexibler Allrounddienstleister | wenn man dafür ein Zertifikat bekommt, dass man gut vermarkten kann |
| Schiffsplatz ist derzeit enorm wichtig, da eine Unterbrechung der Lieferkette nicht akzeptabel ist. Somit ist ein höherer Preis derzeit gerechtfertigt | Äußerst wichtig, da die Lieferkette nicht unterbrochen werden soll und Verzögerungen zu enormen Aufwänden führen | Umweltschonende Transportmittel sollten wo immer möglich zum Einsatz kommen.<br>Wenn die gesamte Performance unseren Anforderungen entsprechen würde, dann wäre ein adäquater Zuschlag dahingehend akzeptabel |
| Die Sicherheit der Lieferkette ist aus heutiger Sicht wichtiger als der Preis, wir müssen produzieren und liefern. Leider hat dies auch höhere Transportkosten zu folge und diese müssen leider auf unsere Produkte hochgerechnet werden. | 2030 wird es mehr und mehr auf die Umwelt ankommen, jedes Unternehmen muss gewisse CO2-Werte einhalten. Dies wird auch die Spediteure immer mehr treffen, Leerfahrten werden vermieden und ich gehe davon aus das gewisse Geschäfte (zu hohe CO2-Werte) abgelehnt werden. | Wir versuchen schon seit langer Zeit unsere CO2-Werte zu reduzieren und weichen immer mehr auf BAHN und SEEFRACHT aus. Leider ist dies bei den heutigen Verzögerungen in der Lieferkette nicht mehr so einfach. Ja wir wären bereit dafür mehr zu bezahlen. |
| Teilweise wird es immer schwieriger Lieferungen zu planen, aufgrund der zunehmenden Unsicherheiten im Transportbereich. | Ich denke der Umweltschutz wird eine noch wichtigere Rolle im Bereich Transport spielen.<br>Des Weiteren besteht die Kernkompetenz nach wie vor in den Bereichen: Zuverlässigkeit, Preisgestaltung, Verfügbarkeit, Service und Abwicklung. | Für viele Unternehmen, uns eingeschlossen wird es immer wichtiger CO2 reduzierte bzw. CO2 neutrale Transportmittel zu verwenden.<br>Bei einer gleichbleibenden Leistung und Qualität der Abwicklung werden Unternehmen meiner Meinung nach durchaus höhere Kosten in Kauf nehmen. |

| | | |
|---|---|---|
| Voranging ist er Preis, jedoch bei Platzmangel wird auch der erhöhte Preis in Kauf genommen, wenn die Ware just in time sein muss.<br>Aufgrund er erhöhten Transportkosten, welche beim Einkauf wie auch beim Verkaufspreis bemerkbar sind, führt dies zum Marktnachteil, da die Preise in gewissen Bereichen nicht mehr attraktiv sind. | Nach wie vor unentbehrlich. | Meine persönliche Meinung dazu ist, wenn etwas via Schiff oder Flugzeug von A-B transportiert wurde (hier kann man ja nur schwer auf umweltschonend umstellen bis dato) rettet der Nachlauf den bereits nicht umweltfreundlichen Haupttransport (80%) nicht mehr. Ob die restlichen 20% des Transports mit Elektrofahrzeug oder Treibstoffbetrieben stattfinden ist auf das Gesamte gesehen nur ein "Tropfen auf dem heißen Stein"<br>Wenn die gesamte Lieferkette umweltfreundlich stattfinden würde und die Transportkosten dafür nicht grad ums doppelte erhöht werden, im Vergleich zur "Umwelt - unfreundlichen" Variante, wäre dies eine Überlegung wert, jedoch sehr wahrscheinlich unrealistisch :-) |
| Für uns ist wichtig das Lieferung rechtzeitig bei uns eintreffen und dafür sind wir auch bereit einen höheren Preis zu bezahlen. | Der Spediteur ist natürlich auch 2030 noch ein ganz wichtiger Bestandteil der div. Lieferketten. Um Kundenbestellungen zeitnah abzuwickeln ist es notwendig das bestellte Waren rasch bei uns eintreffen, bzw. Kundenware ehestmöglich auf den Weg geschickt werden können. | Wenn der Preis im Rahmen bleibt, sind wir natürlich auch gewillt für die div. Transporte mehr zu bezahlen, um die Umwelt zu entlasten. |
| Sicherheit ist extrem wichtig im pharmazeutischen Bereich. Die Kosten spielen allerdings bei der aktuellen Preisentwicklung der Arzneimittel im Europäischen Raum ebenfalls eine gravierende Rolle. | Als Allrounder und Troubleshooter. | Absolut offen dafür. Wenn es im kommerziellen Bereich umsetzbar ist, auf jeden Fall. |
| Ein Preis ohne Schiffsplatz hat keinen Wert d.h., bei kleinen Aufträgen wird Preis inkl. Schiffsplatz im RFQ angefragt und auch nur an den Dienstleister vergeben, der Schiffsplatz garantieren kann.<br>Einfluss auf die Lieferketten -> neben den Preis auf alle Fälle längere Lieferzeiten! | Spediteure sollten ihre Rolle als Service-Dienstleister für die verladende Wirtschaft unbedingt weiterausbauen - nur dann macht es auch weiterhin Sinn, dass Unternehmen nicht direkt bei Reedereien einkaufen, sondern weiter den Weg über die Spedition wählen. | z.b., Bahn: hier braucht es vor allem auch eine Steigerung/Umdenken in der Performance bzw. Art u. Weise der Abwicklung. Hier fehlt teilweise auch noch der Service-Gedanke. Unternehmen mit nicht regelmäßigen Mengen sind aktuell für die Bahn uninteressant... |
| Schiffsplatz oder Containerkapazität ist jetzt schon wichtiger als Preis. Preis muss vorher kalkuliert werden. Bekommt man aber keinen Container oder Schiffsplatz, kommt Ware verspätet und ist ev. Nicht mehr verkaufbar. | Qualität und Kompetenz werden immer wichtiger werden. Auch werden Zusatzleistungen wie Lagerkapazität verlangt werden. Alleine den Transport durchzuführen ist zu wenig. | Dies muss vom Gesetzgeber vorgeschrieben werden. Falls dies nicht der Fall ist, wird es immer Unternehmen geben die sich dann einen Preisvorteil schaffen. |
| Liefersicherheit ist zurzeit wichtiger als der Preis um die Liefersicherheit gewähren zu können | Die Rolle der Speditionen werden in Zukunft noch wichtiger werden da die zuverlässigen Speditionen Mangelware werden | Für eine nachhaltige und umweltschonenden Möglichkeit sind wir auch bereit mehr für den Transport zu bezahlen. |

The factor evaluation of the second and modified Delphi round:

| Faktor (Bewertung 2) | Wert 1 | Wert 2 | Wert 3 | Wert 4 | Wert 5 | Wert 6 | Wert 7 | Wert 8 | Wert 9 | Wert 10 | Mean | Standard Deviation | CV2 | Q1 | Q3 | IQR2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| billigster/niedrigster Preis | 2 | 4 | 3 | 2 | 4 | 3 | 3 | 5 | 2 | 3 | 3.10 | 0.994 | 0.32 | 2.25 | 3.75 | 1.5 |
| Verhältnis von Preis und Qualität | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4.5 | 0.527 | 0.12 | 4 | 5 | 1 |
| Expertise des Dienstleisters | 4 | 3 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4.2 | 0.632 | 0.15 | 4 | 4.75 | 0.75 |
| Umwelteffizienz/Umweltaspekt | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 2 | 3 | 3 | 3.3 | 0.675 | 0.20 | 3 | 4 | 1 |
| Pünktlichkeit/Zeitgenauigkeit | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0.000 | 0.00 | 5 | 5 | 0 |
| Zuverlässigkeit des Dienstleisters | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0.000 | 0.00 | 5 | 5 | 0 |
| Geographische Abdeckung | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 2 | 3.7 | 0.823 | 0.22 | 3.25 | 4 | 0.75 |
| Transportzeit/kurze Transitzeit | 5 | 4 | 4 | 5 | 5 | 3 | 4 | 4 | 5 | 4 | 4.3 | 0.675 | 0.16 | 4 | 5 | 1 |
| Umwelt- u. Sozialkonformität | 4 | 4 | 4 | 5 | 3 | 4 | 3 | 3 | 4 | 3 | 3.7 | 0.675 | 0.18 | 3 | 4 | 1 |
| Schnelle Reaktion auf Probleme | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0.000 | 0.00 | 5 | 5 | 0 |
| Vermeiden von Verlust u. Schäden | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 4.8 | 0.422 | 0.09 | 5 | 5 | 0 |
| Beziehung zu Dienstleistern | 5 | 4 | 4 | 4 | 5 | 4 | 3 | 4 | 5 | 4 | 4.2 | 0.632 | 0.15 | 4 | 4.75 | 0.75 |
| Fähigkeit, unvorhergesehene dringende Lieferungen durchzuführen | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 4.7 | 0.483 | 0.10 | 4.25 | 5 | 0.75 |
| Fähigkeit, Sendungen mit besonderen Anforderungen abzuwickeln | 5 | 3 | 4 | 5 | 5 | 4 | 3 | 4 | 4 | 5 | 4.2 | 0.789 | 0.19 | 4 | 5 | 1 |
| hohe Servicefrequenz | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4.4 | 0.516 | 0.12 | 4 | 5 | 1 |
| vom Dienstleister ausgefüllte Dokumente | 3 | 2 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | 3.3 | 0.675 | 0.20 | 3 | 4 | 1 |
| Sonderangebote/Rabatte | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3.1 | 0.568 | 0.18 | 3 | 3 | 0 |
| Wissen, über angefahrene Häfen | 5 | 3 | 5 | 5 | 4 | 3 | 3 | 4 | 5 | 3 | 4 | 0.943 | 0.24 | 3 | 5 | 2 |
| Verfügbarkeit von Frachtraum | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4.8 | 0.422 | 0.09 | 5 | 5 | 0 |

The open-ended questions of the second and modified Delphi round:

| *The market reflects a shift from price issues to supply chain security. Is the space on a vessel becoming more important than the price and how is this reflected in a supply chain?* | *What will the freight forwarder's role in transport be like in 2030?* | *What is your opinion regarding environmentally friendly transport in your supply chain? Under which circumstances would you be prepared to pay more for their implementation?* |
|---|---|---|
| ja stimme zu, wobei nicht alle Kosten an den Kunden weitergegeben werden. Unsere Produkte benötigen eine lange Vorlaufzeit, 1-1,5 Jahre, deshalb können nicht alle Preiserhöhungen weitergegeben werden. | ja ich stimme dieser Aussage zu | Vollkommen richtig. Die Verlagerung auf die Schiene ist nur bei Standardware möglich, diese haben wir leider nicht. |
| ich stimme zu, Spediteure übertrumpfen sich gegenseitig, um gegenüber Kunden als eine Spedition zu stehen, die besonders zuverlässige Lieferketten anbieten | 4. ein internationales Netzwerk an Transportmöglichkeiten inkl. alternativen Transportrouten anbieten 5. ein Bindeglied zwischen Verlader und Zoll bzw. Behören- vor allem kleinere Unternehmen haben keine eigenen Zollbeauftragten | Dabei zu Bedenken ist auch, dass die Infrastruktur für Schienenverkehr ein größeres Potential besitzt, dass von einfachen Paketversand bis Container reichen kann. Wären andere Transportkapazitäten wie See und Luft eingeschränkter oder zu kostspielig würden Schienentransport eine wesentlich größere Bedeutung bekommen. |
| Nicht jede Sparte hat die Möglichkeit, höhere Kosten an den Kunden weiterzugeben. Dies wird möglicherweise zur Auflassung etablierter Produkte führen. | Stimme vollumfänglich zu. | Stimme zu. |
| Ich stimme dieser Aussage zu. | Ich stimme dieser Aussage zu. | Ich stimme dieser Aussage zu. |
| Ja ich stimme der Aussage zu, allerdings können Kosten nicht immer an den Kunden weitergegeben werden und deshalb bleibt der Transportpreis auch weiterhin wichtig. | Stimme voll zu. | Ja stimme zu. |

| | | |
|---|---|---|
| Stimme ich zu. | Stimme ich zu. | Stimme ich zu. |
| Ich stimme dieser Aussage zu, da eine Verzögerung der Transporte zu massiven Mehrkosten führt, welche nicht in Relation zu den höheren Raten stehen. | Ich stimme auch dieser Aussage zu, allerdings sind diese Eigenschaften auch jetzt schon ein wesentlicher Faktor bei der Auswahl der Speditionen | Ja ich stimme dieser Aussage zu. Bereits heute ist der Umweltfaktor in unserem Unternehmen ein wesentlicher Bestandteil im Auswahlverfahren. |
| ja sehen wir genau gleich | genau gleich wichtig wie 2022, 2023, 2024 | Kann ich mir nicht vorstellen, dass bei einer Verlagerung auf die Schiene alles reibungslos ablaufen kann, wie im Straßentransport. Schienenverkehr hat auch des Öfteren Ausfälle (Schienen-Reparatur, Unwetter, Kran defekt am Terminal usw.). Glaube das die Zustellqualität leichter zum Einhalten ist im Straßenverkehr wie im Schienenverkehr. |
| Stimme ich zu. | Um die Zufriedenheit unserer Kunden beizubehalten, benötigen wir einen Spediteur, der verlässlich, kompetent und flexibel ist. Nicht der niedrigste Preis ist das Ziel, sondern das Einhalten zugesagter Lieferzeiten. | Stimme ich zu. |
| stimme ich zu. | Stimme ich zu. | Stimme ich zu. |

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# Delphi Studie – Fragebogen 1

Branche Ihres Unternehmens: _____

Größe Ihres Unternehmens: _____

Ihre Rolle/Position im Unternehmen: _____

**Welche Faktoren beeinflussen Ihrer Meinung nach die Kaufentscheidung für Seetransportdienstleistungen? Bewerten Sie die folgenden Faktoren nach Wichtigkeit:**

| | überhaupt nicht wichtig | etwas wichtig | relativ wichtig | sehr wichtig | äußerst wichtig |
|---|---|---|---|---|---|
| billigster/niedrigster Preis | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Verhältnis von Preis und Qualität | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Expertise des Dienstleisters | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Umwelteffizienz/Umweltaspekt | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Pünktlichkeit/Zeitgenauigkeit | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Zuverlässigkeit des Dienstleisters | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Geographische Abdeckung | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Transportzeit/kurze Transitzeit | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |
| Umwelt- u. Sozialkonformität | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| *Anmerkung/Begründung:* | | | | | |

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Schnelle Reaktion auf Probleme ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Vermeiden von Verlust u. Schäden ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Beziehung zu Dienstleistern ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Fähigkeit, unvorhergesehene dringende Lieferungen durchzuführen ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Fähigkeit, Sendungen mit besonderen Anforderungen abzuwickeln ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

hohe Servicefrequenz ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

vom Dienstleister ausgefüllte Dokumente ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Sonderangebote/Rabatte ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Wissen, über angefahrene Häfen ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

Verfügbarkeit von Frachtraum ○ 1 ○ 2 ○ 3 ○ 4 ○ 5
*Anmerkung/Begründung:*

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**Der Markt reflektiert eine Verschiebung von der Preisthematik hin zur Sicherheit der Lieferkette. Wird Schiffsplatz wichtiger als der Preis und wie schlägt sich das in Ihrer Lieferkette nieder?**

**Wie sehen Sie in 2030 die Rolle des Spediteurs im Transport?**

**Wie stehen Sie zum Einsatz von umweltschonenden Transportmitteln in Ihrer Lieferkette? Unter welchen Umständen wären Sie bereit, mehr für deren Einsatz zu bezahlen?**

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# Delphi Studie – Fragebogen 2

Nachfolgend finden Sie die gleichen 3 Fragen wie in Fragebogen 1, jedoch ergänzt um die kollektive Gruppenmeinung.

**Der Markt reflektiert eine Verschiebung von der Preisthematik hin zur Sicherheit der Lieferkette. Wird Schiffsplatz wichtiger als der Preis und wie schlägt sich das in Ihrer Lieferkette nieder?**
Antwort: *Zunehmende Unsicherheiten erschweren derzeit die Planung von Transporten. Deshalb hat Schiffsplatz, der die zeitgerechte Versorgung der Produktion gewährleistet, oberste Priorität. Schiffsplatz, der garantiert wird, ist daher auch signifikant höhere Frachtraten wert, um Unterbrechungen der Lieferkette zu vermeiden und Lieferzeiten einzuhalten. Die höheren Kosten werden so weit wie möglich an Kunden weitergegeben.*
**Stimmen Sie dieser Aussage zu? Was sehen Sie anders oder würden Sie ergänzen?**

**Wie sehen Sie in 2030 die Rolle des Spediteurs im Transport?**
Antwort: Der Spediteur ist 2030 noch immer *wesentlicher Bestandteil der Lieferkette. Um 2030 wettbewerbsfähig zu sein, muss der Spediteur folgende Eigenschaften erfüllen:*

1. *ganzheitliche End-to-End Services als Allrounddienstleister anbieten – das bedeutet nicht nur Transport allein, sondern bspw. auch verfügbare Lagerkapazitäten*
2. *ein hohes Maß an Flexibilität aufweisen, um als „Troubleshooter" agieren und möglichst kurze Lieferzeiten sicherstellen zu können*
3. *auf umweltrelevante Ziele der Verlader Rücksicht nehmen, bspw. Vermeidung von Leerfahren und CO2-Emissionen*

**Stimmen Sie dieser Aussage zu? Was sehen Sie anders oder würden Sie ergänzen?**

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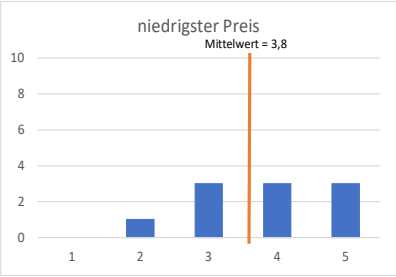
**Wie stehen Sie zum Einsatz von umweltschonenden Transportmitteln in Ihrer Lieferkette? Unter welchen Umständen wären Sie bereit, mehr für deren Einsatz zu bezahlen?**
Antwort: *Der Einsatz von umweltschonenden Transportmitteln wird grundsätzlich befürwortet. Angesichts der zukünftigen Notwendigkeit zur CO2 Reduktion der Unternehmen sind auch „adäquate" Mehrkosten für effektiv umweltschonende Transport bei gleichbleibender Logistikleistung akzeptabel. „Adäquat" bedeutet dabei, dass Unternehmen dadurch nicht die Wettbewerbsfähigkeit am Markt verlieren darf. Marketingwirkung kann fehlende gesetzliche Auflagen kompensieren. Vorausgesetzt ist natürlich, dass die operative Umsetzbarkeit grundsätzlich möglich ist, was derzeit kaum der Fall ist. Eine Verlagerung auf die Schiene ist bspw. nur bei regelmäßig abgewickelten Mengen umsetzbar.*
**Stimmen Sie dieser Aussage zu? Was sehen Sie anders oder würden Sie ergänzen?**

**Wie würden Sie nun mit dem Wissen über die kollektiven Antworten der vorherigen 3 Fragen die Faktoren für die Kaufentscheidung von Seetransportdienstleistungen bewerten?**
Daneben sehen Sie die Auswertung der Antworten aus der ersten Befragungsrunde.

| | überhaupt nicht wichtig | etwas wichtig | relativ wichtig | sehr wichtig | äußerst wichtig |
|---|---|---|---|---|---|
| niedrigster Preis | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |

*Anmerkung/Begründung:*



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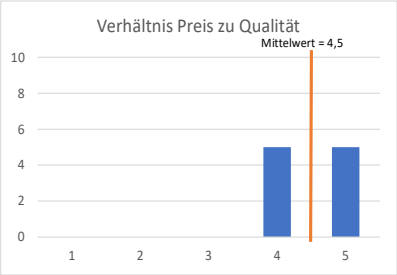
Verhältnis Preis zu Qualität ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




Expertise des Dienstleisters ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

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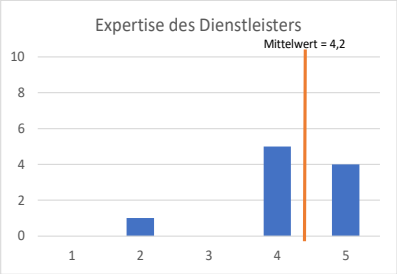
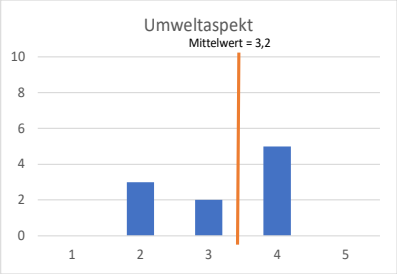


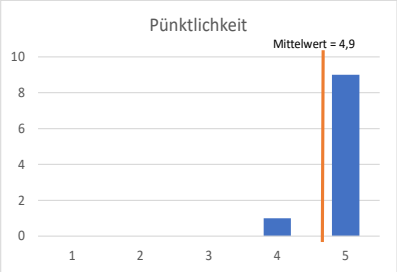

Umweltaspekt ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




Pünktlichkeit ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




Zuverlässigkeit des Dienstleisters ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

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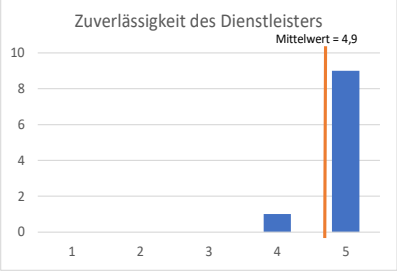

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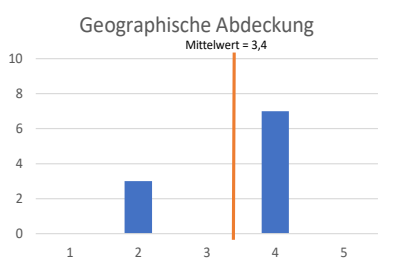
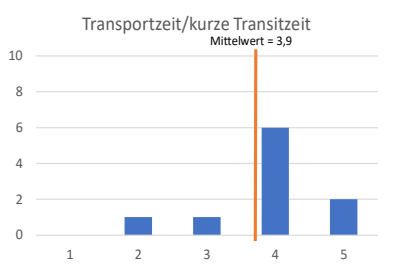
Geographische Abdeckung ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



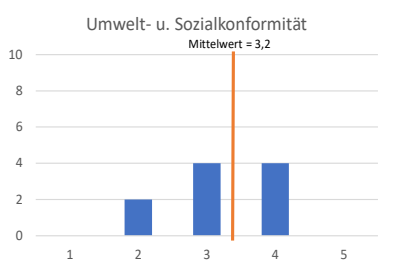

Transportzeit/kurze Transitzeit ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



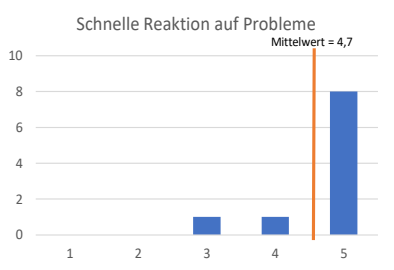

Umwelt- u. Sozialkonformität ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



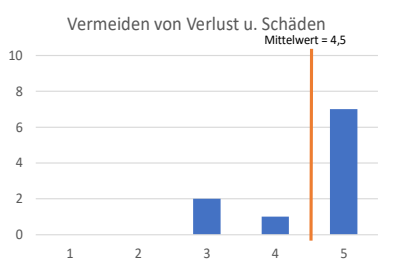

Schnelle Reaktion auf Probleme ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




Vermeiden von Verlust u. Schäden ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



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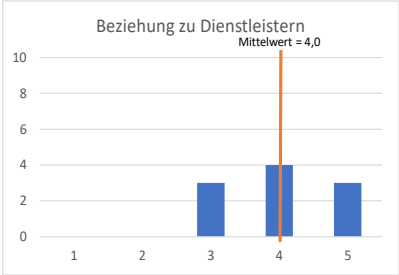
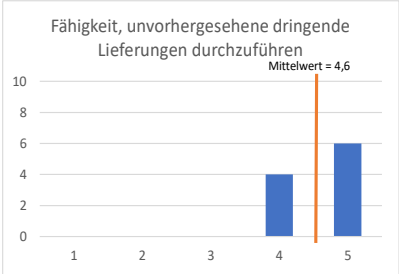
Beziehung zu Dienstleistern ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



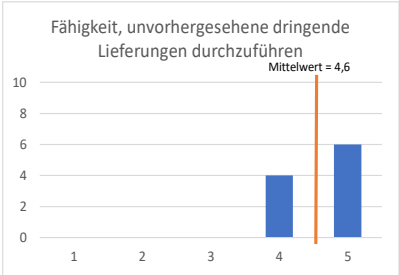

Fähigkeit, unvorhergesehene dringende Lieferungen durchzuführen ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



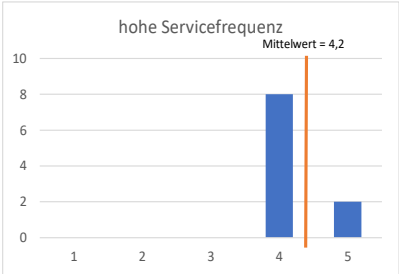

Fähigkeit, Sendungen mit besonderen Anforderungen abzuwickeln ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



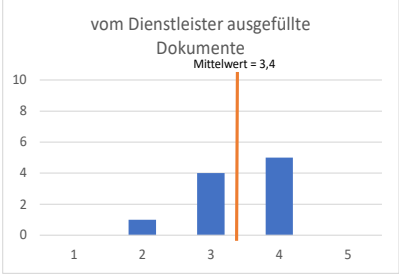

hohe Servicefrequenz ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




vom Dienstleister ausgefüllte Dokumente ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



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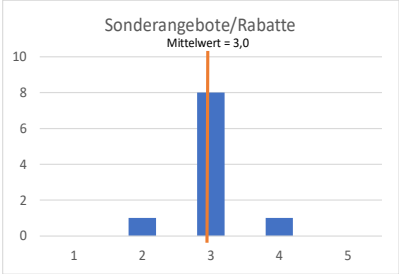
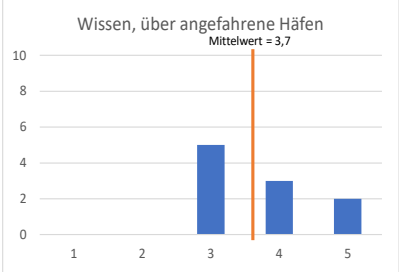
Sonderangebote/Rabatte ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*



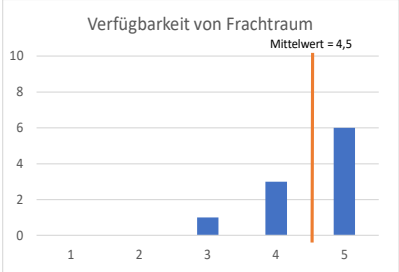

Wissen, über angefahrene Häfen ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




Verfügbarkeit von Frachtraum ○ 1 ○ 2 ○ 3 ○ 4 ○ 5

*Anmerkung/Begründung:*




**Vielen Dank, dass Sie an meiner Umfrage teilgenommen haben!**