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Incorporating Sustainability as a Parameter in the Ocean Carrier Selection Process

A Study Conducted at a Case Company

Master's Thesis in Supply Chain Management

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Abstract

The study has been conducted at a case company in the biomaterials and paper business that delivers products worldwide. Procuring transportation services is critical due to its significant share of logistics costs and impact on business performance. The case company transports a large share of their products through maritime transport, hence, selecting ocean carriers that can meet their needs is critical. Maritime transport is considered environmentally friendly as it carries large volumes over long distances. However, it still faces significant sustainability challenges, including rising GHG emissions and air pollution. Sustainability is a key component of the case company's corporate strategy and governance, and they want it to influence all aspects of their operations, including logistics. Therefore, the purpose of the thesis is to develop a framework for successful incorporation of sustainability as a parameter in companies' LSP selection process for maritime transport.

To fulfill this purpose, the current procurement process for maritime transport at the case company had to be identified. Secondly, through a literature review and empirical findings, suitable sustainability criteria for the container segment within maritime transport were identified. After this, a method that integrates sustainability as a parameter in selecting ocean carriers was developed. It regards the construction of a sustainability performance index which facilitates the assessment of ocean carriers' sustainability performance by weighting and aggregating criteria scores. To obtain scores, a questionnaire based on identified sustainability criteria was created. The AHP method is recommended for weighting and an additive aggregation method for compiling weighted scores into sub-indices within each dimension which together form the sustainability performance index. Lastly, a framework was developed for how sustainability can be integrated as a parameter in the selection process. It is recommended to consider sustainability throughout the selection process to guarantee that ocean carriers' performance is taken into account.

In conclusion, implementation of the developed framework will improve the case company's' selection process, enabling better evaluation and comparison of ocean carriers' sustainability performances.

Keywords: Sustainability, Ocean Carrier Selection, Maritime Transport, LSP Selection, Sustainability Criteria, Sustainability Performance Index

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Alicia Eriksson & Elin Rejgård, Gothenburg, June 2024

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List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

AHP	Analytical Hierarchy Process
CC	Clean Cargo
CI	Consistency Index
CII	Carbon Intensity Indicator
CR	Consistency Ratio
CSDDD	Corporate Sustainability Due Diligence Directive
CSI	Clean Shipping Index
CSPI	Composite Sustainability Performance Index
CSRD	Corporate Sustainability Reporting Directive
EEDI	Energy Efficiency Design Index
EEXI	Energy Efficiency Existing Ship Index
EU	European Union
ESG	Environmental, Social, and Governance
ESI	Environmental Ship Index
ETS	Emissions Trading System
GHG	Greenhouse Gas
GMSC	Global Maritime Supply Chains
HVO	Hydrogenated Vegetable Oil
IMO	International Maritime Organization
LBG	Liquid Biogas
LNG	Liquified Natural Gas
LSP	Logistics Service Provider
MCDM	Multi-Criteria Decision-Making
MTS	Maritime Transport System
NOx	Nitrogen Oxide
RFI	Request for Information
RFQ	Request for Quotation
SBT	Science-Based Targets
SCoC	Supplier Code of Conduct
SEEMP	Ship Energy Efficiency Management Plan
SFC	Smart Freight Centre
SOLAS	Safety of Life at Sea
SOx	Sulfur Oxide
STCW	Standards of Training, Certification, and Watchkeeping for Seafarers
TBL	Triple Bottom Line
TEU	Twenty-Foot Equivalent Unit
UNCLOS	The United Nations Convention on the Law of the Sea

1 Introduction

This chapter provides background to the research topic together with a company and problem description. The thesis' preliminary aim, which is broken down into three research questions, and the demarcations is then presented.

1.1 Background

The basic idea of transportation is to move products from point A to B (Holter et al., 2008). To reach customers, companies can use several transport modes, for example, maritime, rail, and road transport. Maritime transportation is a central part of the transportation system as it carries around 90% of the global trade volume (Christiansen et al., 2007; Kronfeld-Goharani, 2018). Different transport modes bring various advantages and companies have to consider their transport needs. Additionally, most companies no longer manage their own transport but instead outsource it to logistics service providers (LSPs)(Christiansen et al., 2007; Jovčić et al., 2019; Styhre et al., 2023).

The procurement of transportation services is critical for companies that outsource transportation since it has an impact on business performance due to its high share of total logistics costs and its effect on customer service. On top of this, there are several challenges connected to transportation, making it crucial for companies to select adequate LSPs for their specific needs. The selection of LSP is described as a typical multi-criteria decision-making (MCDM) problem. The complexity of the decision is due to the many criteria that have to be compared and evaluated. For instance, trade-offs are typically made between criteria such as cost and quality (Holter et al., 2008; Jovčić et al., 2019). Furthermore, there is increased pressure on businesses to adopt sustainable practices and many have committed to sustainability objectives, which differ from cost-saving objectives, resulting in different procurement behaviors (Bals et al., 2018; Gupta et al., 2022). Since transportation greatly influences a company's supply chain performance in terms of sustainability, it is important to consider environmental, economic, and social aspects in the selection of LSPs (Paul et al., 2020).

Moreover, researchers and practitioners' interest in sustainability related to the maritime transport industry and its carbon footprint has been growing the last years. Maritime transport has been identified as a transport mode with great potential to enable further sustainable development in the transport sector as it is relatively energy-efficient (Benamara et al., 2019; Mansouri et al., 2015). Still, there is room for improvement as major sustainability issues can be detected within maritime transport. For instance, it contributes to 3% of the total global greenhouse gas (GHG) emissions, releases harmful air pollutants such as nitrogen oxide (NOx) and sulfur oxide (SOx) and there is a risk of poor working conditions for seafarers (Altuntaş Vural et al., 2021; Gibson et al., 2019; Malmgren et al., 2023). All parties involved in the maritime transportation industry have a shared obligation to work

together to make the industry more sustainable. Research shows that there is a need for companies buying the transport service to express sustainability requirements in the selection process to show that it is a part of the assessment when selecting an ocean carrier (IVL, 2022).

1.1.1 Company and Problem Description

This study has been conducted at a large Scandinavian company that produces biomaterials and paper products, from now on referred to as the case company. The case company operates in a global environment and its values are based on enhancing human and environmental well-being. They have committed to contributing to a more sustainable future and have set ambitious sustainability targets. Since sustainability is a central part of the company's strategy and corporate governance, they want it to pervade all parts of their business, including logistics. However, the purchasing function at the case company's logistics department has stayed consistent in their ways of working over the last years. According to Pagell et al. (2010) and Weele and Rozemeijer (2022) there is growing pressure for procurement to adapt their ways of working to become strategically involved and improve sustainability. Therefore, the case company needs to evolve its procurement function to be able to contribute to the company's strategy and sustainability targets. This is especially important within the procurement of maritime transport as it accounts for a large share of the company's total transport volume. Despite previous efforts to include sustainability criteria when evaluating and selecting maritime transport providers, i.e. ocean carriers, the main focus is still on price and service requirements. This is mainly due to the complexity of translating sustainability demands into quantifiable criteria and integrating them into the current procurement process.

At the case company, the identified problem is the integration of sustainability as a parameter in the selection of LSPs and how procurement can contribute to their overall strategy and sustainability goals. This is a typical struggle for many companies. Mogre et al. (2017) addresses that it is common that the supplier selection process is poorly integrated with the overall corporate sustainability strategy and claims that more research is needed in the area. Additionally, previous studies show that sustainability aspects tend to be overlooked during the LSP selection process, instead, the main focus is on cost and service quality (Bajec and Tuljak-Suban, 2017; Jung, 2017). According to Prabodhika et al. (2020) and Roy et al. (2020) there is limited research that focuses on how to integrate environmental, social, and economic criteria in the LSP selection. As the selection of LSP for transportation greatly influences a company's sustainability performance, it is critical to avoid poor integration of sustainability criteria and an insufficient LSP evaluation (Paul et al., 2020). However, most studies on this topic are focused on road transport, resulting in a need for more studies on maritime transport as it is critical for world trade and has characteristics that differ from road transport. For instance, there are only a few competing ocean carriers available for selection (Ergin and Alkan, 2023; Malmgren et al., 2023). Therefore, the thesis will not only help to solve the highlighted problem at the case company, but also contribute to the identified research gap.

1.2 Purpose

The purpose of the thesis is to develop a framework for successful incorporation of sustainability as a parameter in companies' LSP selection process for maritime transport. To achieve this, criteria and methods that enable consideration of sustainability as a parameter during the selection will be identified. The current procurement process of maritime transport at a case company will be analyzed to determine how the developed framework can be integrated into the selection process.
Three research questions have been formulated in order to fulfill the purpose:

1. How is the case company's LSP selection process for maritime transport designed and carried out today?

The first research question is formulated to gain knowledge about the LSP selection process for maritime transport in which the framework will be implemented. The current process at the case company will be identified.

2. What criteria and method enable consideration of sustainability as a parameter during the LSP selection for maritime transport?

Once the LSP selection process for the case company has been identified, the next step will be to establish which sustainability criteria are appropriate for assessing LSP sustainability performance in maritime transport. Additionally, a method that supports the evaluation and selection of LSPs based on these criteria will be determined. Research question two is formulated to identify suitable criteria and a method that enable the consideration of sustainability as a parameter in the process.

3. How can sustainability be integrated as a parameter in the case company's LSP selection process for maritime transport?

The final research question is formulated to explore how the identified sustainability criteria and method can be integrated into a company's LSP selection process of maritime transport. Based on this, a framework for how to incorporate sustainability as a parameter in the selection process can be developed. Ultimately, the three research questions enable fulfillment of the purpose.

1.3 Demarcations

The thesis will focus on the ocean container segment within maritime transport. This means that it will not consider any other transport modes or segments in maritime related to breakbulk, liner, or specialized cargo. The reason for this is that the container segment carries a large share of the case company's transported goods within the sea category. Additionally, the main scope of the thesis will be the supplier selection stage in the procurement process. The thesis will not thoroughly

consider stages outside this scope but may briefly touch upon surrounding stages as they are interconnected.

1.4 Outline

The thesis consists of six chapters which are presented and briefly described below.

Chapter 1: Introduction The introduction provides the background of the identified problem and gives the reader an understanding of the setting in which the study will be conducted. Additionally, it presents the purpose of the thesis along with three research questions that are formulated to address the identified problem and fulfill the intended purpose. The demarcations in this chapter set the scope for the thesis on what is to be included and not.

Chapter 2: Frame of reference The frame of reference outlines the findings from the literature review, serving as the foundation for the conducted analysis. This chapter is not only a central part of the analysis, but also provides the reader with the necessary background knowledge to understand the setting and context of the thesis.

Chapter 3: Method The method describes how the thesis has been conducted, detailing the research process, data collection, and data analysis. The quality of used methods is evaluated, and discussions on business ethics, reliability, and validity are included to motivate how these methods contribute to the overall quality of the research.

Chapter 4: Empirical findings This chapter presents the data collected from the case company's internal documents and the interviews with the researchers, ocean carriers, and the case company.

Chapter 5: Analysis and Discussion This chapter provides an analysis and discussion of the empirical findings to fulfill the purpose of the thesis.

Chapter 6: Conclusion This chapter concludes the thesis by presenting the findings and explaining how they contribute to the fulfillment of the stated purpose. Moreover, the theoretical contribution of the thesis is highlighted as well as what future research could focus on, building on the results of the thesis. Lastly, recommendations to the case company are presented.

2 Frame of References

This chapter presents the findings from the literature review. The frame of references covers the areas of procurement, selection of LSP and maritime transport.

2.1 Procurement

Procurement has developed into a key business function with strategic relevance. Traditionally, the focus was on cost minimization through transactional relationships. As globalization has increased, market competitiveness has grown, resulting in more companies turning to outsourcing to improve efficiency and effectiveness by focusing on core competencies and gaining access to other actors' knowledge and resources. This has resulted in a shift of focus to supplier selection and collaboration since effective supplier relationships can contribute to competitive advantages. (McIvor et al., 1998; Van Weele and Rozemeijer, 2022). This shows how changes in the business environment influence procurement attitudes and practices. The procurement function has gained a more strategic role as it is responsible for making decisions that affect a company's performance. Consequently, there is increased pressure on procurement to help the company achieve its overall corporate goals (Bals et al., 2018; Van Weele and Rozemeijer, 2022).

Furthermore, the procurement function is responsible for several activities that are carried out to ensure that the supply of goods and services satisfies company needs. The main activities are presented by Van Weele and Rozemeijer (2022) in a linear procurement process model which consists of six interrelated steps, see Figure 1. It is important that procurement activities align with business needs and requirements which are the input for the model. As the process steps are connected, it is critical that the first steps are performed proficiently as they affect the outcome of subsequent steps.

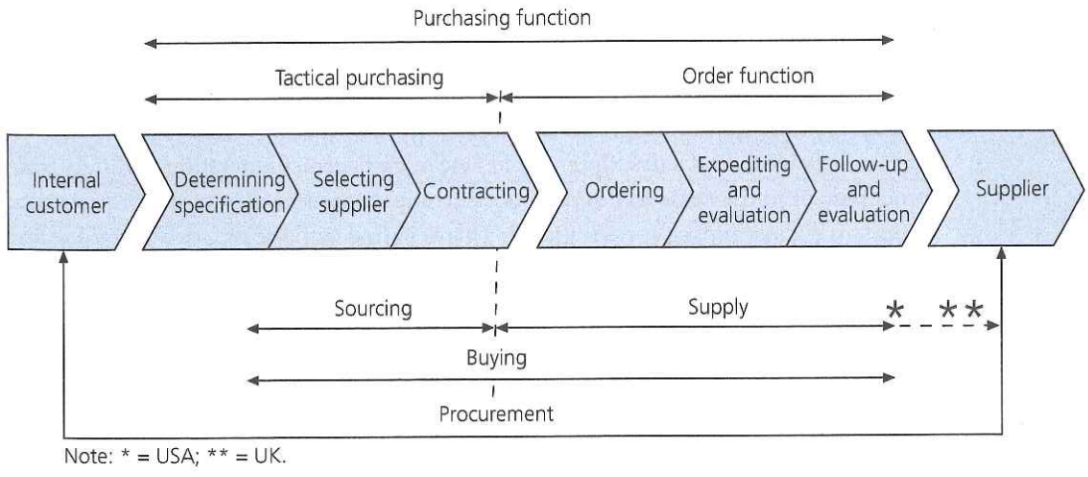

Figure 1: The linear procurement process model, from Van Weele and Rozemeijer (2022).

Sourcing is a tactical part of the process which entails identifying, selecting, and contracting the best possible supplier. The supplier selection is a critical step, as a company's success is affected by its selection process (Taherdoost and Brard, 2019; Van Weele and Rozemeijer, 2022). However, there is no single right way to carry out this process because the most suitable selection criteria and methods depend on the company's context. The common steps in the selection process are described by Van Weele and Rozemeijer (2022). Firstly, the prequalification requirements are established and used to determine potential suppliers. At this stage, these suppliers are sent a request for information (RFI) to get an idea of their capabilities. The RFI helps to gain an overview of the supply market and identify prospective suppliers. Based on the information acquired, the long list of suppliers who meet the prequalification requirements, also known as the bidders' long list, will be narrowed to a bidders' short list. After this, the buyer prepares a request for quotation (RFQ), through which the short-listed suppliers are contacted. This is typically called a tendering process. The suppliers are requested to submit detailed bids that include price offerings and meet the requirements that the buyer has stated in the RFQ. These bids are compared and evaluated by the buyer. The selection process ends when one or multiple suppliers have been chosen for negotiation and contracting.

2.1.1 Sustainable Sourcing

As sustainability challenges are becoming more prevalent, a holistic approach for sourcing is required. This means that economic, social, and environmental factors should be balanced and integrated into the sourcing process. These three dimensions corresponds to the concept of the Triple Bottom Line (TBL), i.e., a business' impacts on people, planet, and profit. Sustainable sourcing refers to all activities related to managing suppliers that are aimed at improving TBL performance. Companies are under increased pressure from stakeholders to adopt more sustainable practices since the awareness of sustainability issues has grown. Customer demands and the necessity to comply with governmental regulations drive companies to improve in all three dimensions. The adoption of sustainable sourcing is critical since it facilitates corporate sustainability and has a significant impact on a company's competitiveness (Ambekar et al., 2018; Schneider and Wallenburg, 2012). Despite this, the adoption of sustainable sourcing is typically at low levels and it is common that the selection process is unconnected to companies' overall sustainability strategies (Mogre et al., 2017; Schneider and Wallenburg, 2012. Van Weele and Rozemeijer (2022) describe that there is a time lag between the implementation of corporate sustainability and adoption of sustainable practices within procurement. Procurement functions with low levels of maturity are mainly focused on compliance with regulations and the environmental and social laws. Higher levels of maturity are achieved when more sustainable practices are developed and incorporated in the sourcing process. To achieve this, all three TBL factors must be considered in the selection process (Ambekar et al., 2018; Van Weele and Rozemeijer, 2022). It is essential that the selection criteria are truly linked to sustainability by going beyond what is required by law and actually limiting the selection. Additionally, the higher maturity levels entail a focus on establishing collaborative supplier relationships

and integrating both internal and external stakeholders to be able to create value for both customers, shareholders and society (Schneider and Wallenburg, 2012; Van Weele and Rozemeijer, 2022). Supplier code of conduct (SCoC) can also be used to achieve more sustainable sourcing (Ambekar et al., 2018; Van Weele and Rozemeijer, 2022). Adopting these sustainable practices is especially important for the sourcing of LSPs as their operations greatly influence a company's sustainability performance (Ambekar et al., 2018; Gupta et al., 2022).

2.1.2 Procuring Transport Services

Many companies no longer manage their own logistics activities and instead outsource them to external LSPs to gain competitive advantages. Logistics outsourcing allows companies to focus on their core competencies while at the same time reducing costs and gaining access to high-quality services (Alkhatib et al., 2015). Transportation is an important logistics activity since it is a vital part of the supply chain. A company's transport performance is affected by the service that is provided by the LSP, making procurement of transportation services critical. In addition to having a large impact on service quality, for instance through transit times, transport typically accounts for the largest share of total logistics costs (Holter et al., 2008; Paul et al., 2020). On top of this, Alkhatib et al. (2015) claim that it has the biggest environmental impact of all logistics activities. This emphasizes the importance of sourcing transport services from appropriate LSPs and determining how to allocate transporting volumes between them (Jung, 2017). According to Van Weele and Rozemeijer (2022), sourcing services can be very challenging in comparison with goods. For instance, it can be more difficult to find objective selection criteria, making it harder to compare various service providers.

2.2 Selection of LSP

Choosing an appropriate LSP is critical since the decision influences a company's competitiveness while also involving a high level of complexity. Factors such as intense market competition, economic recession, and sustainability threats make the decision more uncertain and affect the way companies evaluate and select LSPs (Alkhatib et al., 2015). Identifying the most appropriate LSP requires much more than just analyzing pricelists. Many different criteria can be used to describe LSPs performances such as cost, delivery, quality, and reliability. Consequently, a large number of criteria, both tangible and intangible, should be taken into consideration in the selection and it is common that the various criteria are conflicting as well. Therefore, the LSP selection is typically seen as a MCDM problem (Jovčić et al., 2019; Jung, 2017). Regarding the selection of transport service providers, it used to mainly be price-driven (Davis-Sramek et al., 2018b). Hedvall et al. (2017) point out that research indicates that price is still seen as the most important criteria. Based on previous literature reviews, conducted by Alkhatib et al. (2015) and Aguezzoul (2014), quality, services, flexibility and delivery are examples of criteria that are commonly considered besides cost for the LSP selection. However, the importance of these criteria has varied over time. Davis-Sramek et al. (2018b) state that recent research shows that sustainability criteria have gained in importance, but including them in the selection requires a new mindset. Besides having precise and clearly defined selection criteria, it is also important to use an appropriate MCDM method for the logistics sector that preferably can manage both intangible and tangible criteria as well as conflicting criteria (Bajec and Tuljak-Suban, 2017).

A lot of research has been conducted on the topic of LSP selection. However, several researchers point out that the inclusion of sustainability in LSP selection and evaluation is seldom mentioned in the literature. From the literature reviews conducted by Prabodhika et al. (2020) and Roy et al. (2020), it is seen that there is a need for studies that incorporate all three aspects of sustainability as they are commonly addressed in isolation. The main focus has been on economic criteria, whereas the integration of environmental and social criteria has received limited attention. Jung (2017) highlights that there is little research on social sustainability in general. Consequently, it has received even less attention with regard to LSP selection. In addition, Bajec and Tuljak-Suban (2016) describe that there is limited research on environmental criteria as well. These mentioned researchers have tried to fill the identified research gaps by publishing research that includes sustainability criteria and decision-making frameworks for LSP evaluation and selection. Paul et al. (2020) have contributed to research in this area by developing a framework for the evaluation of transport services based on sustainability criteria. However, it is evident more research is necessary and Prabodhika et al. (2020) especially highlight that there is a need for more industry-specific frameworks since the most prominent sustainability issues vary depending on the context.

2.2.1 Sustainability Criteria

The logistics and transportation sector contributes to a variety of environmental issues, including for instance global warming, air pollution, noise and congestion. Social challenges such as safety are also critical in this sector since logistics services rely on transport vehicles and employees. Evidently, sustainability is very important and relevant for logistics services. Despite this, it is usually not one of the main criteria for selecting LSPs (Jazairy, 2020; Jung, 2017). Bask et al. (2018) describe that even though environmental criteria sometimes are considered when companies procure transport services, they typically only consist of minimum requirements and serve as order qualifiers. This means that they are not used as order winners for the selection, instead, economic factors are seen as the critical ones. Traditional criteria such as cost and service quality tend to be prioritized over sustainability for LSP selection (Jazairy, 2020; Jung, 2017). This is in line with Bajec and Tuljak-Suban's (2017) findings from their literature review. Even though sustainability challenges related to LSPs impact companies' profitability and competitiveness, they are often excluded from the selection process.

Incorporating sustainability in the LSP selection is demanding since it requires consideration of both environmental, social, and economic aspects. The wide range of criteria that must be identified and taken into account increases the complexity of the decision. On top of this, determining the interrelations and potential trade-offs between the three dimensions can be challenging (Paul et al., 2020; Prabodhika et al., 2020). Furthermore, many sustainability criteria, especially the ones linked to the social dimension, are intangible and based on qualitative descriptions of LSP performances. This complicates the selection as the criteria are hard to measure and quantify. The level of uncertainty is also increased when the criteria are highly subjective (Prabodhika et al., 2020; Roy et al., 2020).

Based on the findings of this literature review, multiple sustainability criteria that can be used to evaluate and select LSPs have been identified. Criteria that are mentioned by several researchers and are relevant for the selection of transport service providers have been considered in this study. These are shown below in Table 1.

Table 1: Identified sustainability criteria from the literature review.

Environment	Compliance to Environmental Laws and Regulations	Kumar and Anbanandam (2022), Paul et al. (2020), and Prabodhika et al. (2021)
	Environmental Certification, such as the International Organization for Standardization (ISO) 14000	Bask et al. (2018), Kumar and Anbanandam (2022), Prabodhika et al. (2020), and Roy et al. (2020)
	GHG Emissions	Bajec and Tuljak-Suban (2016), Evangelista et al. (2018), Kumar and Anbanandam (2022), and Prabodhika et al. (2020)
	Air Pollutants Released	Bajec and Tuljak-Suban (2016, 2017)
	Energy Consumption	Bajec and Tuljak-Suban (2016, 2017), Evangelista et al. (2018), and Prabodhika et al. (2021)
	Energy Efficient Transportation	Bask et al. (2018), Paul et al. (2020), and Prabodhika et al. (2021)
	Use of Alternative Fuels	Evangelista et al. (2018) and Kumar and Anbanandam (2022)
	Waste Management	Bajec and Tuljak-Suban (2016) and Prabodhika et al. (2020)
Social	Staff Training	Jung (2017), Kumar and Anbanandam (2022), and Roy et al. (2020)
	Corruption Risk	Kumar and Anbanandam (2022) and Prabodhika et al. (2020, 2021)
	Health and Safety Practices	Jung (2017), Kumar and Anbanandam (2022), Prabodhika et al. (2020), and Roy et al. (2020)
	Compliance to Laws and Regulation and Humans Rights	Jung (2017), Kumar and Anbanandam (2022), and Prabodhika et al. (2020)
	Social Commitment and Investment in Communities	Jung (2017), Kumar and Anbanandam (2022), Prabodhika et al. (2021), and Roy et al. (2020)
	Level of Diversity in the Workforce	Kumar and Anbanandam (2022), Paul et al. (2020), Prabodhika et al. (2021), and Roy et al. (2020)
Economic	Cost of Service	Paul et al. (2020) and Roy et al. (2020)
	Financial Performance	Bajec and Tuljak-Suban (2016) and Paul et al. (2020)
	Reliability	Paul et al. (2020) and Prabodhika et al. (2020)
	Market Share and Market Position	Paul et al. (2020), Prabodhika et al. (2021), and Roy et al. (2020)

2.2.2 Methods for Evaluation and Selection

The LSP selection is a MCDM-problem, as elaborated above. Different methods for evaluation and selection can be used as decision support systems in these situations. Depending on the context, some methods can be more suitable than others. The Analytical Hierarchy Process (AHP) is one of the most commonly used in LSPs evaluation and selection studies. AHP is often combined with fuzzy logics, DEMATEL, or TOPSIS since these techniques can support the evaluation and ranking of LSP by dealing with the uncertainties associated with decision makers' preferences (Alkhatib et al., 2015; Bajec and Tuljak-Suban, 2017). The advantages of AHP are its ease of use and the ability to deal with both qualitative and quantitative criteria which are desired for logistics-based decisions (Bajec and Tuljak-Suban, 2017). It has been shown to be a very useful method and is widely applied for these types of decision-making problems (Jovčić et al., 2019; Jung, 2017).

Moreover, regarding the evaluation of LSPs, assessments of their sustainability performances often necessitate the use of a vast number of indicators. Because of the difficulties linked to decision-making based on too many indicators, composite indices have been developed to integrate information and make it easier to interpret. One way to design a composite index is to utilize the AHP method for weighting the indicators before aggregating them (Gan et al., 2017; Krajnc and Glavič, 2005; Prabodhika et al., 2021). This will be described further below.

The AHP method

Thomas L. Saaty developed the AHP method in the 1970s and it has since been widely used by both academics and practitioners for MCDM-problems. The method uses hierarchical structures and pairwise comparisons to structure and formalize the decision process. Complex decision problems need to be broken down to find the different elements of the actual problem, i.e the goal, criteria and sub-criteria (R. W. Saaty, 1987; Singh et al., 2007). As previously stated, AHP is a suitable approach for LSP selection and evaluation processes because they are generally characterized by both qualitative and quantitative variables (Bajec and Tuljak-Suban, 2017). Additionally, the method is appropriate to apply when evaluating sustainability performance as it requires the consideration of several dimensions and criteria (Singh et al., 2007).

The first step of the AHP method is to develop a hierarchical structure of the factors that are relevant to the decision problem (T. L. Saaty, 1990). Previous research has shown that it is difficult for decision-makers to handle too many factors, therefore it is suggested to avoid having more than five factors at the same level (Jung, 2017). Gan et al. (2017) provides an example of how the factors can be arranged in hierarchical levels. The top level consists of the overall goal, in this example, it is to conduct a sustainability assessment. The subsequent levels include criteria and subcriteria that are important to the decision and for achieving the goal. In this case, the criteria are the environmental, social, and economic aspects and the associated sustainability indicators function as subcriteria at a lower level. T. L. Saaty (1990) also includes a bottom level that consists of the alternatives for solving the decision

problem. For LSP evaluation, the lowest level encompasses the alternative LSPs (Jung, 2017). The next step entails pairwise comparisons of factors at the same hierarchical levels to determine relationships and priorities within the structure. This is done by judging the criteria and sub-criteria in each cluster in pairs to establish their relative importance concerning the overall goal. How much more a certain factor is perceived as important over another factor is expressed through a fundamental scale, see Table 2.

Table 2: The fundamental scale, from R. W. Saaty (1987).

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two acitivites contribute equally to the objective
3	Moderate importance of one over another	Experience and judgment strongly favor one activity over another
5	Essential or strong importance	Experience and judgment strongly favor one activity over another
7	Very strong importance	An activity is strongly favored and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between the two adjacent judgments	When compromise is needed
Reciprocals	If activity i has one of the above numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	

As a result of the comparisons, pairwise comparison matrices for each cluster of factors are developed. The last step is to calculate the factors' weights to determine the final priorities by using an eigenvector approach (R. W. Saaty, 1987; T. L. Saaty, 1990). The constructed pairwise comparison matrix A is an $n \times n$ matrix, where n is the number of factors in a cluster. Matrix A is filled with the factors' relative weights based on the performed comparisons. The normalized weight of each factor is calculated by dividing its relative weight by the sum of the factors' relative weights in the column. After the columns in matrix A have been normalized, the final priority weights of each factor can be computed by averaging the row values (Krajnc and Glavič, 2005; Singh et al., 2007).

Additionally, a consistency ratio (CR) can be calculated to assess the consistency of a decision-maker's judgments while conducting the pairwise comparisons. Some level of inconsistency can occur from thoughtless mistakes or exaggerated judgements. If there is no inconsistency, the CR is 0.0. If the CR exceeds the acceptable upper limit of 0.1, the decision-maker has to redo the pairwise comparisons until the consistency is improved. In order to calculate the CR, a consistency index (CI) has to be calculated first, as shown in equation (1). $\lambda_{\max}$ is the maximum eigenvalue of the $n \times n$ pairwise comparison matrix (R. W. Saaty, 1987; Singh et al., 2007).

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{1}$$

The CR can then be calculated using equation (2). RI is a random consistency index and its value depends on the size of the matrix, see Table 3(R. W. Saaty, 1987; Singh et al., 2007).

$$CR = \frac{CI}{RI} \tag{2}$$

Table 3: Random consistency index value from R. W. Saaty (1987).

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Composite Sustainability Performance Index

Composite indices are constructed by weighting and aggregating several indicators. A variety of methods can be used for this. Gan et al. (2017) conducted a literature review to identify the methods that are frequently used for creating sustainability indices. Regarding weighting methods, equal weighting was most common, but the AHP was mentioned as an alternative and useful method because of its hierarchical structure, simplicity, and flexibility. The downside with the AHP is that a large number of indicators can result in excessive pairwise comparisons and inconsistencies in the judgments. However, as mentioned above, the benefit is that the method includes a consistency check, resulting in revised judgments if there are too large judgment errors. An example of a study where the AHP was used as a weighting method is the one conducted by Singh et al. (2007), who developed a composite

sustainability performance index (CSPI) to support decision-making in the steel industry. After appropriate sustainability indicators had been identified, they were prioritized and weighted using AHP. The reasons for adopting this method were the benefits mentioned above and its capability to deal with both qualitative and quantitative sustainability criteria. Additionally, the hierarchical approach was described as suitable since it helps to structure and link criteria under the different sustainability dimensions.

Furthermore, regarding the most commonly used aggregation methods, a vast majority of them are additive aggregation methods (Gan et al., 2017). The sustainability index is then calculated by multiplying each indicator's normalized score with its weight and then summarizing the indicators' normalized values. The advantage of this method is that it is transparent and simple. However, it is not suitable to use if the indicators are highly interdependent. Nevertheless, Azevedo et al. (2017) use an additive aggregation method in their study to construct a company sustainability index and argue that the method provides a very accurate estimate of the ideal value function even if the sustainability indicators are somewhat independent. The composite index is computed by aggregating three sub-indices, one within each sustainability dimension. These sub-indices are calculated by summarizing the values of indicators that belong to the same dimension and measure economic, environmental, or social performance. Other examples of studies that use both the AHP method for weighting and an additive aggregation method for composing a sustainable composite index are the ones conducted by Krajnc and Glavič (2005) and Prabodhika et al. (2021). Krajnc and Glavič (2005) describe how a composite index makes it easier for decision-makers to assess a company's sustainability performance. Instead of trying to interpret many different indicators, the aggregated sub-indices integrate information about social, environmental, and economic performance, making it easier to identify improvement areas. Prabodhika et al. (2021) show how a CSPI can be applied to evaluate and select LSPs based on their sustainability performance. The AHP method is used to give weights to each sustainability dimension and the selected indicators under each dimension. Once the LSPs' performance levels of the indicators are determined, an additive aggregation method is used to form the CSPI by aggregating the weighted indicator scores. The LSP with the highest CSPI value is assessed as the best alternative in terms of sustainability performance. An illustration of the hierachical structure of the CSPI is shown in Figure 2.

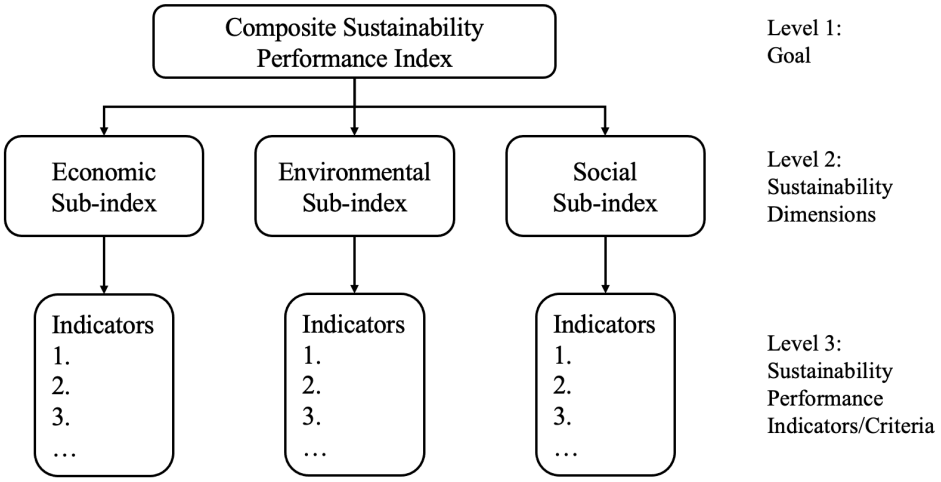

Figure 2: Hierarchical structure for calculation of composite sustainability performance index, inspired by Krajnc and Glavič (2005), Prabodhika et al. (2021), and Singh et al. (2007).

2.3 Maritime Transport

The term maritime refers to navigation or commerce at sea and includes a wide range of sectors, such as shipping, fishing, and offshore oil and gas operations. Shipping, also called maritime transport, is one sector that has become crucial for the world's economy as it currently carries about 90% of the volume of global trade Christiansen et al., 2007; Kronfeld-Goharani, 2018; Mansouri et al., 2015). Stopford (2009) differentiates three segments in the maritime transport system (MTS) which are bulk transport, specialized cargo transport, and liner transport. The bulk transport includes dry and liquid bulk cargo, specialized transport carries large non-homogeneous cargo such as cars, chemicals, or forest products and liner transport includes general cargo such as containers, pallets, and flats. These operate in Global Maritime Supply Chains (GMSC), which is the network of cargo transportation from origin to destination overseas (Garg and Kashav, 2019). The three segments operate differently as they often serve in specific geographic locations and have varying customers. For example, container ships often operate on fixed routes on a schedule whereas bulk transport, where usually one shipper owns the goods, operates more flexibly without a fixed schedule but the number of departures is more restricted. The actors operating in the GMSC involve shippers, forwarders, ocean carriers, shipbuilders, ports, and consignees (Garg and Kashav, 2019; Hasanspahić et al., 2021). Because numerous actors are involved in the GMSC, it is challenging to manage and coordinate cargo, information, and financial flows effectively (Lam, 2015).

The maritime transport market is typically seen as complicated as it is governed by old traditions and there are few competing shipping companies (Malmgren et al., 2023). Companies that transport freight in the GMSC context are usually referred to as "ocean carriers". The segment of general cargo, including containerized freight, carries approximately 16% of the world trade volume (Benamara et al., 2019). Carriers within this segment create value for their customers through several activities such as consolidation, optimization, flexibility, and the possibility of attaining economies of scale. They have also managed to decrease costs due to investments in efficient cargo handling operations. The competition among these carriers has meanwhile led to lower profits and a struggle to gain market share. For this reason, they are pushed to elaborate their strategy and create value that goes beyond what customers expect. The concept of "green shipping" is frequently used when describing how environmental aspects are considered in the context of GMSC. Including this concept in the strategy makes it possible to bring more value to customers (Garg and Kashav, 2019). Furthermore, green solutions are being introduced across many segments due to increased regulation around sustainability in maritime transport. According to Altuntaş Vural et al. (2021), technical and operational initiatives have been developed to reduce emissions and meet the sharpened regulations. Technical measures are characterized by the design of ships, propulsion systems, and fuel types whilst the operational measures are characterized by the optimization of fleet and route designs, green vessel scheduling, and slow steaming.

The maritime transport sector accounts for approximately 3% of the global GHG

emissions (Gibson et al., 2019; Malmgren et al., 2023). It is considered one of the biggest air pollution sources and it affects marine life, the health of staff and coastal communities near frequently used ports (Gibson et al., 2019; Kronfeld-Goharani, 2018). Given the speed at which the demands of the world's population increase, forecast scenarios suggest that emissions are prone to increase if no actions are taken (Christodoulou, 2019). In recent years, the interest in reducing the carbon footprint in maritime transport through decarbonization has been growing among researchers and practitioners. Because of its strategic importance and environmental efficiency, compared to other transport modes, maritime transport has the potential to enable sustainable development in the transport sector (Benamara et al., 2019; Mansouri et al., 2015).

Alternative fuels can minimize the carbon emissions of transport. In maritime transport not many ships use alternative fuels, but those that do mostly use Liquified Natural Gas (LNG). As technology develops, Liquid Biogas (LBG), Hydrogenated vegetable oil (HVO), and Methanol are becoming more widespread as well. Actors in the GMSC context have to adapt and develop technologies that can help support sustainability objectives. Moreover, they all have to share the research and development costs to push the shift and advance the use of alternative fuels (Länsstyrelsen Västmanland, n.d.). Over the years the marine industry has relied heavily on fossil fuels, and today around 99% of fuels used are fossil, making the transition to alternative fuels and energy efficient shipping crucial. Currently, it's difficult to choose alternative fuels because of the high costs and lack of infrastructure. There is also a lot of uncertainty linked to which alternative fuel to invest in as the development is slow. It is difficult to predict which one will be the best over time and considered worth investing in (Malmgren et al., 2023). Likewise, to reach energy-efficient shipping, investments are needed and it is also dependent on the ship's fill rate, size and design. This makes the market for sustainable shipping alternatives severely constrained(IVL, 2022). Nevertheless, it is possible to create financially viable maritime transportation that does not jeopardize the environment and human lives. However, for this to work the three key elements, i.e. environmental, social, and economic, of sustainable maritime transport must be balanced and all actors in the GMSC must take responsibility (Hasanspahić et al., 2021).

Furthermore, it is reasonable to predict that more sustainability initiatives will be initiated given the advancement of sustainability in international policy over the past thirty years (Kronfeld-Goharani, 2018). Although, Lam (2015) states that there is limited research on the topic of sustainable shipping, Mansouri et al. (2015) identified in their literature review that sustainability has appeared more frequently in maritime studies over the past twenty years. However, research on containerized freight in GMSC is limited which provides an opportunity to increase the knowledge of the topic and simultaneously go deeper into the question of how sustainability will continue to prevail in shipping (Garg and Kashav, 2019; Mansouri et al., 2015).

2.3.1 Sustainability Issues

As mentioned previously, maritime transport is considered the most efficient and cost-effective mode for the international transportation of goods. However, it still contributes to global carbon dioxide emissions that is bound to increase if no actions are taken, as world trade is expected to grow (Christodoulou, 2019). For this reason, the environmental pillar is critical in the maritime industry. Besides GHG emissions, the environmental issues are mainly connected to the discharge of waste, oil, ballast water, and pollution such as SOx and NOx (Benamara et al., 2019). Garg and Kashav (2019) emphasize that these issues need to be mitigated by increasing the GMSC actors' responsibility. Companies in the GMSC must work towards identifying and implementing environmentally friendly practices, such as installing oil spill controls, waste management, and ballast water treatment systems on ships. To lower SOx emissions, ocean carriers can either install scrubber systems that cleans SOx from exhaust gases or switch to fuels with lower sulfur content. Not having these practices in place compromises marine ecology and can harm biodiversity. Furthermore, it has become apparent that the design of the ships and their engines is crucial to facilitate energy efficiency (Benamara et al., 2019; Garg and Kashav, 2019). Lai et al. (2011) argue that ship owners' responsibility extends til after the ship's operational lifetime, meaning that they should contribute to the correct dismantling and recycling of the ship and not promote unsustainable disposal. Companies should establish policies for how ships are managed after being taken out of the fleet.

Moreover, nations need to support the development of strategies and technologies as well as implement new policies, laws, and regulations to mitigate the environmental impacts on the maritime industry (Carpenter et al., 2021). The effects of reducing the impact on ecosystems, enhancing fuel efficiency, and developing cleaner technologies will not only benefit the environmental pillar, it will also indirectly contribute to the economic and social pillars (Altuntaş Vural et al., 2021; Mansouri et al., 2015). The economic pillar has traditionally received a lot of attention by practitioners and scholars as the economic performance is a critical issue in the maritime industry due to the highly competitive business environment (Lam, 2015). On the other hand, research on social sustainability in maritime is still limited (Karakasnaki et al., 2023; Lam, 2015). Altuntaş Vural et al. (2021) mention that one social issue that needs to be addressed is the seafarers safety on board as their tough working conditions have long term impacts on physical and mental health. Moreover, issues related to deficient employee training, education and equality also need to be addressed, leading to the conclusion that ocean carriers must implement strategies and policies for social sustainability. It is evident that the social sustainability pillar needs more attention to ensure seafarers' well being (Altuntaş Vural et al., 2021; Karakasnaki et al., 2023).

2.3.2 Laws and Regulations

The United Nations has enforced a legal framework for all maritime activities which is called The United Nations Convention on the Law of the Sea (UNCLOS), and it

is an international agreement (IMO, 2024f). The International Maritime Organization (IMO) is an agency of the United Nations that was established in 1948. Their mission is to promote safe, secure, environmentally sound, efficient, and sustainable shipping. They act as a regulatory body to manage and govern sea legislation. Various conventions have been developed over the years and there are three key IMO conventions, SOLAS, STCW, and MARPOL, which are further described in Table 4. As an example of another convention besides these three, IMO has developed a convention that sets requirements on ships to manage their ballast water according to a certain standard. IMO's key conventions are mandatory for all member countries and nations to comply with and the rules apply to ships and vessels operating in international waters. The implementation of these laws and regulations is a complex process and the responsibility of enforcing it belongs to the governments. As governments work differently in bureaucracy, handling and processing this implementation can either take longer or shorter to enforce (IMO, 2024a). Furthermore, as a complement to the three key IMO conventions, the International Labor Organization, which also is an agency of the United Nation, has developed a mandatory Maritime Labor Convention (MLC). The MLC is called the "fourth pillar" of international maritime law and sets minimum standards for seafarers' working and living conditions (ILO, 2024).

Table 4: Key IMO conventions

Convention	Full Name and Area	Description
SOLAS	Safety of Life at Sea	International Maritime Safety Convention. The SOLAS convention aims to specify minimum standards for ships regarding their construction, equipment, and operation, ensuring their safety. The current SOLAS convention includes articles that set out general obligations, amendment procedures, and an Annex containing 14 chapters (IMO, 2024e).
STCW	Standards of Training, Certification, and Watchkeeping for Seafarers	International convention on standards for training, certification, and watchkeeping for seafarers (IMO, 2024d)
MARPOL	International Convention for the Prevention of Pollution from Ships	International Maritime Environmental Convention (IMO, 2024c)
	Annex I	Prevention of Pollution by Oil
	Annex II	Control of Pollution by Noxious Liquid Substances
	Annex III	Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
	Annex IV	Prevention of Pollution by Sewage from Ships
	Annex V	Prevention of Pollution by Garbage from Ships
	Annex VI	Prevention of Air Pollution from Ships

Up until recently, maritime transport has not been the focus of the sustainability debate as it has been considered relatively environmentally friendly, hence it has been less regulated (IVL, 2022). Table 4 shows the regulations that actors in the maritime sector have followed for many years. Member nations are expected to follow the conventions and develop concrete guidelines and legislation that strengthen the work towards supporting and achieving IMO's target of net zero GHG emissions from shipping close to 2050 (European Comission, 2024; IMO, 2024a). As of today, more initiatives from the IMO and the European Union (EU) have been presented. In 2023, the climate package developed under the European Green Deal, "Fit for 55", was agreed upon and enforced by the EU. It is supposed to regulate the transport modes further with the target of reducing emissions by 55% by 2030, compared to 1990, and eventually reach climate neutrality by 2050. The maritime sector is dependent on fossil fuels, which is why there is a need to change as it is unsustainable

in the long run. The Fit for 55 climate package withholds preliminary settlements regarding renewable energy, enabling energy efficiency, investment in infrastructure, and alternative fuels, forcing actors to take responsibility. Moreover, new control systems and legislation will regulate the use of fossil fuels that previously haven't been taxable. The EU emissions trading system (ETS) is one of the key parts of the climate package. It was introduced in 2005 but is now reformed to apply to more industries, including maritime transport. The EU ETS puts a price on carbon dioxide and companies must purchase allowances corresponding to their carbon dioxide emissions. A cap is set every year for each industry how much they are allowed to emit, however, the cap decreases every year as a financial incentive to reduce emissions further. Since the new reform of the EU ETS includes maritime transport, this further pushes actors in the sector to take responsibility for decreasing emissions. EU ETS cover 100% of emissions from voyages within the EU and 50% from voyages that start or end outside of the EU. In addition to the reform of EU ETS, a new law called FuelEU maritime was presented by the EU council as an initiative to kick-start the transition to more sustainable maritime fuels. It includes requirements to gradually reduce the GHG intensity of fuels used by ships. The law will foremost be applied to ships with a gross tonnage above 5000 as they are considered to be responsible for the majority of the carbon emissions in the maritime sector. The EU has also implemented a system for shipowners called EU MRV, which concerns monitoring, reporting, and verifying the emissions from their maritime transport on a ship level. In 2018, reporting in this system became mandatory for ships over 5000 gross tonnage (European Comission, 2024; IVL, 2022). However, even with these initiatives and laws in place, a lot of work needs to be done. Topping (2021) highlights that the success of the regulations combined with IMO's conventions depends on governments' abilities to implement policies that support achieving the set targets.

In addition to laws and regulations that are specific for the maritime transport industry, the EU has also developed directives as part of the Green Deal legislation. The Corporate Sustainability Due Diligence (CSDDD) will apply to large companies that operate within the EU and require them to manage their impacts on human rights and the environment from their operations, subsidiaries, and both upstream and downstream business partners (European Council, 2023). Furthermore, the EU has also enforced the Corporate Sustainability Reporting Directive (CSRD) which not only strengthens the regulation regarding how companies are to report on the environmental, social, and governance (ESG) variables but also modernizes it. This directive aims to help stakeholders such as consumers, investors, and other social organizations evaluate the sustainability performance of companies relating to their climate-related financial risks, sustainable business practices, and regulatory compliance (EU Comission, 2024).

2.3.3 Selection of Ocean Carriers

Carrier selection has previously been mentioned as a strategic decision. As a company tries to fulfill both customer needs and its own objectives, the selection becomes

crucial (Jung, 2017). Looking into the research regarding selection of transport providers during the last fifty years, it has to a large extent focused on road transport, even though maritime transport has made great progress and accounts for the majority of the world's trade volume. The ocean carrier selection should be studied independently as there are significant differences in terms of criteria prioritization. Despite this, there is limited literature on this subject, especially from the perspective of large shippers (Ergin and Alkan, 2023; Kent and Parker, 1999). The existing studies have shown that criteria used for selection decisions and the criteria's relative importance differ depending on shippers' and ocean carriers' perspectives, their size, industry, and geographical location (Ergin and Alkan, 2023; Fanam et al., 2016).

The selection is no easy task because it constantly involves uncertainty and complexity. Shippers thoroughly need to consider what methods and criteria they find appropriate to use for their business (Alkhatib et al., 2015). There are several methods mentioned in research for the selection of LSP and the AHP method is labeled appropriate for maritime transport selection (Lam and Zhang, 2014). The selection criteria that have been mentioned as the most important in research are cost, service quality, and delivery performance. However, in recent maritime transport research, the increased importance and need for sustainability have been identified. Shippers play an important role in the sustainable development of the maritime sector as they can demand ocean carriers to follow more sustainable practices and thus include sustainability criteria when selecting ocean carriers (Brooks, 1995; Ergin and Alkan, 2023). One common sustainability requirement in the procurement of maritime transport is that the ocean carrier follows the existing laws and regulations set by IMO and other regulatory bodies, such as the EU. Furthermore, these requirements are usually combined with having certifications for sustainable management, for example, ISO 14001 (Länsstyrelsen Västmanland, n.d.). However, demanding fulfillment of sustainability requirements and more sustainability initiatives from ocean carriers is challenging. IVL (2022) illustrates this by stating that the size and relationship between the shipper and ocean carrier are decisive factors for how prone the ocean carrier is to deliver on the sustainability requests. Smaller shippers might not have the power to set certain sustainability requirements that larger shippers can, because shippers providing higher volumes usually have more influence. Still, they are all highly dependent on the closeness of the relationship with carriers. Nonetheless, in order to really make an effort towards the transition of more sustainable maritime transport, shippers need to be more active in setting sustainability requirements, regardless of their position.

As previously mentioned, the procurement process includes steps such as sending out RFI and RFQ to potential suppliers to gather information and get a quotation, but the question remains when requests on sustainability should be made. Styhre et al. (2023) mention in their report that, according to a study on Swedish shippers, sustainability requirements are most commonly sent out in the RFQ. Some shippers have reported that the requirements are present in the following phase as well, which includes evaluation of quotations and negotiation. Sending out requirements on sustainability shows the ocean carriers that it is something shippers value and consider

in the selection. However, the requested sustainability requirements need to be evaluated and not forgotten throughout the process (IVL, 2019; Länsstyrelsen Västmanland, n.d.). It is further explained by Länsstyrelsen Västmanland (n.d.) that one reason for not following up or keeping the criteria present during the proceeding stages when making the decision is the difficulty of calculating and evaluating the ocean carriers' performance within sustainability. For instance, if shippers don't know how to calculate or lack information on the ocean carriers' emissions, they won't be able to assess if the desired performance level is met. Apart from these hindering factors, shippers' lack of knowledge about sustainable solutions and limited understanding of what requirements to set is withholding them from being more active. The barriers for enabling a more sustainable maritime transport ranges from the ocean carries' severe limitation of providing sustainable options to the shippers willingness to pay more for these sustainable solutions (Malmgren et al., 2023). The gap between the actors is apparent and there is a need to create a solution where everyone contributes and takes responsibility for enabling and driving sustainable maritime transport. Hence, actors' collaboration is regarded as a key enabler for bringing out major change in the sector as well as increasing legislative initiatives. (IVL, 2022).

2.3.4 Measuring Environmental Impact

Nowadays, more studies regarding sustainability in maritime transport have emerged. Pérez Lespier et al. (2019) explain that, as the shipping industry increases its environmental awareness, it requires the supply chain partners to offer more sustainable services. The reason for sustainability objectives not being fulfilled is partly due to companies not understanding the environmental aspects and how they can be incorporated into business. This indicates that more research is necessary to derive methods that simplify the inclusion and measuring of sustainability performance in the MTS (Davis-Sramek et al., 2018a).

Moreover, many companies strive to reduce their GHG emissions and have set science-based targets (SBT) that are in line with the Paris Agreement goals, i.e. to limit global warming to 1.5C. The SBT consists of three scopes that help companies map their GHG emissions in different parts of their business. The first scope includes mapping of the company's direct emissions from their operations. The second scope includes indirect emissions that result from the company's consumption of purchased energy. The third scope includes mapping of indirect emissions from the entire value chain in which the company operates, both upstream and downstream. The GHG emissions from maritime transports impact a shipper's ability to achieve its SBT within scope 3. Hence, there is a need to calculate and map ocean carriers' emissions (Länsstyrelsen Västmanland, n.d.; SBT, 2024). Usually, shippers find it difficult to calculate the emissions of their freight transports. Therefore, many ask the carriers to perform the calculations, but there is often a lack of transparency of what method was used. To solve this issue, shippers can determine one method that they require the carriers to use. In addition, standards and certifications can contribute to getting a better overview of a carrier's environmental

performance. Environmental management systems, such as ISO 14001, are used to provide tools and set requirements for businesses to improve their environmental impact (Länsstyrelsen Västmanland, n.d.). The majority of the large ocean carriers are commonly ISO-certified to reassure the shippers they operate according to certain standards (Bask et al., 2018).

As mentioned, buyers of transport have the ability to affect the carriers and demand that sustainability is integrated with their business. Because of the growing concern among buyers about their environmental performance and GHG emissions in the supply chain, some indices and measurements have been developed. There are currently various sustainability indices that can support the assessment of the environmental performance of maritime transporters. Commonly mentioned are the Clean Shipping Index (CSI), Environmental Ship Index (ESI), and Clean Cargo (CC) (Christodoulou, 2019; Gibson et al., 2019; Länsstyrelsen Västmanland, n.d.). These indices are described in Table 5. Furthermore, IMO has developed indices for energy efficiency to promote reduction of GHG emissions from shipping. These include the Energy Efficiency Existing Ship Index (EEXI) and Energy Efficiency Design Index (EEDI), which regulate both old and new ships' energy efficiency based on their technical design. The Carbon Intensity Indicator (CII) measures the ships' operational performance and the Ship Energy Efficiency Management Plan (SEEMP) focuses on how ship owners should make their fleet more energy efficient. The energy efficiency indices became mandatory on 1 January 2023 after the update of the MARPOL Annex VI convention(IMO, 2024b) and they are further explained in Table 5.

Table 5: Maritime shipping indices

Index Name	Full Name	Description
CSI	Clean Shipping Index	This index measures the air and water pollution from ships. It is an independent labeling system that is used to determine the environmental performance of individual ships. The ship is given a rank 1-5 on how well they are performing (IVL, 2024).
ESI	Environmental Ship Index	This index was established by the non-governmental organization International Association of Ports and Harbours. It identifies ships that perform better than what is expected by IMO standards in terms of lowering air emissions (ESI, 2024).
CC	Clean Cargo	This index was developed by the nonprofit business network, Businesses for Social Responsibility as a global carrier-shipper initiative to calculate carbon dioxide emissions from ships with containerized cargo. It has since 2022 been managed by the non-profit organization Smart Freight Centre (SFC)(Smart Freight Centre, 2024).
EEDI	Energy Efficiency Design Index	A measure used to encourage the use of engines and equipment that are more energy efficient when designing new ships. It sets a minimum limit for the energy efficiency level to improve technical performance of new ships (IMO, 2024b).
EEXI	Energy Efficiency Existing Ship Index	Similar to EEDI, this measure focuses on energy efficiency based on technical performance, but for the existing ships in operation instead of new build ships. (IMO, 2024b).
CII	Carbon intensity indicator	This index reflects the energy efficiency of ships in terms of operational performance. It gives ships a ranking from A to E based on reported fuel consumption data.(IMO, 2024b).
SEEMP	Ship Energy Efficiency Management Plan	This is a management plan for ship owners that encourages them to consider new technologies and practices to optimize their operational performance and improve the energy efficiency of their ships cost-effectively. (IMO, 2024b).

3 Method

This chapter presents the method. First, a description of the research design and strategy is given. Thereafter the research process is illustrated and the data collection and analysis is explained. Lastly, the research quality is addressed.

3.1 Research Design and Strategy

The research design lays the foundation of the logical plan for connecting the collected empirical data to the research questions and the conclusion. This thesis has conducted a case study where one organization was the single unit of analysis. The case study methodology is suggested to give a holistic view of an individual or group when studied in a specific context. Therefore, the single-unit case study was selected because it captures the circumstances and conditions of an everyday situation that expands the knowledge regarding a process as well as increasing theoretical interest (Yin, 2014).

Moreover, qualitative research is mostly concerned with words and visual data, rather than numbers, in the data collection and analysis. In contrast to quantitative research, it also seeks a contextual understanding and the researcher is close to those being studied to get their perspective. This thesis adopts a qualitative research strategy as it is a case study focusing on understanding the studied context. Additionally, the data gathering relies mainly on interviews and organizational documents which include verbal and observational data. Qualitative methods are highly useful when there is a focus on thorough analysis of a specific setting (Bell et al., 2022).

3.2 Research Process

The research process has been divided into three phases, see Figure 3. The phases will be described further below.

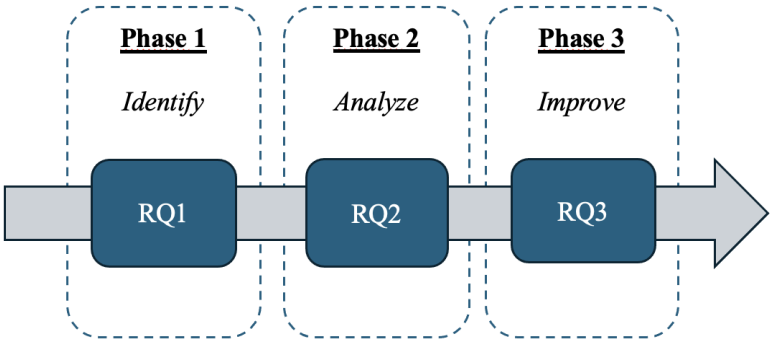

Figure 3: Research process

The first phase began by identifying the context in which the thesis scope is set. In this context, the current LSP selection process for maritime transport was identified

by collecting data through interviews and documents provided by the case company. Consequently, the first research question could be answered.

Furthermore, a literature review was used to gather theory and research on the topic to enable analysis of the LSP selection process. It included a distinction of selection methods used in LSP selection and frequently used selection criteria related to sustainability. Additional interviews with ocean carriers and researchers were held to get further insights on the research topic and understand what sustainability criteria are considered most relevant for maritime transport. Ocean carriers' sustainability reports were also scanned to identify common measures of their sustainability performances. Analyzing potential methods and criteria related to LSP selection and sustainability in the context of maritime transport made it feasible to answer research question two. A questionnaire was developed, which includes criteria and questions that enable scoring of ocean carriers' sustainability performance. During the process of selecting sustainability criteria and questions, iterative meetings were held to evaluate them with case company representatives. Before finalizing the questionnaire, one researcher was asked to validate the criteria and questions. Lastly, case company representatives agreed on the criteria and questions. After this, a sustainability performance index was constructed based on the questionnaire, the selection method AHP and an additive aggregation method. Due to this study's time constraint, the sustainability performance index was not utilized in practice. Instead, criteria weighting through the AHP method, scoring of sustainability performance within each criterion, and aggregation of criteria scores were only demonstrated in the report by the authors of this study.

The third and last phase began as the second research question was answered. At this point, the analysis provided insights as to what method and criteria are suitable for considering sustainability in the LSP selection. The literature review together with conducted interviews contributed to understanding how they could be integrated into the selection process. As a result, a framework could be developed for how sustainability can be integrated as a parameter in the LSP selection process for maritime transport. Ultimately, it was possible to answer the last research question and provide suggestions for how the case company can improve its selection process by implementing the developed framework.

3.3 Data Collection

In a case study, combining multiple qualitative methods to prevent overreliance on one method for data collection is appropriate. Interviews are often the main data source, whereas documents are used as a complementary source (Bell et al., 2022). For this thesis, a combination of primary and secondary data was used. Interviews were conducted to gather primary empirical data, whereas secondary empirical data was collected through organizational documents. Additionally, the literature was reviewed to obtain data about the research area. During the data collection, research quality parameters, such as validity and reliability have been present and acknowledged throughout. Several data collection methods were used,

making triangulation possible. This will be further explained below.

3.3.1 Interviews

Interviews in qualitative research tend to have a higher degree of generality in the question formulation. They are characterized as flexible in contrast to quantitative interviews as interviewers can depart from the initial structure or guide to develop a deeper understanding based on the replies of the interviewee. In this case study, qualitative interviews were conducted to collect empirical data since the aim was to maintain a specific focus, the LSP selection process, and also increase knowledge of the research topic, integrating sustainability in the LSP selection process. The interviews were semi-structured, enabling the researchers to stay flexible throughout the interview and leave room for follow-up questions for the interviewee to elaborate and explain further if needed. Before the interview sessions, an interview-guide was prepared and given to the interviewees to ensure that they were aware of the topics. Using an interview-guide strengthens the dependability of the research as it helps to adhere to the key topics of interest. (Bell et al., 2022).

The selection of participants is of great importance as it influences both data collection and analysis. For this case study, interviewees were selected based on their connection and knowledge regarding the studied context and research topic, as well as their availability. In line with the qualitative research strategy, the selection was not randomized, instead, participants were carefully selected based on their affiliation with the context and ability to benefit the research. The number of participants was determined by reaching the saturation point. From this point, participants no longer generated information that was unfamiliar to the researchers in regards to the topic (Galletta, 2013). To get different perspectives on the research topic, interviewees with different background and roles were chosen, see Table 6. Besides the described interviews in Table 6, weekly meetings were held with two case company representatives to maintain a continuous dialog regarding the collected data and the progress of the thesis.

Table 6: Summary of conducted interviews.

Company	**Roles**	**Interview Types**	**Dates**	**Number of Interviews**
Case Company	Sea Sourcing Manager	Face to face and Digital	5/2, 29/2	2
Case Company	Manager Sourcing Sustainability	Face to face and Digital	26/1, 29/2	2
Case Company	Procurement Manager, Category Sea	Digital	20/3	1
IVL Svenska Miljöinstitutet	Researcher	Face to face	21/2	1
	Researcher			
Chalmers	Researcher	Digital	22/2	1
Chalmers	Researcher	Face to face	1/3	1
Ocean Carrier A	Chief Commercial Officer	Digital	26/3	1
	Business Controller			
Ocean Carrier B	Manager Green Strategy Department	Face to face	27/3	1
	Senior Key Account Executive			

Interviews were primarily conducted face to face because of the advantages related to ability of controlling the interview environment, making sure of no disturbances. Moreover it is easier when sitting across from one another to assess non-verbal cues and body language which allows for more transparency and hence deeper understanding of the interviewee. Conducting interviews face to face also reduces the risk of technical issues. However, in the cases where it was not possible to conduct face to face interviews, video interviews were conducted instead. The advantages with video interviews are that they are usually more easy to schedule as they are not affected by geographical distances and are less time-consuming (Bell et al., 2022).

The conducted interviews lasted on average one hour. They were audio-recorded and then transcribed, as is customary in qualitative research (Bell et al., 2022). Before starting each interview, participants were asked to give consent to the recording. The transcription was done using an online service that transformed the recorded audio into text. The generated text was then reviewed and revised by simultaneously listening to the audio. This was done to avoid errors and ensure a high quality of the transcription as it is critical that the written text accurately captures the interviewees' precise words.

3.3.2 Documents

Qualitative research often involves the collection and analysis of documentary data. Organizational documents was used in this thesis as a complement to the interviews to acquire additional information about the case company and their procurement process. The empirical data was accessed through internal documents and their company website. These types of documents can be useful as a source to providing

information about for instance policy statements, organizational charts, and outcomes (Bell et al., 2022; Yin, 2014). In addition to the case company's internal documents, ocean carriers' sustainability reports were reviewed to identify which sustainability areas they focus on and how they measure their performance. The selection of sustainability reports to review was based on the ocean carriers that the case company contracted last year within the container segment.

3.3.3 Literature Review

To learn more about the research area, literature was reviewed to understand the scope and discover what research already exists. The literature review resulted in a frame of reference that served as a base for analyzing the empirical data. As suggested by Bell et al. (2022), the literature search started by exploring books and articles from previous course material. Based on them, keywords within the research area and references to other relevant literature were identified. An online search was conducted to collect additional literature on the subject. Due to the large amount of available information online, it is essential to be selective and only use trusted sources(Bell et al., 2022). To ensure that the gathered literature were reliable sources of information and sufficiently academic, Chalmers Library and Google Scholar were used as online databases. Keywords that were used for the search included maritime transport, ocean carrier, LSP, sustainable sourcing, sustainability criteria and LSP selection.

3.4 Data Analysis

Qualitative research usually generates a lot of textual and unstructured data which can be hard to analyze. Conducting a thematic analysis is a common way to deal with this. The analysis starts with coding, meaning that qualitative data is divided into different categories. These categories are labeled and then aggregated into higher-level themes based on their similarity. This process aims to make the data easier to manage (Bell et al., 2022; Miles et al., 2014). A thematic analysis with initial coding was applied in this thesis to structure data from the transcribed interviews and the literature review. The thematic analysis was found appropriate due to its compatibility with the research design and strategy. Furthermore, coding is a central process in grounded theory. Based on the interpretation of collected data, conclusions were drawn to achieve the aim of the thesis.

Furthermore, the data analysis is done similar to grounded theory. Grounded theory mainly concerns development of theory out of gathered data and that the data collection and the analysis are done in parallel, referring back to each other (Bell et al., 2022). As described, coding is a central part of grounded theory, this is true for how data is analysed in this thesis as well. Apart from the similarities with coding, there has also been a constant comparison between the data gathered from the literary review and the data which the interviews provided. Bell et al. (2022) describes the process of grounded theory as iterative with a constant movement back and forth to continuously discuss and elaborate on collected data. Likewise, in this

thesis, iterative meetings were held with case company representatives during the data analysis to gain additional insights.

3.5 Research Quality

The research quality includes both research ethics and validity and reliability.

3.5.1 Research Ethics

It is important to ensure high standards of ethical integrity when conducting business research, especially when human subjects or research participants are involved, as was the case for this thesis. Therefore, four ethical principles have been followed to minimize the risk that ethical issues arise. The principles are focused on avoidance of harm, informed consent, protection of privacy through confidentiality, and preventing deception (Bell et al., 2022). These were taken into account when interviews were conducted, for instance by ensuring that the interviewees were informed about their involvement in the study and given the possibility to withdraw. Another ethical aspect to consider is whether information in the thesis about the studied company is allowed to be published. To ensure that no sensitive data was disclosed, a company representative was able to review the thesis before it went public.

Furthermore, ethical considerations were addressed within the specific context of this thesis, namely the LSP selection of maritime transport. This was done by taking into account if the selection was fair and morally justified. Societal and ecological aspects were also considered during the analysis since the thesis focused on how to incorporate sustainability. Thereby the impact on both the environment and society was regarded.

3.5.2 Validity and Reliability

Bell et al. (2022) highlight the discussion of the two frequently appearing terms reliability and validity that are established in quantitative research strategy, and proceed to explain how researchers question their relevance in qualitative research. Mainly, this is because these terms are more related to measuring, which is not as predominant in qualitative studies. Making the concept more adapted to qualitative research, Bell et al. (2022) differentiate between internal and external validity and reliability.

Internal reliability refers to the consistency of the researchers' understanding of the study and collected data, whereas external reliability determines the study's degree of dependability and possibility to replicate. Common criticism towards qualitative research is that it tends to be subjective and relatively unstructured, making it hard to replicate. To avoid this, it is important to not allow for personal values to affect the interpretations of collected data. Furthermore, to avoid the influence of subjective values in this thesis, participants and sources have been chosen in a connected

and meaningful way, laying the foundation for the gathering of empirical data. In addition, the coding of collected data has ensured that it is interpreted in the same way by the researchers, thereby increasing the degree of internal reliability. Meetings were also held with case company representatives and one researcher to discuss the findings and development of the framework. These iterative meetings contribute to internal reliability as their input helps validate interpretations of collected data which reduces the risk of personal bias.

Regarding external reliability, the research process has been documented to provide transparency of how data was collected and analyzed. The formulation of the research questions has been done in accordance with the selected research design. To achieve the aim of the thesis, a case study was conducted and questions were formulated to direct the research and establish consistency as the thesis progressed, keeping a high trustworthiness and thereby increasing the external reliability (Bell et al., 2022; Miles et al., 2014).

Internal validity considers the credibility of the study's findings and external validity determines the possibility to generalize the study and its transferability. To increase validity, the data collection was triangulated by using several methods for the collection, namely interviews, an internal document study and a literature review. Multiple sources of data contribute to obtaining different perspectives on the research topic. Regarding the conducted interviews, several participants with different backgrounds, i.e. researchers and representatives from the case company, and ocean carriers, were chosen to get their various views. Additionally, three employees at the case company were interviewed to cross-check obtained data about their internal processes. Weekly meetings were also held with case company representatives to confirm that collected data about the case company was correctly understood and aligned with their perspectives. This type of respondent validation further increase the internal validity (Bell et al., 2022).

Findings from case studies in qualitative research are usually oriented to the uniqueness of the context, making it difficult to generalize. Therefore, Bell et al. (2022) highlight the concept thick description as important for qualitative studies which entails that researchers need to present all relevant details about the context. This allows readers to interpret the findings and make their own judgments about the possibility of generalization. In this thesis, the findings from the studied context are presented together with detailed descriptions about the case company to increase the external validity. As the framework for integrating sustainability in the LSP selection process for maritime transport was developed, researches kept in mind that it should be possible to use by other companies besides the case company. Conclusions and findings needed to be applicable to other companies to allow for generalization, leading to a higher degree of external validity.

4 Empirical Findings

This chapter presents the empirical findings. A description of the case company and input from interviewed ocean carriers and researchers are provided.

4.1 Case Company Description

Empirical data about the case company was gathered through interviews with employees, internal documents, and their website. General information about the company, its procurement process for maritime transport, and sustainable sourcing practices are presented below.

4.1.1 Company Overview

The case company is a large provider of biomaterials and paper products. It is divided into five divisions based on different product categories. In their paper mills, they produce products that are delivered to customers all over the world. The logistics function is responsible for the logistic related activity within all divisions. The logistics function is divided further into teams that have specific focus areas i.e. operations, network design, customer fulfilment and sourcing. These groups work very closely to manage the complex supply chains.

The sourcing team divides the transport modes into three categories: land, rail, and sea. The most dominant mode is sea transport accounting for the majority of transported volume every year. The sea category is thereafter divided into four segments which are breakbulk, liner, ports and container. These are procured separately due to their vast differences in operation and stakeholder collaboration. The breakbulk segment relates to products that are more easily transported in bulk, both for operational and financial reasons. The transport of breakbulk goods are specifically scheduled when there is enough volume to fill a vessel. The liner segment is defined by goods that are transported in special company-developed loading units, that go on specific routes and schedules. The operational setup of this segment is developed closely with strategic suppliers. The port segment includes procurement of port and terminal activities, such as on-carriage or warehousing. The last and largest segment is container with regards to transported volume. As the mills are to a larger extent concentrated around Scandinavia, the majority of container shipments depart from there. The sea transport is directly procured from the ocean carriers, usually on a port to port basis. As previously mentioned, the case company's customers are located all over the world, meaning they need to make sure they have ocean carriers that can travel to all these locations. See Figure 4 for a map with the geographical delivery locations where the size of the circles represents the volumes shipped to each geographical location.

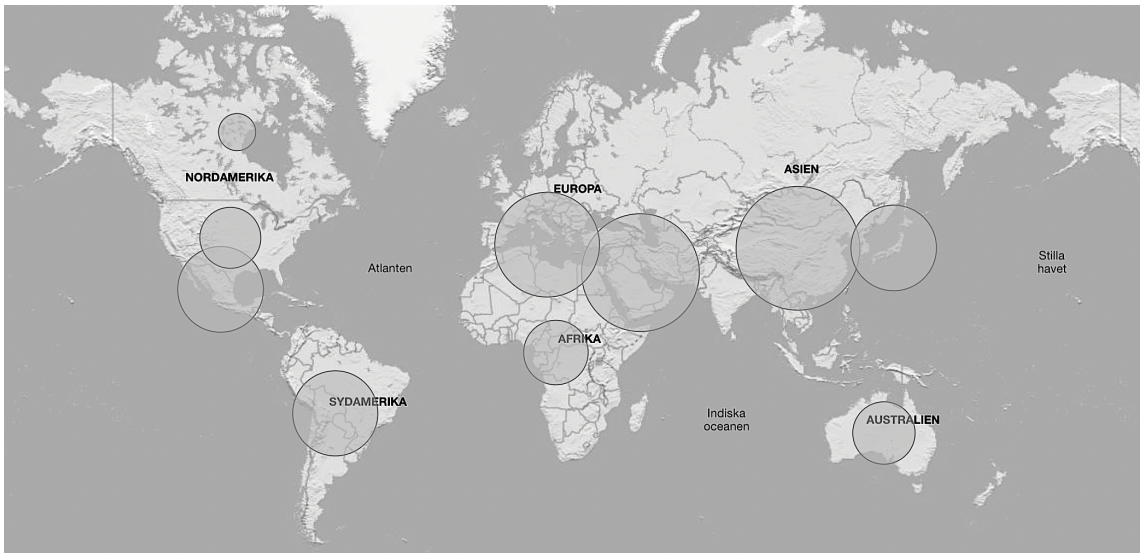

Figure 4: The case company's delivery locations

4.1.2 Current Procurement Process for Maritime Transport

For the sourcing team that procures the maritime transport in the container segment, the work is a continuous process. The team is divided to have responsibility over different geographical markets, but they all follow the same sourcing process, see Figure 5.

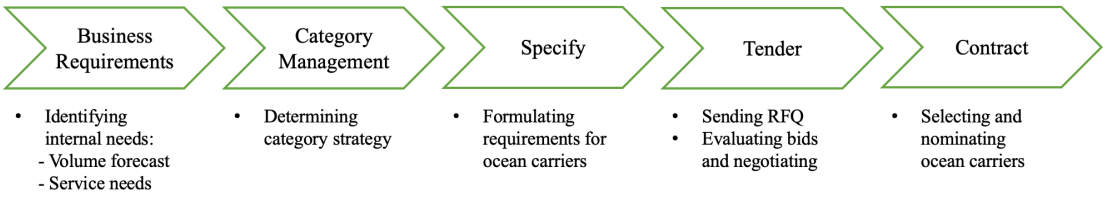

Figure 5: The case company's sourcing process for maritime transport

The first steps, business requirements and category management, focus on identifying internal needs. Starting with the business requirements, a forecast is made on how much volume will be produced by all the mills that need to be shipped in containers for the following year, as well as between what port pairs the volume will be divided. Additionally, the service needs are revised through internal discussions. The customer-specific requirements in terms of service quality are also revised and taken into account. These requirements can range between, free days at port, container quality, return time on booking requests, and transit times. For category management, the team is focused on determining the strategy they will have during the upcoming selection and contracting of ocean carriers. The strategy includes for instance having at least two ocean carriers per port pair to secure delivery capacity and targets for savings and sustainability. However, the latter is currently not adapted for the container segment specifically, but it includes statements that it should contribute to the SBT that the case company has committed to.

Based on the internal business requirements and the category strategy, requirements for ocean carriers are formulated for the tender. The specified requirements include, for example, volume, origin and destination ports, and service level. After requirements have been specified, the tendering starts when the case company sends out the RFQ. As the container market is special in the sense that there are very limited options when it comes to ocean carriers, the RFQ is sent to all available ocean carriers on the market. An ocean carrier that has been used the previous year will not automatically be used again, they will be re-evaluated and need to bid like all other ocean carriers. However the ones bidding again, will be asked if they want to increase, have the same, or decrease the volume that they were allocated last year. This, together with historical performance data, is used to get an indicator of their capacity to handle their requested volume. Still, all available ocean carriers are invited to give a bid so the case company can benchmark and increase competitiveness on the market. Before ocean carriers can be contracted, they have to become approved suppliers by the case company. This means that they must comply with pre-qualification requirements, these will be further described in the next section. Ocean carriers that have been contracted by the case company before can reply to the RFQ directly and do not have to be approved again unless the requirements have been updated. Because of the limited amount of ocean carriers, the case company is well aware of the market, and many ocean carriers are already known and approved suppliers, hence they typically do not send out an RFI. The case company uses a web-based system called Carrier Point to communicate and transfer documents to ocean carriers. This system is used in the selection process since ocean carriers can accept prequalification and reply to RFQs and place bids digitally through the system.

Moreover, the tender includes several biddings from ocean carriers that meet the requirements. The bidding is done in several rounds and a face-to-face meeting is held with representatives from both parties for negotiation. Following negotiations, the case company nominates ocean carriers for selection and they are allocated shares of volume between specified port pairs. Before the ocean carriers are notified, the procurement team needs to present the nominations and allocated volumes to the case company's sourcing committee to get their approval before proceeding. The allocated volumes for all port pairs are included under one contract for each ocean carrier. Contracting is then completed when the selected ocean carriers have been notified and thereafter approved the contract.

After the contract is filed, the case company can start to order container transport in line with the contracts. Henceforth, the procurement team have followup meetings to evaluate fulfilment of the allocated volumes and discuss the outcome so far. If there are any inconsistencies in terms of performance there can be changes made to the contract. The case company is aware they cannot have unreasonable demands about the market offerings. They, as well as the ocean carriers, have to accept the market conditions. The case company's approach is to work together to solve any issues that arise by keeping a good dialogue with the contracted ocean carriers.

4.1.3 Sustainable Sourcing

The case company's sustainability approach is linked to its internal values and purpose. The company has set sustainability goals within three different transformation areas, these are biodiversity, circularity, and climate, see Figure 6.

Figure 6: The case company's sustainability transformation areas

The foundation for achieving goals within these three areas is the case company's commitment to responsible business practices, including sustainable sourcing practices. Conducting responsible business is key to ensure that their value chain impacts are managed, in terms of environmental impacts, but also social impacts as the company values for instance safety for workers and human rights. It is important for the case company to maintain and improve sustainability to be an attractive employer, meet customer requirements and attract investors. On top of this, the company has committed to SBT to contribute to the Paris Agreement goals. The SBT serves as a driver to reduce GHG emissions and, as it includes scope three, it is linked to the sourcing of logistics services. Legislation is another external factor that drives sustainability improvements. For instance, the upcoming legislation from the European Green Deal pushes large companies to take responsibility for sustainability impacts from their entire value chains. To manage the sustainability impact from all suppliers in the value chain, the case company currently works with risk assessments. The assessments provide input to the procurement decisions and serve as a basis for what suppliers to focus on when monitoring them through visits and audits.

The case company has over 20000 suppliers, out of which 5000 are LSPs. The sustainable sourcing practices are critical to manage their large supplier base and these practices apply to purchases of logistics services, including maritime transport. All LSPs must fulfill pre-qualification requirements to become approved suppliers that can be contracted. These requirements include compliance with the case companys' SCoC, cargo handling and securing manual and frame agreements and completing a safety e-learning program. The SCoC addresses the topics of laws and regulations compliance, responsible business, occupational health and safety, human and labor rights, and environmental protection. Over the last few years, more work has been done to address sustainability while sourcing logistics services. In 2018, three sustainability criteria were added to the sourcing process, see Table 7. These criteria are requested from the LSPs every year, most commonly through the RFQ, and the case company uses them to monitor their performance and if there are any trends over the last three years.

Table 7: The case company's current sustainability criteria for evaluating LSPs.

Climate Change Mitigation Performance	GHG Emissions
Operational Safety Performance	Total Recordable Incident Rate
Financial Stability	Credit Rating

Despite the inclusion of these sustainability criteria in the sourcing process, the emphasis during selection often remains on cost and service quality. One evident barrier to considering sustainability in the process is the lack of ways to compare ocean carriers on their sustainability performance, as current sustainability criteria are deficient. The criteria financial stability is not utilized by buyers since another department has the responsibility to control ocean carriers' credit rating and financial performance before they are contracted. Furthermore, there is a need to improve the way GHG emissions are measured since the case company currently asks the ocean carriers for their emissions in relation to spend. This intensity ratio can be misleading as it can seem as though the GHG emissions increase or decrease when the freight rates change. Additionally, it can differ between ocean carriers what data they provide. Some report their total GHG emissions and spend, while others just report the GHG emissions and spend that are connected to the case company's volumes, making it difficult to compare the ocean carriers based on this criteria. As a result, the primary focus is on their compliance with the SCoC and regulations from IMO and the EU. Aside from that, sustainable sourcing practices within sea transport mainly center around the case company's sustainability area "climate" by looking at ways to reduce GHG emissions and contribute to the SBT. Furthermore, the case company is a member of SFC who manages the CC program which is focused on measuring and reducing GHG emissions within container shipping. All ocean carriers that the case company uses are currently members of CC. The case company considers it positive that ocean carriers are engaged in these types of programs or similar initiatives that focus on improving sustainability within shipping.

Furthermore, there is a willingness to increase the maturity of the sustainable sourcing process by including additional criteria related to all three sustainability pillars, rather than simply ensuring legal compliance. The aim is to know more about the ocean carriers' overall sustainability performance before entering negotiations. There was an attempt to achieve this by developing a questionnaire for the ocean carriers that included more sustainability criteria than the ones in Table 7. However, it was never successfully implemented as it was time consuming to gather data, required manual work, and had too much focus on legal requirements. Therefore, it was perceived as difficult to integrate its use with the current sourcing practices. On top of this, the questionnaire was generic for all segments within sea transport which proved to be insufficient as the segments have different characteristics.

Moreover, some central steps that are included in the sustainable sourcing process are supplier development and collaboration. By following up on suppliers' performances, potential improvement areas can be identified to develop suppliers. Additionally, supplier collaboration can help identify how GHG emissions can be reduced

and to gain knowledge about various sustainability topics. Regarding the sourcing of maritime transport within the container category, sustainability is discussed with the ocean carriers during the previously mentioned quarterly follow-up meetings. However, more and clearer sustainability criteria are preferred to be able to monitor and discuss the ocean carriers' performances. Furthermore, it is currently difficult for the case company to source sustainable maritime transport solutions as the offerings are very limited. Within the container segment, they perceive that they have limited possibility to affect the ocean carriers' offerings as they are a relatively small actor compared to them and the ocean carriers must adhere to many different shippers' demands. A container ship carries goods for many shippers', making the case company a relatively small customer as their volume of goods only accounts for a small percentage of the total volume. On the other hand, one possible sustainable offer that is available on the market for the case company is the purchase of biofuel via mass balance method. This means that ocean carriers invest in biofuels that will be used within their fleet, but there is no guarantee that the ship that carries the case company's goods will run on biofuel. Still, the case company can report that they have minimized their GHG emission through this purchase. However, the cost of switching to alternative fuels is very high and to bear that cost, the case company needs to either receive customer demands for it or have a defined internal strategy that they want to support this transition. As of today, internal directives are staring to emerge as well as customer requests on sustainability, but its presence need to be enhanced for it to reflect on processes to drive the transition. Nevertheless, the quarterly meetings help the case company to identify ocean carriers' current sustainability initiatives and get insight about offerings that might be of interest to them in the future.

4.2 Ocean Carriers' Perspectives

Empirical data about maritime transport solutions was gathered through interviews with representatives from two ocean carriers, which is presented below.

4.2.1 Sustainability Solutions within Maritime Transport

The mindset is changing in the maritime industry and it is fundamental for ocean carriers to have support from top management to get on the path of providing more sustainable solutions, both in terms of investments and for driving the change. The maritime industry is a traditional business which has been focusing on the operational effectiveness since the start. It is a business that relies on economics of scale to minimize cost and sustain growth. However, it is becoming more common for the operating carriers to involve sustainability in their strategy as it is something customers are starting to ask for and increasing regulations restrict their operations. The interviewed ocean carriers have set ambitious sustainability targets to be more sustainable going forward. The targets range from being the leader in decarbonizing the industry to having a fleet running 100% on renewable fuels with zero fossil emission, which both will require a huge amount of resources to reach. Furthermore, ocean carriers are to a larger degree committing to the SBT, as well as shippers.

But, as it requires an extensive amount of money and resources not everyone can commit to the SBT. At this point, mainly the larger ocean carriers and shippers have the ability to make this commitment.

As a step towards being more sustainable, ocean carriers are obtaining ISO quality standards, ISO sustainability standards and other certificates to show their commitment to the sustainability pillars, apart from adhering to the baseline regulations set by IMO and other regulatory bodies. Simultaneously, some of the larger ocean carriers are investing in more extensive sustainability solutions that are currently under development. There are a few solutions already available for shippers. The main offer is that shippers can buy an amount of biofuel that is needed to transport a certain volume. But, this biofuel will unlikely be used to transport the shipper's volume directly, instead ocean carriers guarantee it will be used by a vessel in their fleet at some point in time. Ocean carriers can provide certificates of this and shippers can thereby account for having used biofuel for that transported volume.

Nowadays, many vessels are equipped with technology that aims to make their operation in regard to route planning, fuel consumption, and energy efficiency as effective and optimized as possible. Slow steaming has for many years been the response to becoming more sustainable for ocean carriers, but as regulations keep on confining, they must advance and assume even greater responsibility. For example, one ocean carrier focuses on increasing operational efficiency by making sure that the vessels sail at a speed that is suitable for their design and they monitor the vessels' operations through a digital performance management system. In addition, ocean carriers are building new vessels propelled by alternative fuels such as LNG, Methanol and Ammonium. Some of these vessels are already operating, and it is highlighted that many ocean carriers are continuously investing in developing vessels that will be even more sustainable. For instance, hull modifications help streamlining the vessels, wind sails are used to propel the vessel and anti-fouling paint is used to prevent marine growth on the vessel surface.

4.2.2 Barriers and Drivers for Sustainable Shipping

Nevertheless, there are barriers that hinder ocean carriers' transition to more sustainable practices. As mentioned previously, shippers mainly demand low cost, high service levels and competitive transit times. Despite the fact that shippers have started to demand sustainable solutions, their willingness to pay more for these solutions is still quite low. Spending money on sustainable solutions without shippers paying for them will not be economically viable, preventing ocean carriers from investing in solutions that are neither requested nor compensated for.

Alternative fuels are mentioned as key enablers for sustainable maritime transport, however, they are hard to obtain. It is difficult to bunker biofuel on the vessel and the production of biofuels is limited. For instance, there is not enough methanol on the market to be used on a larger scale in the maritime transport industry. Additionally, it is difficult for ocean carriers to know which alternative fuel to invest in. Because

of these uncertainties, some carriers are building different kinds of vessels to be prepared for multiple outcomes in alternative fuels development. For instance, by developing some that are designed for methanol and some for ammonium. Moreover, for container shipping the distances are too long for electricity to be a feasible option.

As many of the newly developed vessels go into ocean carriers' existing fleets, the question still remains whether they will make enough difference in the short term. Because of the long development and deployment time of a vessel, it might already be outrun by the new technology when entering the fleet. However, new vessels have a better environmental performance in comparison with the older ones. Old vessels that are already operating and run on marine diesel fuel are hard and expensive to retrofit and it is usually not an option to scrap them as many are at the beginning or middle of their operative lifetime, thus having many years left. For these reasons, the transition to alternative fuels is a long and challenging process. It is stressed that, as sustainability investments grow in scale, a lot is still unknown, which is why ocean carriers express a need for regulations and international bodies to point them in the right direction by stating what is green or not, as well as providing certifications for the implementation of alternative fuels.

Despite the barriers described above, the marine industry is moving toward more sustainable shipping because there are other factors influencing this transition as well. One common barrier that has been mentioned is the lack of customer demand and willingness which as it hinders the carriers' investments in sustainable solutions. However, these factors can be drivers for the transition too, since some customers have started to ask for sustainable solutions and green products. Even if sustainability usually is the lowest prioritized criterion for shippers when procuring maritime transport, the ocean carriers are starting to see a shift as some shippers, even though they are a minority, are starting to demand green solutions and are willing to pay for them. As described, it is a question of the shippers' maturity with regard to sustainability targets and ambitions.

Another driver for change is the growing number of regulations which force ocean carriers to improve sustainably. Ocean carriers that are at the forefront of change and have already started to invest in sustainable solutions welcome stronger regulations as they contribute to even out costs. The ones that have not begun to invest in sustainability risk paying large fees and taxes if they fail to meet the impending legal requirements, resulting in higher costs and decreased competitiveness for them.

Besides these external drivers, ocean carriers can also demonstrate an internal drive for change by including sustainability as a part of the core strategy. When top management is committed to being at the forefront, sustainability initiatives such as investments in new technology are supported to achieve sustainable maritime transport. An example where an internal drive can be seen is linked to an ocean carrier that has made an internal decision to buy biofuel that is equivalent to 1% of the total amount of used fuel for their transportation to start the transition towards using alternative fuels. Furthermore, many ocean carriers are reaching out

to companies that produce alternative fuels to facilitate collaboration by showing that there is a demand for it and trying to secure production capacity for it.

Lastly, ocean carriers view collaboration with shippers as a major driver and facilitator of change. They need to see more customers interested in sustainable solutions and that they are willing to pay for it. If more customers are interested in, for instance, a biofuel-based offering, economies of scale can help drive down the price and create a market for these types of green products. Furthermore, ocean carriers express the need to have a dialogue with shippers about the current offerings, what is needed to elevate them, and how to progress. Keeping the dialogue becomes essential to bridge the gap between shippers' requirements and ocean carriers' available offerings. The shippers need to have an understanding that the transition cannot happen over a day. Therefore, the ocean carriers want to discuss what they want to achieve together and collaborate to develop. It is necessary to share the costs of investing in alternative fuels and other sustainable solutions. To summarize, these drivers and barriers to ocean carriers' shift to sustainable transport solutions are presented below in Table 8.

Table 8: Drivers and barriers for sustainable shipping

Drivers	**Barriers**
Laws and regulations	Customers willingness to pay
Customer demand	Large investments
Internal drive	Long vessel lifetimes
Stakeholder collaboration	Alternative fuels availability and development

4.3 Researchers' Perspectives

Empirical data about the research area was gathered through interviews with researchers. The main takeaways from these interviews are described below.

4.3.1 Procurement of Maritime Transport

It can be challenging to procure maritime transport due to the market characteristics. As it is a complex and specialized market, buyers typically have very few ocean carriers to choose from. The selection decision is restricted by for instance the type of segment within maritime transport, the start and destination point, and the service levels. On top of this, a maritime transport solution is dependent on collaboration between many actors, such as ports, ocean carriers, shipping companies, and fuel producers, which can pose as a challenge as it increases complexity. Furthermore, the procurement is usually done on annual contracts, but they are often amended due to price fluctuations. As the maritime transport business is costly and requires large investments, the ocean carriers have high fixed costs which they try to cover by achieving economies of scale, making them sensitive to fluctuations in demand. When capacity utilization fluctuates, prices fluctuate as well. In addition,

the limited number of ocean carriers on the market creates an imbalanced power structure. The possibility to put pressure on ocean carriers is linked to shippers' volumes. Although carriers compete fiercely to attract customers and cover their high costs, almost all shippers have little possibility of affecting them because they are not as big as the carriers. Because of this, it is difficult for shippers to demand more sustainable transport solutions, which are currently scarce on the market.

The limited offerings on the market together with shippers' lack of power and knowledge within maritime transport are barriers to procuring more sustainable solutions. Shippers' unwillingness to pay more for sustainable solutions also pose a barrier. If sustainability is not prioritized internally and supported by the management, the focus when procuring maritime transport will primarily be on lowering the cost. Buyers are typically inclined to mainly check prices and service levels due to time and knowledge constraints. Therefore, they need to be trained on how to gather information and assess ocean carriers' sustainability performances. They should also be aware of industry developments and the available sustainability solutions on the market.

Moreover, considering the procurement process, it is preferable to acknowledge sustainability from the beginning of the process when internal needs are identified. This is necessary to identify sustainability requirements that should be included in the subsequent process steps. It is beneficial to include sustainability requirements already in the RFI, before the tendering starts. The reason for this is that it helps identify ocean carriers that can and will deliver and report on those requirements. It also provides an opportunity to discuss with ocean carriers about sustainability improvements and to find solutions through collaboration. Even if the ocean carriers cannot meet the specific requirements, it is crucial to include them to establish a demand for sustainable solutions. However, it is important to avoid symbolic requirements and instead introduce criteria that actually help assess ocean carriers' sustainability performances. Too specific requirements on technical solutions should also be avoided as it can lead to suboptimization if the buyer lacks insight about how ocean carriers manage the transportation. Criteria that are linked to ocean carriers' sustainability impacts, such as emissions caused by the transport, are instead preferable to use. However, it can be difficult to measure, evaluate, and follow-up performances. For instance, when receiving reports from ocean carriers on their emissions, it is important to not blindly trust the numbers as they depend on the methodology that has been followed to calculate the emissions. Despite the difficulties related to the use of sustainability criteria, it is better to include them than doing nothing. Basically, it is about demonstrating an interest in sustainability within maritime transport by keeping dialogue and engaging with ocean carriers.

4.3.2 Sustainability within Maritime Transport

Maritime transport is normally regarded as one of the most environmentally friendly transport modes because economies of scale can lead to lower emissions per unit. However, as the criticality of climate change is increasing, there is a need to mitigate

the sustainability impact that maritime transport contributes to. For example, a vast majority of ships run on the dirtiest fuel out of all transport modes, marine diesel oil, which can no longer be neglected. The most central issue discussed in relation to sustainability within maritime transport is GHG emissions, especially the CO2 emissions. To reduce CO2 emissions, some ships now run on LNG as it is a cleaner fossil fuel. However, these ships emit methane which is a considerably stronger GHG than CO2, meaning even small amounts can have great environmental impact. This shows that there is a need to focus on other issues as well apart from CO2 emissions. Emissions of particles such as NOx and SOx should also be considered as it has a negative impact on air quality. These types of emissions has historically received more attention and progressively been regulated, in some parts of the world more than others. For example, ships that never berth European ports are not required to comply with EU regulations, and might therefore perform badly in terms of air and water pollution as well as discharges of oil and waste. Another issue that must be considered is the discharge of ballast water as it can result in the spread of potentially invasive species and negatively effect the ecological environment. To achieve a comprehensive understanding of environmental challenges in maritime transport, more aspects than just climate change caused by GHG emissions must be addressed.

Besides these environmental issues, shippers must also be aware of social and economic sustainability issues within maritime transport. One prominent social issue is poor working conditions for the ship crews because of the characteristics of the job. These crew members are typically on sea for a long time at high risk and with limited supplies. On top of this, they generally work under quite hierarchical structures. As a result, the work environment can affect workers' physical and mental health negatively. Additionally, the level of diversity in the workforce tend to be low because the majority of them typically represent only a few nations, but this is not the case at higher ranks. Ocean carriers often use crewing agencies to recruit seafarers, which can be considered a social risk if they lack insight into how the crew is employed. Other social issues are linked to the societal impact that shipping activities at port cities can have. To mitigate these social sustainability risks, ocean carriers are increasing their efforts in areas such as education and training of new employees in the industry as well as philanthropic activities in the regions affected by their maritime transport operations. In terms of governance, corruption is a pressing issue since shippers' goods pass through numerous customs, making it critical to refrain from engaging in any form of corruptive economic activity.

Moreover, laws and regulations together with financial incentives are required to increase the sustainability of the maritime transport industry. They ensure that sustainability is not only a matter of interest or commitment by a few ocean carriers in the industry, as it becomes economically important for all ocean carriers. When actors in the industry realize that their costs would increase if they do not work on the transition to sustainable maritime transport, they are pushed to improve. For example, one driver for change that is currently underway and has a significant impact on maritime transport development is EU's Fit for 55 package

and the accompanying instruments, such as EU ETS and Fuel EU maritime. In addition, IMO works to reduce emissions from shipping, and as they are the largest regulator of maritime transport, all ocean carriers are now trying to demonstrate that they are working towards this and seek alternatives to decarbonize shipping. For instance, they invest in alternative fuels and work with ship design, while simultaneously pursuing more operational measures such as slow steaming. The problem with investing in new ships and engines is that it is hard to have solid foresight and assurance that what you invest in is a feasible long-term solution. The lead time for building ships is approximately three years and then they have a lifespan of at least 25 years, during which time technology development can change. As there are uncertainties about which type of fuel and technology will be the best in the future, some ocean carriers research and invest in, while others are more reluctant. The problem with company-led research is that ocean carriers want the alternative fuel in which they have put their time and money to be successful, so they only focus their research and marketing efforts on that. This makes it difficult for shippers to compare ocean carriers' efforts and determine which one is on the right path.

5 Analysis and Discussion

This chapter presents the analysis and discussion of the empirical findings.

5.1 Sustainability Criteria for Ocean Carrier Selection

In the literature review, it is highlighted that the LSP selection has been price focused for many years (Davis-Sramek et al., 2018a; Hedvall et al., 2017). This is still true according to the interviewed researchers and ocean carriers, but they are starting to see a slight shift among shippers who are becoming more focused on sustainability. The shift is noted by Davis-Sramek et al. (2018a) as well who report that the importance of including sustainability in the LSP selection is growing. This requires shippers to evolve their mindset of how sustainability can be used in the selection process. Paul et al. (2020) and Prabodhika et al. (2020) explains that selecting sustainability criteria is challenging due to the interrelationships and trade-offs between them. According to Ergin and Alkan (2023) and Fanam et al. (2016), criteria that influence selection decisions and their importance levels vary depending on factors such as shipper and ocean carrier perspectives, company size, industry, and geographic location. Therefore, the chosen sustainability criteria must be relevant and consistently linked with industry characteristics, regulations, and companies' sustainability ambitions.

Focusing on the case company, sustainability is at the core of their business and they have the ambition to elevate it further and improve their sustainability performance. Therefore, they have taken measures towards including more sustainability in their LSP selection processes. Currently, they have included sustainability requirements that LSPs have to comply with through the SCoC. Additionally, they have included three sustainability criteria for the selection process that LSPs have to report on yearly. However, these criteria have shown to not be useful for comparing the ocean carriers' sustainability performance, resulting in a need to change them. In an attempt to identify more suitable criteria, they developed a sustainability questionnaire for the LSPs to fill out, enabling comparison and assessment of their sustainability performance. However, the questionnaire was never fully implemented due to the difficulties in determining sustainability criteria that are relevant for each segment within maritime transport. The chosen criteria for the questionnaire also had too much focus on compliance with laws and regulations. This is in line with Prabodhika et al. (2020) and Roy et al. (2020) who explains that it is complex to include sustainability criteria in the selection. Case company representatives express that they want to extend their sustainability criteria beyond LSP compliance with laws and regulations. Therefore, sustainability criteria that consider other aspects than just law and regulation compliance are identified in this study. For each criterion, questions are formulated to gather information that enable assessment of ocean carriers' sustainability performance within that criterion. Furthermore, the selected criteria and their related questions are compiled in a new questionnaire

based on collected empirical data and the literature review. The latter resulted in identification of commonly used sustainability criteria for LSP selection, see Table 1. These criteria together with identified sustainability issues in the maritime transport industry show what the case company and similar shippers should base their criteria on. A more detailed explanation is provided in the next section of why each criterion and related questions are selected to be included in this study's developed questionnaire.

Moreover, the selected criteria are divided into three sustainability dimensions namely environment, social, and governance. The governance dimension is included instead of the economic dimension as governance is more in line with how ocean carriers report their sustainability performance. Furthermore, since the EU has enforced the CSRD, more companies have to report their ESG performance, which includes governance (EU Comission, 2024). Although Lam (2015) highlights the criticality of economic performance within maritime transport as it is a highly cost-competitive industry, the literature review showed that there are several environmental and social sustainability issues within the maritime transport industry that needs to considered as well. Therefore, it is critical to go beyond price-focus and assess whether ocean carriers are responsible and ethical, as well as socially and environmentally sustainable. In addition, the case company explains that it is not the buyer's responsibility but another department that checks ocean carriers' financial performance before contracting them. For these reasons, the identified criteria in Table 1 within the economic dimension are not selected in this study. Instead, the focus is only on criteria that relate to social, environmental, and governance aspects.

5.1.1 Environmental Criteria

The environment dimension outlines the six criteria, environmental certification and engagement, CO2e emissions, air pollution, energy efficient transportation, recycling of ships, and use of alternative fuels, see table Table 9. These criteria seek to assess ocean carriers' efforts to mitigate their negative environmental impacts. Furthermore, it gives the shipper an idea of how they are progressing toward decarbonization and what solutions they intend to pursue. Comparing the chosen criteria to the identified criteria in frame of reference, see Table 1, compliance with environmental laws and regulations was excluded from the questionnaire as the case company representatives expressed their need for criteria that go beyond the current laws and regulations. Energy consumption was also excluded as the criteria energy efficient transportation was considered sufficient to cover this topic. Waste management and additional environmental issues in maritime transport mentioned by Benamara et al. (2019) and Garg and Kashav (2019), such as oil spills and the release of ballast water, are not included in the questionnaire. Although these are relevant issues to handle as they still occur, IMO has extensive regulations in place that are mandatory for ocean carriers to follow (IMO, 2024c).

Table 9: Environmental criteria and related questions

Criteria	**Questions**
Environmental Certification and Engagement	Have your company implemented an environmental management system?
	Are you engaged in environmental tools/initiatives such as Clean Shipping Index, Smart Freight Center's program Clean Cargo, or Environmental Shipping Index? If yes, please specify which tools/initiatives.
CO2e Emissions	Do you calculate and monitor CO2e emissions on a well-to-wake (WTW) basis? If yes, provide the average CO2e/TEU-km (WTW)
	What methodology is utilized to calculate and monitor CO2e emissions?
	Do you use industry average or own data when calculating CO2e emissions?
	Do you monitor trends in your CO2e emissions based on CO2e/TEU-km? If yes, provide the trend through year on year percentage.
	Do you have reduction targets for CO2e emissions? If yes, please specify.
	How do you manage EU ETS? If measures have been implemented to reduce emissions, please specify them.
Air Pollution	Do your ships operate solely on low sulfur fuels or do they have scrubbers installed?
	If scrubbers are installed, what type of scrubber system is mainly used?
	What share of your fleet has scrubbers installed?
Energy Efficient Transportation	What is the average CII rating of your fleet?
Recycling of Ships	Do you comply with the Hong Kong Convention or the EU Ship Recycling Regulation (EU SRR) for recycling ships?
	Do you use 3rd party audits to check used dismantling sites?
	Are you a part of the Ship Recycling Transparency Initiative (SRTI) or similar?
Use of Alternative Fuels	What is your share of ocean freight transported with alternative fuels?
	Have you increased your share of alternative fuels compared to last year?
	Do you have ships in your orderbook that are alternatively fuelled capable?
	Do you offer transportation solutions utilizing alternative fuels? If yes, please specify the available offerings.
	What alternative fuels do you utilize?

The first criterion in this dimension is environmental certification and engagement. This criterion was identified in the literature review and used in the case company's' previous questionnaire. As Kronfeld-Goharani (2018) claims, it is expected that more sustainability initiatives will be initiated given the increase in policies and regulations worldwide within maritime transport. The case company expresses that they value ocean carriers' engagement in sustainability organizations and initiatives as it demonstrates commitment to solving sustainability issues. Therefore, this criterion partly focus on environmental engagement. Furthermore, Bask et al. (2018) explains that most of the large ocean carriers are ISO-certified, as they need to operate according to certain quality standards. As a result, this criterion also include environmental certification to ensure that carriers are adhering to an ISO standard for environmental management or that they are working systematically to achieve a specific quality standard related to their sustainability work.

The second criterion, CO2e emissions, is selected as it is a critical issue within maritime transport since GHG emissions are expected to increase due to the continued growth of world trade (Benamara et al., 2019; Christodoulou, 2019). CO2e refers to carbon dioxide equivalent emissions. It is a measurement of the total greenhouse gases emitted that is commonly occurring in ocean carriers' sustainability reports. As the case company has committed to SBT and climate is one of their sustainability transformation areas, this criterion is highly relevant for them. The criterion seek to assess the ocean carriers' emissions, year-on-year trend, and what reduction targets they have set up. Länsstyrelsen Västmanland (n.d.) address the difficulty regarding calculation of GHG emissions and that many do it differently, making it complex to understand and compare the results. Therefore, ocean carriers are asked to provide their emissions with specific units and what calculation methods they have used. In addition, as the EU ETS regulation will lower the cap for emissions within maritime transport in the coming years (European Comission, 2024), understanding how ocean carriers are to comply with the limitation in allowances becomes crucial, as it highly affects the shippers.

The third criterion, air pollution, is chosen because there is a need to look at more pollutants, not only CO2e emissions. Benamara et al. (2019) explains that emissions of SOx and NOx is an environmental issue in maritime transport because these pollutants degrade the quality of the air itself and pose a threat to the respiratory health of seafarers, port personnel, and nearby communities. This is consistent with interviewed researchers who emphasize the criticality of air pollution within maritime transport and as a result, emissions of SOx and NOx have become very regulated. Formulating questions regarding these emissions is considered unnecessary as ocean carriers are forced to comply with these regulations if they operate in international waters. However, the case company expresses the need to know if ocean carriers are using scrubber systems to comply with SOx regulations as some systems are better than others in regards to water pollution and biodiversity. Although interviewed researchers state that requirements on technical solutions should be avoided, it is in this case beneficial to gather information about ocean carriers' solutions to reduce SOx emissions.

The fourth criterion, energy efficient transportation, is included because it can contribute to reducing GHG emissions which is a central sustainability issue within maritime transport (IMO, 2024b. IMO has established several indices for ocean carriers to report their ships' energy efficiency, these are EEDI, EEXI SEEMP, and CII, see table Table 5. Including all these measures is considered too detailed for the questionnaire. Instead, only CII is included in the questionnaire as it gives an overall understanding of how the ocean carriers' fleet is performing in terms of energy efficiency since it focuses on operational performance.

The fifth criterion, recycling of ships, is chosen as Lai et al. (2011) explains how the dismantling of ships is a sustainability issue in maritime transport. As a result, it is important to hold ocean carriers accountable for this. Interviews with ocean carriers show that they want to upgrade their existing fleets with newly developed vessels to improve environmental performance. However, they further address that this upgrade will take several years as many old ships are in the beginning or middle of their operational lifetime. Nevertheless, the old ships will eventually be scrapped and it is important to ensure that ocean carriers are transparent about how they do it to ensure an environmentally sound recycling. Furthermore, in the case company's previous questionnaire, a question regarding ship recycling was included as it is related to their sustainable transformation areas circularity and biodiversity. For these reasons, questions about ship recycling are included to gain an understanding of how ocean carriers manage this issue. The questions are formulated based on the case company's previously used question as well as information from ocean carriers' sustainability reports.

The sixth criterion, use of alternative fuels, is included based on the empirical findings as ocean carriers disclosed they are investing in new ships that will be alternatively fuelled capable. It also becomes relevant as new regulations, such as the "Fit for 55" climate package, put pressure on ocean carriers to decrease the use of dirty marine fuels to lower emissions (European Comission, 2024; IVL, 2022). As mentioned previously, one of the most pressing sustainability issues in maritime transport is GHG emissions (Benamara et al., 2019). This is one of the underlying reasons why ocean carriers are developing solutions to use alternative fuels. As a result, questions about how ocean carriers are working towards increasing the usage of alternative fuels are appropriate to determine where they stand in this transition.

5.1.2 Social Criteria

The social dimension includes four criteria which are, occupational health and safety, human and labor rights, societal commitment and investment, and level of diversity in the workforce, see Table 10. These criteria seek to gather information regarding how the ocean carriers take responsibility for internal and external staff and the societies they affect while doing business. Compared to Table 1 in the frame of reference, the criterion compliance with laws and regulations and human rights, which fall under the social dimension has been excluded. Case company representatives believe this criterion is very important, however, as previously stated, they

want to go beyond laws and regulations that are already mandatory. In addition, legal compliance and human and labor rights are already play a large role in the SCoC. As a compliment to the SCoC, this topic is assessed by including questions on how the ocean carriers train their staff in human and labor rights. Therefore, the criterion staff training in Table 1 is not assessed in isolation and instead included through questions in other selected criteria. Lastly, the criterion corruption risk is moved from the social dimension as it better aligns with the added dimension governance. This is because governance provides a more holistic view of a company's ability to enforce policies, allocate resources, and supervise maritime activities to ensure safety, security, efficiency, and environmental sustainability within maritime. Furthermore, it was seen in ocean carriers' sustainability reports that corruption is commonly addressed under governance, and interviewed researchers also mentioned it as a governance risk.

Table 10: Social criteria and related questions

Criteria	**Questions**
Occupational Health and Safety (OHS)	What is your company's official TRI (total recordable incidents) rate for the last 12 months?
	Have your company implemented an OHS management system?
	Do you have a system for reporting of near misses and accidents which is monitored and systematically followed up?
	Are employees (including onboard personnel) provided with training on OHS? If yes, what fulfillment rate do you have for employee training on OHS?
Human and Labor Rights	Do you ensure that crewing agencies have fair recruitment practices?
	Who pays recruitment fees for onboard personnel?
	Are employees (including onboard personnel) provided with training on human and labor rights? If yes, what fulfillment rate do you have for employee training on human and labor rights?
	Do you have a procedure for how to manage stowaways?
Societal Commitment and Investment	Do you calculate your societal contributions? If yes, please insert the ratio of your societal contributions to total revenue.
Level of Diversity in the Workforce	Do you work to improve the diversity (gender, age, nationality) of the onboard crew? If yes, please specify how.

As mentioned by Altuntaş Vural et al. (2021), the tough working conditions have long-term impacts on the physical and mental health of seafarers. Therefore, occupational health and safety is included as a criterion. Furthermore, the case company has previously included the measure TRI as a way to assess operational safety performance, see Table 7. As they consider this measure valid for monitoring incidents,

it is kept in the questionnaire. In addition, ocean carriers need to have systems for upholding occupational health and safety and incident reporting, therefore questions regarding this are included. Furthermore, the literature review revealed several issues related to deficient employee training, education, and equality which carriers need to have policies for (Altuntaş Vural et al., 2021; Karakasnaki et al., 2023). Hence, similar questions regarding staff training on health and safety are included in the same way as training on human and labor rights which was mentioned above. In addition, having these types of staff training in place is not enough, employees need to be engaged and take part in them as well. This is the reason why ocean carriers are asked to provide fulfillment rates for their training. They are also asked questions about crewing agencies and recruitment fees to ensure fair recruitment of seafarers since interviewed researchers mentioned that some ocean carriers use these agencies. A question regarding how ocean carriers manage stowaways is also included as it was present in the last questionnaire and it is a reoccurring issue in maritime transport, reported by the case company.

Moreover, the case company has for many years reported on societal commitment and investment since it is something they consider important. A part of their SCoC also highlights that suppliers must strive to support and engage with communities. Interviewed researchers explain that shipping activities have a societal impact, especially in port cities. Therefore, it is essential that ocean carriers take responsibility of the social issues that their operations bring. Hence, questions regarding their societal contribution, for instance through charity spending, are included. Furthermore, from the interviews with researchers, it is understood that the low level of diversity among seafarers is combined with hierarchical structures on ships. To mitigate this social issue, questions regarding crew diversity on ships have been included.

5.1.3 Governance Criteria

The governance dimension includes two criteria, responsible business and sustainable supply chain management, see Table 11. The governance dimension was not distinguished in Table 1 in the frame of reference, but instead identified in ocean carriers' sustainability reports. The two selected criteria are commonly occurring in these reports. In addition, governance is included in the EU's CSRD, meaning that larger companies, like the case company, will have to report on for instance their business ethics, corporate culture and management of relationships with customers, suppliers, and communities that are affected by their business activities (EU Comission, 2024). These topics are in line with the selected criteria as well.

Table 11: Governance criteria and related questions

Criteria	**Questions**
Responsible Business	Are employees (including onboard personnel) provided training on ethics and anti-corruption? If yes, what fulfillment rate do you have for employee training on ethics and anti-corruption?
	Do you have a zero-tolerance policy on bribery and corruption?
	How does your company work with sustainability reporting?
	Are you committed/engaged in international treaties/committees/organizations? If yes, please specify.
Sustainable Supply Chain Management	Do you ensure that your supplier/service provider/agency network complies with our SCoC requirements or your own equivalent code of conduct? If yes, please specify how you work to ensure this.
	What share of your suppliers are assessed on their sustainability performance?

The criterion responsible business regards business ethics, which includes anti-bribery and anti-corruption. These are central topics for companies to report on within the CSRD European Comission, 2024). Responsible business is also a central part of the case company's SCoC, and they need to ensure that ocean carriers comply with their requirements in this area. Furthermore, interviewed researchers highlight corruption as a sustainability issue within maritime transport since most shippers' goods pass several customs. Corruption risk was also identified in the literature review as an appropriate criterion for LSP selection. Hence, having a criterion to monitor this is relevant. Questions regarding staff training on ethics and anti-corruption as well as policies to manage these issues are included within this criterion. To ensure that ocean carriers' are transparent about their sustainability performance, a question about sustainability reporting is also included. Moreover, as a means to assess the ocean carriers commitment in upholding responsible business practices, they are asked to report if they are engaged in any treaties, committees or organizations that advocate for this.

Sustainable supply chain management is selected as a final criterion in the questionnaire. The case company want to ensure that ocean carriers take responsibility for improving their own and upstream suppliers' sustainability impacts. One reason for this is that they have committed to the SBT, which Länsstyrelsen Västmanland (n.d.) and SBT (2024) describe includes indirect emissions from their entire value chain. Another reason is the upcoming legislation CSDDD linked to the European Green Deal which will push large companies to take responsibility for sustainability impacts from their entire value chains. Furthermore, Garg and Kashav (2019) describes GMSC as interconnected networks with many involved actors. This is consistent with interviewed researchers who express that maritime transport can be complex as it is dependent on collaboration between these actors. Because of this, it

is essential for the case company that ocean carriers assess their suppliers' sustainability performances and ensure that their network of suppliers, service providers, and agencies comply with the SCoC or equivalent code of conduct.

5.2 A Method to Consider Sustainability Criteria as a Parameter for Ocean Carrier Selection

Incorporating sustainability criteria in the LSP selection is difficult as it necessitates that a wide range of criteria is considered (Paul et al., 2020; Prabodhika et al., 2020). The same applies for ocean carrier selection, as it is a type of LSP selection. Case company representatives express that they want to increase their knowledge about ocean carriers' overall sustainability performance, but that they currently lack ways to measure and compare their performances. Aside from changing and increasing the number of sustainability criteria they currently use, developing a sustainability performance index can make it easier for them to assess the performance of ocean carriers. Krajnc and Glavič (2005) explain that a CSPI can facilitate the evaluation of a company's overall sustainability performance by combining the wide range of sustainability criteria into a single sustainability performance index. It can also help identify improvement areas because it allows for the assessment of a company's performance at various aggregated levels.

For the reasons described above, a sustainability performance index was created in this study using the listed sustainability criteria and questions in Table 9, Table 10 and Table 11 which together form a questionnaire. According to Prabodhika et al. (2020) and Roy et al. (2020), it can be challenging to quantify LSPs sustainability performances because many sustainability criteria is hard to measure. The case company addressed this issue in the previous questionnaire that they tried to implement by giving ocean carriers numerical scores based on their answers to each question. The same is done for the developed questionnaire in this study to make the information that ocean carriers provide about their performance measurable. The majority of questions have a drop-down list with predetermined alternative answers from which ocean carrier can select the option that best fits their current practices. The different alternatives they select translate to a specific score, which combined give the ocean carrier a total score that ranks their performance. Table 12 shows an example of how ocean carriers receive numerical scores for a question that belong to the criteria sustainable supply chain management. There are four possible answers to this question and depending on which one the ocean carriers choose, they receive a score ranging from zero to three.

Table 12: Example of how a question's answers corresponds to numerical scores.

What share of your suppliers are assessed on their sustainability performance?	
Possible answers	Scores
We do not assess our suppliers	0
$0\% <$ Share of assessed suppliers $\leq 50\%$	1
$50\% <$ Share of assessed suppliers $\leq 75\%$	2
$75\% <$ Share of assessed suppliers $\leq 100\%$	3

However, there are some exceptions in the questionnaire where no score is given to questions that only seek to gather additional information about the ocean carrier's practices. As an example, some questions ask them to specify and elaborate on their chosen alternative to the previous question, while others ask them to provide a calculated number from a specific metric. In Appendix 1, all the questions that include scores are presented together with their alternative answers and their corresponding scores.

Furthermore, to develop a sustainability performance index, criteria in the questionnaire are combined within the dimensions they belong to, namely environment, social or governance. These dimensions constitute sub-indices which together form the sustainability performance index. AHP can be utilized for weighting the selected criteria and dimensions. AHP is a MCDM method that can manage both qualitative and quantitative criteria, making it suitable for both LSP selection and to assess sustainability performances (Bajec and Tuljak-Suban, 2017; Singh et al., 2007). On top of this, Lam and Zhang (2014) specify that AHP is suitable for ocean carrier selection. AHP also has the benefits of being simple to use and include a consistency check of the pairwise comparisons that were made to arrive at weights, which helps prevent inconsistent assessments of the relative importance of the dimensions and criteria. The method also helps to structure MCDM-problems as it includes the development of a hierarchical structure (Gan et al., 2017). This is especially useful when constructing a CSPI as it allows for criteria to be grouped within each sustainability dimension (Singh et al., 2007). See Figure 7 for a hierarchical structure of the sustainability performance index developed in this study. As previously mentioned, the index is composed of the criteria outlined above in the analysis. Therefore, there are six criteria in the environmental dimension, four in the social dimension and two in the governance dimensions.

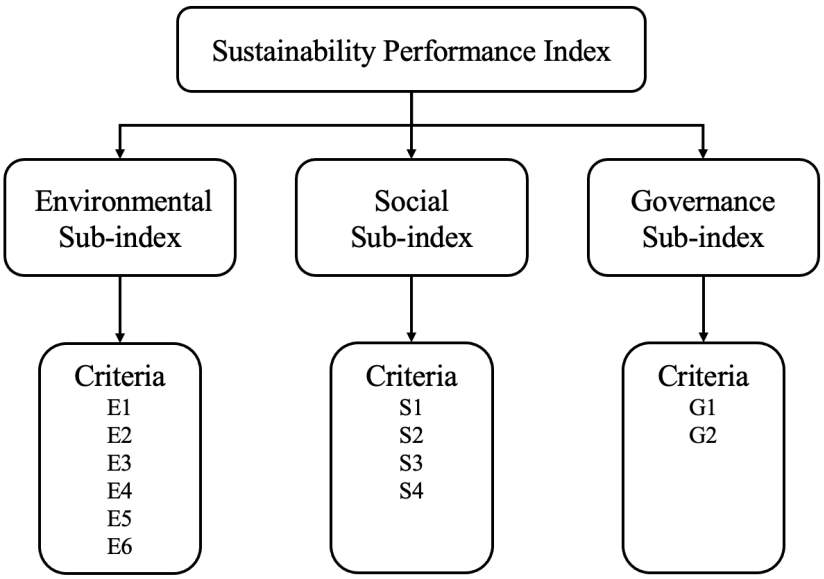

Figure 7: Hierarchical structure of the sustainability performance index developed in this study, adapted from Figure 2.

Furthermore, an additive aggregation method can be utilized to aggregate weighted scores of the criteria and dimensions in Figure 7. This method is argued by Azevedo et al. (2017) to be suitable when constructing a sustainability index. In addition, Gan et al. (2017) describe that the method is commonly used for this because of its transparency and ease of use. By aggregating ocean carriers' scores from the various questions, buyers can be provided with quantitative descriptions of the ocean carriers' sustainability performances within each criteria and dimension. This is preferable to avoid subjective interpretations of their performances, which otherwise can be hard to achieve as Prabodhika et al. (2020) and Roy et al. (2020) describe that it is common with sustainability criteria that are based on qualitative descriptions. An example of how the sustainability performance index is computed based on weighting and aggregation of criteria scores is shown in Figure 8 and Figure 9. Criteria scores in this example are randomized and weights are obtained from an AHP conducted by the authors of the study to enable demonstration of the method. Tables that show the pairwise comparisons are presented in Appendix 2.

For each criterion, an ocean carrier's answers to questions related to that criterion result in a score that is divided by the criterion's maximum score to obtain a normalized score. The normalized scores facilitate the assessment and comparison of an ocean carrier's performance within the different criteria. The normalized scores are then multiplied with their respective criterion weight, resulting in weighted scores, as presented in Figure 8.

Dimension	Criteria	Score	Maximum Score	Normalized Score	Weight	Weighted Score
Environment	Environmental Certification and Engagement	0	4	0,00	0,03	0,00
	CO2e Emissions	6	6	1,00	0,35	0,35
	Air Pollution	0	3	0,00	0,13	0,00
	Energy Efficient Transportation	0	4	0,00	0,14	0,00
	Recycling of Ships	4	4	1,00	0,05	0,05
	Use of Alternative Fuels	5	10	0,50	0,30	0,15
Social	Occupational Health and Safety (OHS)	5	9	0,56	0,42	0,23
	Human and Labor Rights	5	6	0,83	0,42	0,35
	Societal Commitment and Investment	0	5	0,00	0,05	0,00
	Level of Diversity in the Workforce	1	1	1,00	0,11	0,11
Governance	Responsible business	5	8	0,63	0,50	0,31
	Sustainable Supply Chain Management	4	5	0,80	0,50	0,40

Figure 8: Demonstration of calculated normalized and weighted criteria scores.

In Figure 9, dimension scores are calculated by summarizing weighted scores of criteria that belong to the same sustainability dimension. The dimension scores represent the environmental, social and governance sub-indices which illustrate how an ocean carrier performs in each dimension. Thereafter, each dimension score is multiplied with the dimension weight to obtain a weighted score. The weighted scores are then summarized to calculate the sustainability performance index score which reflects the assessed ocean carrier's overall sustainability performance.

Dimension	Score	Weight	Weighted Score
Environment	0,55	0,49	0,27
Social	0,69	0,31	0,22
Governance	0,71	0,20	0,14
Sustainability Performance Index			0,63

Figure 9: Demonstration of calculated sub-indices and sustainability performance index.

5.3 Integration of Sustainability as a Parameter in the Ocean Carrier Selection Process

The selection of ocean carriers is critical since, according to Ambekar et al. (2018) and Gupta et al. (2022), a company's sustainability performance is affected by the way its LSPs operate. Ambekar et al. (2018) and Schneider and Wallenburg (2012) describes that the implementation of sustainable sourcing practices can improve a company's competitiveness. Successful integration of sustainability as a parameter in the ocean carrier selection process is therefore important. Despite this, sustainability is often overlooked in LSP selections, because companies tend to focus on criteria like cost and service quality instead (Jazairy, 2020; Jung, 2017). This is evident at the case company where the three sustainability listed in Table 7 are used, but not prioritized in the selection as they are inadequate to assess and compare ocean carriers' performances. Furthermore, the attempt to implement a questionnaire with additional sustainability criteria was unsuccessful. This is in line with Paul et al. (2020) and Prabodhika et al. (2020) who describe that it is challenging to integrate sustainability as a parameter in the LSP selection due to the complexity

of considering several criteria within various sustainability dimensions. As stated by interviewed researchers, buyers who procure maritime transport must learn how to assess ocean carriers' sustainability performance and incorporate criteria that can facilitate the assessment. It is preferable to consider sustainability from the beginning of the procurement process. However, a study by Styhre et al. (2023) shows that it varies between companies where sustainability requirements are included in the selection process, although they are most commonly included in the RFQ. This indicates that it can be difficult for buyers to understand how to integrate sustainability criteria into the selection process since there does not appear to be an established approach that everyone follows. To address this, Figure 10 shows a framework created in this study for incorporating sustainability as a parameter in the ocean carrier selection process. The framework was developed based on the literature review and empirical findings. It includes the standard steps in the supplier selection process as outlined by Van Weele and Rozemeijer (2022), namely establishing prequalification requirements, sending out RFI and tendering which includes RFQ. These three steps are utilized in the framework as they are also similar to the case company's selection process steps for ocean carriers. The only exception is that they rarely sends out RFIs, but they have prequalification requirements and send out RFQs when tendering.

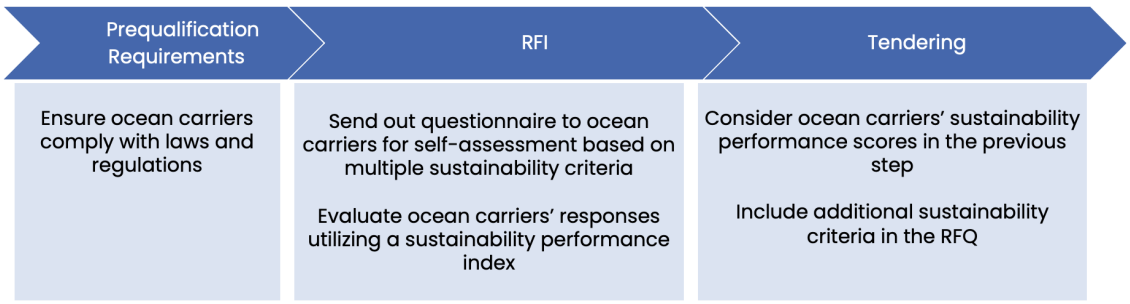

Figure 10: Framework for how to incorporate sustainability as a parameter in the ocean carrier selection process.

The first step in the framework addresses the prequalification requirements where it is suggested to include the requirement of compliance with laws and regulations, see Figure 10. The second step regards the RFI, which is proposed to consist of the questionnaire developed in this study. This questionnaire will be sent to the ocean carriers for self-assessment. As mentioned above, ocean carriers will then receive scores based on their responses to the questionnaire which enables assessment of their sustainability performance using a sustainability performance index, as demonstrated in Figure 8 and Figure 9. The last step involves the tendering and sending out RFQs. Additional sustainability criteria, besides the ones used in the RFI, can be included in the RFQ. As an example, it is suggested that the case company include CO2e emissions for the specific port pair they tender on. These three steps and the reasoning behind the developed framework will be further explained below.

Regarding the first step in the framework, see Figure 10, maritime transport has

become more regulated in terms of sustainability than it was historically due to initiatives by IMO and the EU (IVL, 2022). Based on interviews with ocean carriers and researchers, stricter laws and regulations promote sustainable shipping. Therefore, it may be beneficial as a buyer to emphasize them in the selection. According to Länsstyrelsen Västmanland (n.d.), buyers frequently use compliance with laws and regulations from organizations like IMO and the EU as a sustainability requirement. Legal compliance was also identified in the literature review as a common sustainability criterion within both the social and environmental dimensions for LSP selection, see Table 1. Nevertheless, one issue with the case company's previous questionnaire for assessing ocean carriers was that it was too focused on laws and regulations. Therefore, it is suggested that compliance with maritime laws is separated from the other criteria in the questionnaire by including it in the prequalification requirements. The case company could be argued to already have done this, as their SCoC addresses the topic of legal compliance. However, if a company lacks a SCoC or if it is not comprehensive enough to cover this criterion, the following is a suggestion for how this type of prequalification requirement can be formulated:

- *The supplier shall comply to IMO's (International Maritime Organization) regulations, including the key conventions:*
  - *MARPOL*
  - *STCW*
  - *SOLAS*
- *The supplier shall comply to ILO's (International Labor Organization) Maritime Labor Convention (MLC).*
- *The supplier shall comply with local environmental regulations in operating regions.*

The focus is on the main international maritime laws which IMO (2024a) and ILO (2024) describe include IMO's three key conventions, presented in Table 4, and ILO's MLC. In addition, shippers who deliver goods all over the world, like the case company, should also include compliance with local laws and regulations in their requirements, as the laws that ocean carriers must follow vary depending on the start and delivery locations.

Moreover, the case company wishes to improve its level of maturity in sustainable sourcing and the second step in the framework, shown in Figure 10, can contribute to achieving this. Ambekar et al. (2018) and Van Weele and Rozemeijer (2022) describe that it is important to consider criteria beyond legal requirements to achieve a higher level of maturity. Therefore, in addition to ensuring legal compliance in step one, the proposed questionnaire in the following step includes a wide range of criteria to address various sustainability issues. These criteria help identify actions ocean carriers take to improve their sustainability, besides following laws and regulations. However, it was noted during interviews with case company representatives that they previously had issues with implementing a similar questionnaire, partly because it was too time-consuming to use and it involved manual work. To avoid this and make the questionnaire easier to use, it should be sent digitally as a self-assessment form

for ocean carriers to complete. For the case company, questionnaires should be sent through Carrier Point, the web-based portal, as this is where they communicate with ocean carriers. Uploading the questionnaire in this format is considered preferable as the procurement managers are familiar with this process and compared to, for instance, sending it to each carrier by email, it is easier to streamline the process. Figure 11 illustrates the digital process of sending and receiving questionnaires via Carrier Point.

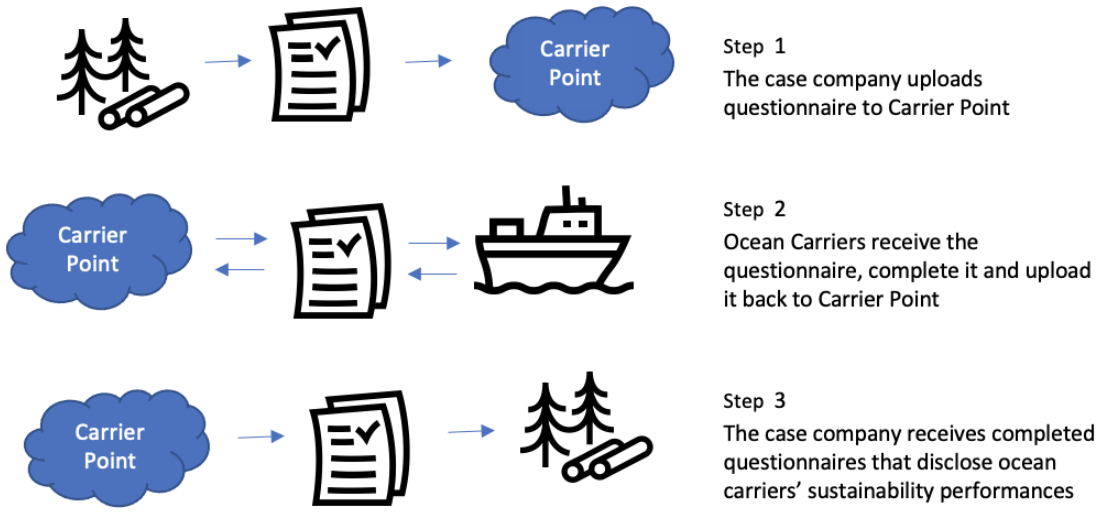

Figure 11: The digital process of sending and receiving questionnaires via Carrier Point.

Furthermore, as mentioned above, most questions in the questionnaire also have predetermined response options that correspond to specified scores which can be aggregated through the sustainable performance index. This makes it easier for buyers to interpret and evaluate ocean carriers' performances and helps them save time since they do not have to collect and compile ocean carriers' answers themselves. Furthermore, Van Weele and Rozemeijer (2022) explain that an RFI can provide an overview of the supply market and an assessment of suppliers' performances. Therefore, the questionnaire is suggested to be sent out as an RFI since case company representatives said that they want to have knowledge about ocean carriers' performances before tendering. According to interviewed researchers it is preferable to include sustainability requirements in the RFI. They also state that it is important for buyers of maritime transport to be aware of industry developments and available solutions on the market. This can be accomplished by using the questionnaire as an RFI since it helps buyers evaluate ocean carriers' sustainability performances and learn about current market offerings. Ultimately, buyers become better prepared for the tendering.

Furthermore, while tendering, which is the third and final step in the framework, it is important that the case company considers more than just the performance of ocean carriers in terms of traditional criteria, such as cost and service, as they usually do. Based on research conducted by Styhre et al. (2023), shippers frequently

include sustainability requirements both in their RFQs and bid evaluations. IVL (2022) describes that shippers need to set sustainability requirements to encourage a shift to more sustainable maritime transport. According to Länsstyrelsen Västmanland (n.d.) these requirements should be present in each step of the procurement process. Therefore, it is suggested that the result from the assessment of ocean carriers' sustainability performances in the second step of the framework is taken into account by buyers when evaluating ocean carriers' bids. On top of this, additional sustainability criteria can also be included in the RFQ. Which criteria to add should be determined by the shippers internal requirements. Focusing on the case company, reducing GHG emissions is an important sustainability target that is incorporated in the container segment's category strategy because the company has committed to SBT. However, Länsstyrelsen Västmanland (n.d.) explain that GHG calculations can be challenging for shippers and that there can be uncertainties about what method ocean carriers use. This is consistent with the input from interviewed researchers who emphasize the necessity of not blindly trusting the emissions that ocean carriers report. To overcome this issue, Länsstyrelsen Västmanland (n.d.) further describe that it is important with transparency about how emissions are calculated and that shippers should advocate for all ocean carriers to use the same methodology. The empirical findings showed that all ocean carriers within the container segment are members of CC, meaning that they should report and calculate CO2e emissions according to the CC methodology. The case company can therefore request the ocean carriers to report their CO2e emission based on this methodology making it more comprehensive and easy to compare. The CC method help measure ocean carriers' emissions performance within the container segment (Smart Freight Centre, 2024). Therefore, the suggestion for the case company is to request ocean carriers to provide their CO2e emissions for the specific port pair that they are tendering on.

5.4 Framework Implementation

In order to successfully integrate sustainability as a parameter in the selection process, it is important that the selection is linked to the other steps in the procurement process. As Van Weele and Rozemeijer (2022) describe, the procurement steps are interconnected, meaning that the outcome of one step affects the subsequent steps. As a result, the selection process should not be treated in isolation because it is affected by previously determined procurement requirements that are based on internal business needs, see Figure 1. Interviewed researchers emphasized the importance of considering sustainability already in the beginning of the procurement process. Companies should look at their own values and sustainability strategy when deciding what sustainability criteria to use in the selection process. Therefore, if companies implement the framework in Figure 10, it is important that it is adjusted to align with their internal sustainability requirements. The framework is flexible as it allows for selected sustainability criteria to be changed. The same holds for the questionnaire's questions and their corresponding scores. Furthermore, the weighting of dimensions and criteria by the companies that utilize the questionnaire ensures that it is aligned with their respective priorities.

Moreover, as laws and regulations change, the framework must be updated regularly once it has been implemented, preferably once a year. Stricter laws and regulations can be expected in the future as a result of the sustainability targets set by regulatory bodies like the IMO and the EU. For instance, the EU "Fit for 55" package has resulted in regulations such as FuelEU maritime and EU ETS which will put tougher requirements on ocean carriers in the upcoming years and force them to improve sustainably (European Comission, 2024). As a result, technical measures that facilitate energy efficient transportation and alternative fuel usage are being developed (Altuntaş Vural et al., 2021). Hence, available transport solutions will likely increase over time. To keep the questionnaire relevant and up to date, it will be necessary to remove outdated criteria and add new ones. Likewise, the formulation and scoring of questions along with their response options will have to be updated.

5.5 Implications of the Framework

It is evident from the literature review and empirical findings that buyers' lack of knowledge about how to measure and evaluate ocean carriers' performances based on sustainability, which prevents them from setting requirements for sustainable transport solutions. The developed framework should contribute to solving this issue as it helps buyers determine what sustainability criteria to use and how to implement them in the selection process. However, it can still be difficult for shippers to select ocean carriers based on sustainability because, as interviewed researchers point out, the maritime transport market is special given that there are only a few ocean carriers that shippers can select and sustainable offerings on the market are very limited. This is in line with the case company's experience on the market and they also perceive that the lack of buying power within the container segment hinders their ability to push ocean carriers to develop more sustainable maritime transport solutions. Basically, the main offering that is available today is a certificate of emission reduction through biofuel usage.

Although implementation of the framework will not be enough to enable procurement of sustainable transport solutions, it is still beneficial to use as it is critical for buyers to send signals to ocean carriers that sustainability is important to them. IVL (2019) and Länsstyrelsen Västmanland (n.d.) describe that including sustainability requirements in the selection help buyers demonstrate that they care about the sustainability impacts from shipping. As shown in the interviews with ocean carriers, customer demand is a main driver for them to develop sustainable offerings. In addition, the questionnaire in the framework enable ocean carriers to share information with the buyers about their current offerings, thereby contributing to bridge the gap that interviewed ocean carriers noted between what buyers request and what ocean carriers actually can offer. As presented in Table 8, there are many factors that hinder ocean carriers from offering sustainable solutions, such as the availability of alternative fuels and long vessel lifetimes. It is important that buyers become aware of these barriers and help ocean carriers overcome them. For instance, buyers must be aware that if they want to select ocean carriers' sustainable

solutions, they must be willing to pay more because these solutions require large investments from the ocean carriers. The framework can help shippers and ocean carriers to start discussions about sustainability and how they can work together to enhance current offerings and further develop sustainable solutions. IVL (2022) explains that actor collaboration is key to increasing sustainability in the maritime transport industry, this was also emphasized by interviewed researchers and ocean carriers.

Furthermore, supplier development and collaboration are important steps in the case company's sustainable sourcing process. Therefore, they expressed a need for sustainability criteria that help them follow-up contracted ocean carriers' performances and identify areas for improvement. The developed framework addresses this since criteria used in the selection process can be used to evaluate and follow-up ocean carriers' performances as well, facilitating ongoing dialogues with ocean carriers throughout the entire procurement process.

6 Conclusions and Recommendations

This chapter presents the conclusions and theoretical contribution of this study. Recommendations for future research and for the case company are also presented.

6.1 Conclusions

The purpose of this study was to develop a framework for the successful incorporation of sustainability as a parameter in companies' LSP selection process for maritime transport. Three research questions were formulated to fulfill this purpose. Firstly, the case company's current procurement process for maritime transport was identified to gain an understanding of the selection process. The selection process is a part of the sourcing process, which is outlined in Figure 5. The case company specifies requirements for ocean carriers based on internal needs and established category strategy. The selection is based on these requirements and the tendering starts when they send out RFQs to potential ocean carriers. To be considered as a potential ocean carrier, compliance to the case company's prequalification requirements is needed. Ocean carriers are then selected after the case company has evaluated their bids and conducted negotiations based on them.

Next, the current selection process was analyzed based on the conducted literature review and collected empirical data. Suitable sustainability criteria for the container segment within maritime transport was identified. These are presented together with formulated questions for each criterion in Table 9, Table 10 and Table 11. Furthermore, a method for how to consider sustainability as a parameter in the selection was also established. The method regards the development of a sustainability performance index, illustrated in Figure 7. This method facilitate the assessment of ocean carriers' sustainability performances by weighting and aggregating criteria scores. To score ocean carriers' performances within each criterion, a questionnaire was created based on the identified sustainability criteria and their related questions. The AHP method is suggested for weighing the sustainability criteria and the three dimensions they belong to. To aggregate the weighted criteria scores, an additive aggregation method is suggested. This allows for the creation of sub-indices within each dimension, which together contribute to the development of a sustainability performance index, as demonstrated in Figure 8 and Figure 9.

Based on the selected criteria and method, research question two was answered and a framework could be developed for how to incorporate sustainability as a parameter in the ocean carrier selection process. The framework is illustrated in Figure 10, and the implementation of it is a suggestion for how to improve the case company's current selection process. Hence, the third and final research question could also be answered.

To conclude, the developed framework helps buyers evaluate and compare ocean carriers' sustainability performances during the selection process. Thereby, the purpose is fulfilled.

6.2 Theoretical Contribution

Many studies have been conducted on LSP selection, but there has been limited research on ocean carrier selection. This should be addressed since maritime transport is an important transport mode that accounts for the vast majority of the world trade volume. In addition, social and environmental sustainability has received less attention than the economic perspective in LSP selection research. Although sustainability within maritime transport is more frequently appearing in research, more studies are needed since there are several sustainability issues that needs to be addressed in the industry.

This study contributes with research in these areas by examining how sustainability can be integrated as a parameter in the ocean carrier selection process. Sustainability criteria within both the social and environmental dimensions, as well as governance, have been identified. On top of this, a discussion is also provided on how they can be successfully implemented in the selection process. Finally, this study provides insights about sustainability within the maritime transport industry from three different perspectives, namely researchers, ocean carriers and the case company which represent the shippers.

6.3 Future Research

For future research, it is recommended to utilize the AHP-method, as suggested in this study, and ask various shippers to conduct pairwise comparisons of selected sustainability criteria and dimensions that the developed sustainability performance index is composed of, see figure x. It would interesting to study more than one case company to understand what companies that procure maritime transport solutions prioritize.

Furthermore, as this study focuses on the container segment within maritime transport, it is suggested to conduct studies on other segments, such as bulk or specialized cargo transport, since they have different characteristics and there is a need for studies on ocean carrier selection within all segments.

Lastly, it is recommended to further investigate ocean carriers' perceived barriers and drivers for sustainable transport solutions that were identified in this study, see Table 8. For instance, it would be interesting to identify relevant stakeholders in the maritime transport industry since stakeholder collaboration was identified as a critical driver for increasing sustainability. This would contribute to an enhanced understanding of what collaborations are needed to facilitate the transition to sustainable shipping.

6.4 Recommendations to the Case Company

The case company is recommended to implement the framework developed in this study, illustrated in Figure 10, to improve the way they consider sustainability when selecting ocean carriers and increase their level of maturity in sustainable sourcing. The questionnaire and additional criteria in the framework should be used instead of the three sustainability criteria that are currently used. To keep the questionnaire valid, it must be updated yearly to reflect developments and critical sustainability issues within the maritime transport industry. To further improve the questionnaire, they are suggested to utilize the AHP method to obtain criteria and dimension weights that align with their prioritization, as it was not done in this study due to time constraints.

Furthermore, the focus in this study was on the container segment since it is the largest segment within the sea category. However, the framework is recommended to be adapted to fit other segments within maritime transport as well by modifying a few criteria. A final recommendation is to focus on collaboration with ocean carriers and other stakeholders in the maritime transport industry to promote the development of sustainable transport solutions, ultimately making it easier to select ocean carriers based on their sustainable offerings.

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Appendices

Appendix 1: Ranking of Alternative Answers to Questions in the Questionnaire

Environment	
Environmental Certification and Engagement	**4**
Have your company implemented an environmental management system?	
Yes, ISO 14001 certified	2
Yes, have implemented a company-wide management system, but not ISO certified	1
No	0
Are you engaged in environmental tools/initiatives such as Clean Shipping Index, Smart Freight Center's program Clean Cargo or Environmental Shipping Index?	
Yes	2
No	0
CO2e Emissions	**6**
Do you calculate and monitor CO2e emissions on a well-to-wake (WTW) basis?	
Yes	1
No	0
What methodology is utilized to calculate and monitor CO2e emissions?	
Smart Freight Center's Clean Cargo methodology	1
ISO14083 guidelines	1
Other	0
Do you use industry average or own data when calculating CO2e emissions?	
Mostly based on own data	1
Mostly based on industry average	0
Do you monitor trends in your CO2e emissions based on CO2e/TEU-km?	
Yes	1
No	0
Do you have reduction targets for CO2e emissions?	
Yes, committed to Science Based Targets (SBT)	1
Yes, committed to other emissions reduction targets	1
No	0
How do you manage EU ETS?	
Implement measures to reduce emissions	1
Purchase additional allowances	0
Air Pollution	**3**
Do your ships operate solely on low sulfur fuels or do they have scrubbers installed?	
Low sulfur fuels	3
A combination	1
Scrubbers	0
If scrubbers are installed, what type of scrubber system is mainly used?	
Closed loop	2
Hybrid solution	1
Open loop	0
What share of your fleet has scrubbers installed?	
Ships with scrubbers ≤ 25%	
25% < Ships with scrubbers ≤ 50%	
50% < Ships with scrubbers ≤75%	
75% < Ships with scrubbers	

Energy Efficient Transportation	**4**
What is the average CII rating of your fleet?	
A	4
B	3
C	2
D	1
E	0
Recycling of Ships	**4**
Do you comply with the Hong Kong Convention or the EU Ship Recycling Regulation (EU SRR) for recycling ships?	
Yes	2
No	0
Do you use 3rd party audits to check used dismantling sites?	
Yes	1
No	0
Are you a part of the Ship Recycling Transparency Initiative (SRTI) or similar?	
Yes	1
No	0
Use of Alternative Fuels	**10**
What is your share of ocean freight transported with alternative fuels?	
Share of alternative fuels ≤ 3%	1
3% < Share of alternative fuels ≤ 6%	2
6% < Share of alternative fuels ≤ 10%	3
10% < Share of alternative fuels	4
Have you increased your share of alternative fuels compared to last year?	
Yes	2
No	0
Do you have ships in your orderbook that are alternatively fuelled capable?	
No	0
Yes, over 50% are alternatively fuelled capable	1
Yes, over 80% are alternatively fuelled capable	2
Do you offer transportation solutions utilizing alternative fuels?	
Yes	2
No	0

Social	
Occupational Health and Safety (OHS)	**9**
What is your company's official TRI (total recordable incidents) rate for the last 12 months?	
TRI ≤ 3	2
3 < TRI ≤ 5	1
5 < TRI	0
Have your company implemented an OHS management system?	
Yes, ISO 45001 certified	2
Yes, have implemented a company-wide management system, but not ISO certified	1
No	0
Do you have a system for reporting of near misses and accidents which is monitored and systematically followed up?	
Yes	2
No	0
Are employees (including onboard personnel) provided with training on OHS?	
Yes	1
No	0
If yes, what fulfillment rate do you have for employee training on OHS?	
Fulfillment rate ≤ 50%	0
50% < Fulfillment rate ≤ 80%	1
80% < Fulfillment rate ≤ 100%	2
Human and Labor Rights	**6**
Do you ensure that crewing agencies have fair recruitment practices?	
Yes	1
No	0
Who pays recruitment fees for onboard personnel?	
Employer	1
Employees (onboard personnel)	0
Are employees (including onboard personnel) provided with training on human and labor rights?	
Yes	1
No	0
If yes, what fulfillment rate do you have for employee training on human and labor rights?	
Fulfillment rate ≤ 50%	0
50% < Fulfillment rate ≤ 80%	1
80% < Fulfillment rate ≤ 100%	2
Do you have a procedure for how to manage stowaways?	
Yes	1
No	0

Societal Commitment and Investment	**3**
Do you calculate your societal contributions?	
Yes	1
No	0
If yes, please insert the ratio of your societal contributions to total revenue.	
Ratio of societal contributions to total revenue ≤ 1%	0
1% < Ratio of societal contributions to total revenue ≤ 5%	1
5% < Ratio of societal contributions to total revenue	2
Level of Diversity in the Workforce	**1**
Do you work to improve the diversity (gender, age, nationality) of the onboard crew?	
Yes	1
No	0

Governance	
Responsible business	**8**
Are employees (including onboard personnel) provided training on ethics and anti-corruption?	
Yes	1
No	0
If yes, what fulfillment rate do you have for employee training on ethics and anti-corruption?	
Fulfillment rate ≤ 50%	0
50% < Fulfillment rate ≤ 80%	1
80% < Fulfillment rate ≤ 100%	2
Do you have a zero-tolerance policy on bribery and corruption?	
Yes	2
No	0
How does your company work with sustainability reporting?	
No systematic work	0
Annual sustainability report	1
Annual sustainability report with independent assurance/verification	2
Are you committed/engaged in international treaties/committees/organizations?	
Yes	1
No	0
Sustainable Supply Chain Management	**5**
Do you ensure that your supplier/service provider/agency network comply with Stora Enso's SCoC requirements or your own equivalent code of conduct?	
Yes	2
No	0
What share of your suppliers are assessed on their sustainability performance?	
We do not assess our suppliers	0
0% < Share of assessed suppliers ≤ 50%	1
50% < Share of assessed suppliers ≤ 75%	2
75% < Share of assessed suppliers ≤ 100%	3

Appendix 2: Pairwise Comparisons of Sustainability Criteria and Dimensions for the AHP

Pairwise comparison matrix Environmental						
	Environmental Certification and Engagement	CO2e Emissions	Air Pollution	Energy Efficient Transportation	Recycling of Ships	Use of Alternative Fuels
Environmental Certification and Engagement	1	1/7	1/5	1/5	1/3	1/7
CO2e Emissions	7	1	3	3	7	2
Air Pollution	5	1/3	1	1	5	1/5
Energy Efficient Transportation	5	1/3	1	1	5	1/3
Recycling of Ships	3	1/7	1/5	1/5	1	1/7
Use of Alternative Fuels	7	1/2	5	3	7	1

Pairwise comparison matrix				
	Occupational Health and Safety (OHS)	Human and Labor Rights	Societal Commitment and Investment	Level of Diversity in the Workforce
Occupational Health and Safety (OHS)	1	1	7	5
Human and Labor Rights	1	1	7	5
Societal Commitment and Investment	1/7	1/7	1	1/3
Level of Diversity in the Workforce	1/5	1/5	3	1

Pairwise comparison matrix		
	Responsible business	Sustainable Supply Chain Management
Responsible business	1	1
Sustainable Supply Chain Management	1	1

Pairwise comparison matrix			
	Environment	Social	Governance
Environment	1	2	2
Social	1/2	1	2
Governance	1/2	1/2	1

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