

**Navigating the Tides of Sustainability:
Gaps in IMO Legislation and the Shipping Industry's Perception
on a Transition Towards Sustainability**

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Abstract:

Considered the most cost and energy-efficient mode of transportation, the shipping industry is responsible for 90% of trade and is predicted to grow. Although it has been central for the development of nations, this activity is not exempt of negative externalities, largely contributing for unsustainability. A sustainable transition is, thus, required to address the overall super wicked problem of the sustainability challenge. This thesis employed qualitative research composed of two main research phases. The first one assesses the alignment of IMO's legislation with a sustainable transition for the shipping industry. A document analysis of this regulation was done by applying a methodology based on sustainability principles from the FSSD. Our findings point to multiple misalignments with both social and ecological principles, as well as a lack of a systems perspective of the industry. The second phase of the research explores what different practitioners perceive is needed for the sustainability transition. For this, nine semi-structured interviews were conducted. An inductive data analysis resulted in 15 main findings, addressing different topics perceived as relevant for this transition. This included the need for a just and equitable transition; enhanced governance and more stringent regulations; as well as fair and unbiased treatment of seafarers.

Keywords: Shipping Industry, Strategic Sustainable Development, Transition, Regulations, International Maritime Organisation

Statement of Contribution

This thesis is the product of a journey of discovery shared by four diverse women. Our international team –Chaima (Morocco), Divya (India), Fee (Germany), and Madalena (Portugal)- tried to address the sustainability challenge of the shipping industry and its transition, with a focus on IMO (International Maritime Organisation) and industry practitioners. With curiosity, learning, and collective spirit the team created a thesis anchored in leadership and strategic sustainable development. The combination of different personalities, academic backgrounds, professions, cultures, strengths, and weaknesses contributed positively to the outcome of the thesis.

Looking back at our thesis journey it is needless to say we have very much enjoyed working together and are very grateful to work with each other. Diving into this topic, we have learned so much about the shipping industry and strategic sustainable development. While we are aware we might have only touched the tip of the iceberg, these last months have been a wonderful learning experience. We have learned to accept each other for what we are and make the best of each of our weaknesses and strengths. Everyone contributed to their best ability, energy, curiosity, and perspectives. Beginning our team process with the canvas model, we worked hard to achieve our individual and collective goals and tried to support each other when doing so. We regularly held feedback sessions and conversations about our journey.

This thesis topic was chosen due to a common interest, curiosity, and a desire for practical study. As none of us were practitioners in the shipping industry, we worked hard in the initial months and through the process to educate ourselves on the industry and its complexity. We also worked hard on delivering an academically sound text, and what in our minds is a high-quality outcome that we set for ourselves at the start of the project.

Chaima contributed with her thought-provoking and challenging questions which helped us formulate arguments and our thesis processes critically. She is very hands-on and brought her perspective from her experience of working with supply chains for many years. She is the first to let go of her ideas in support of the collective efforts of the team, while still standing firm on ideas that she feels strongly about. With a bird's eye view of the thesis, she helps the team remember inconsistencies and recognize potential problems. Leading with a smile, and calmness, her collaborative spirit aided the team to stay afloat.

Divya contributed with her collaborative spirit and network which helped us cruise the stakeholders of the Northern-European shipping industry. She is fast and reliable. She communicates openly, is proactive, and does not hesitate to do group tasks – by the time we are done discussing who could do it, she usually has done it already. She is so efficient; we have the phrase “What would Divya do? - Divya would have done it already”, when some of us would get lost fixating on small details in the name of perfectionism. Her network in the shipping sector paved the way for our interviews and gathering insightful data.

Madalena contributed with her structured, rigorous, and methodical approach which helped us navigate the complexity of the shipping industry's sustainability challenge. Consistently, she stayed curious about the shipping industry, constantly trying to find more knowledge about the sector and creating a shared mental model. Her rigorous note-taking of open questions and

inconsistencies helped us constantly tie up loose ends and work towards a high-quality written text. She cared a lot about face-to-face interaction and spending time outside of school together.

Fee contributed with her planning and strategic thinking which helped us stick to the decided deadlines and timeline. She constantly used the back-casting approach to help us formulate actionable steps. Lifting the group up with her positive, optimistic mind-set, she reminded us to celebrate the small victories. Her knowledge of transition theory, policies, and academic writing helped us bring this lens out in our discussion and our draft overall. She is communicative and critical of our processes and ideas. Her calmness, optimism, and reliability were crucial to our group processes and the team.

We are grateful for having been part of this team and given the chance to explore the shipping industry and its transition. It has been a learning experience professionally, academically, and personally. We are thankful to have worked with such a diverse group and hope our findings will help the shipping industry in a small way.

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We want to thank all of our interviewees for their time, knowledge and sharing their thoughts on the transition of the shipping industry.

Lastly, we want to thank our classmates without whom the past year would not have been the same.

Executive Summary

Introduction

Our economies and social structures have been growing without consideration of the planetary boundaries, which has put humanity on the course of an unsustainable future (Robèrt, Broman, and Basile 2013). In response to this, two core components need to be in place to deal with the wicked problems of sustainability: enhancing the system's resilience and rethinking leadership to formulate structures better suited to the complex collaborative approaches (Avery and Hughes 2012). By adopting a strategic sustainable development approach, society can counter this downhill course and prevent the further depletion of resources it is dependent on. This entails the transition of the current unsustainable society to one based on a shared understanding of sustainability informed by principles that lay the basic requirements for a society to be sustainable.

The shipping industry is responsible for the transportation of goods and people by sea (Serra and Fancello 2020). Known as the “backbone of international trade”, the sector represents 80-90% of the total volume of global trade (Serra and Fancello 2020, 1). It is also the most cost and energy-efficient mode of transport and the International Maritime Organisation (IMO) estimates a 39% growth in demand by 2050 compared to 2019 (Serra and Fancello 2020). While shipping has played a central role in the intellectual, social, and economic integration of our globe (Kaukiainen 2014) and enabled the development of many nations and reduced poverty (Bergh and Nilsson 2014), the increasing demand for products and services has fuelled the systematic degradation of our social and ecological systems in different ways.

The shipping industry is responsible for 3% of global anthropogenic greenhouse gas emissions and many other airborne pollutants. Shipping ports also impact water and soil quality as well as habitat conservation (Delphine *et al.* 2019). Moreover, higher demand for seaborne trade has led to an increase in maritime roads, which further exacerbated the disruption of maritime ecosystems (Pirodda *et al.* 2019). This includes the effects of noise pollution on whales and an influx of various invasive species (Seebens *et al.* 2013).

Ship-breaking and recycling are also associated with increasing toxin concentrations in coastal environments, labour safety threats, occupational health problems, social unrest, and even conflicts. This is a specially pressing issue in Least Developed Countries (LDCs), where this activity occurs under poor planning, management, and lack of regulations (Hossain *et al.* 2016).

The industry is vulnerable to various risks such as natural disasters, extreme weather events, and geoeconomics confrontations (WEF 2023). The vast scale of operations within shipping and its interconnection with other systems make the industry more vulnerable to stressors and systemic disruptions, which can have ripple effects along entire supply chains (Waddock 2013).

The International Maritime Organization (IMO), a United Nations (UN) body, is the sole regulator of international shipping. Committed to supporting the 2030 Agenda for Sustainable Development, it has integrated the Sustainable Development Goals (SDGs) into its programming and planning to support member states in a more tangible and targeted approach (IMO n.d). Despite its intention of providing a unifying framework and integrated action

towards sustainable development, the concept of sustainable shipping is still ambiguous with the main focus both in regulations and practice being green shipping (Zhou, Li and Yuen 2023).

This thesis utilises the Framework for Strategic Sustainable Development (FSSD) as its conceptual framework. This framework sees unsustainability as a result of systemic errors in the societal design that are interconnected in complex ways and systematically erode the socio-ecological system (Broman and Robèrt 2017). The FSSD employs Sustainability Principles (SPs) that are derived from an understanding of essential aspects of the ecological and social systems that when eroded, undermine the capacity of humans to fulfil their needs. There are three ecological principles and five social principles (Broman *et al.* 2017; Missimer, Robèrt, and Broman 2017).

Research Questions

The introduction above demonstrates the complex relationship between the shipping industry, the sustainability challenge, and different actors, which both influence and are also being impacted by this super wicked problem. As the industry's regulating body, the IMO plays a central role in setting a level playing field for the industry and its transition, and so analysing its legislation is prone to be relevant for our research. Nonetheless, we acknowledge that no systemic change can come merely by imposing strict policy, but rather agency must come from those working within the sector. Their thoughts and perceptions on what is needed for a transition towards sustainability are most relevant in understanding where it currently stands and where it needs to move towards. Hence, this thesis aims to investigate the following research questions (RQs):

RQ1: How aligned is IMO's legislation with a transition towards sustainability for the shipping industry?

RQ2: What do practitioners in the shipping industry perceive is needed for a transition towards sustainability?

Methodology

Considering the nature of our research questions, a qualitative research approach was adopted and divided into two main phases: Phase I (answers RQ1) and Phase II (answers RQ2).

Phase I

IMO Conventions were the primary documents used for data collection in Phase I. A deductive data analysis using the conceptual framework of SPs was used to create themes for coding. While inductive coding has the distinct advantage of “being loyal to the data” by creating codes based on the data (Skjott Linneberg and Korsgaard 2019, 64), utilizing a list of pre-defined codes allowed us to assess the data against our set of values. From our knowledge, this is a unique approach to analysing IMO's policy, compared to other studies in the existing literature.

We used FSSD to develop a methodological framework, by formulating a set of questions that follow the rationale of all eight SPs. We argue that SPs facilitate the identification of root causes of unsustainability, or “first harm”. We see this as an effective way to leverage change instead of merely addressing the symptoms of unsustainability. By focusing on systematic degradation

(ecological SPs) and obstacles (social SPs), the SPs deviate from temporary events or cyclical fluctuations, thus capturing structures that have potential system-wide and lasting effects. Questions were tailored to the context of the shipping industry and laid across three lifecycle stages namely production and construction, use and maintenance as well as end of life for both ships and ports. This framework allowed us to identify gaps in the sustainability aspects of IMO legislation.

The questions were tailored to the context of the shipping industry by combining the latter with the impacts of the industry identified by previous research. The questions were formulated according to three life-cycle stages, production and construction, use and maintenance, and end of life, thereby taking a cradle-to-grave point of view instead of just focusing on the use stage. Each of the three stages was applied to ports and ships due to their overall relevance in the industry, and because IMO's jurisdiction falls within this scope. The questions formulated are, thus, specific for each SP and category, allowing to identify gaps in sustainability aspects of IMO legislation.

Phase II

With the insights gathered from Phase I, questions were formulated for semi-structured interviews. While capturing perceptions can result in diverse findings, understanding how a certain group perceives and makes sense of the systems can help identify e.g., limiting beliefs, communication-gaps, mental models, personal motives, desires, decision-making, and actions. The interviews were conducted with practitioners from a diverse range of organisations and roles in the shipping industry of Northern Europe.

All the data arising from the 9 interviews were recorded, manually transcribed, and coded using an inductive approach. The first cycle assigned descriptive codes based on the content, while the second cycle examined patterns based on the first cycle codes (Skjott Linneberg and Korsgaard 2019, 266) to analyse connections and classify the data.

Results and Discussion

Phase I

Our document analysis shows that IMO's legislation is, to a large degree, not yet aligned with a principled definition of sustainability and that many root causes of unsustainability are not yet addressed legislatively. In the production of ships, IMO already aligns with the system's thinking perspective of strategic sustainable development, although there is still room for improving its legislation to cover ecological and social aspects more comprehensively.

Our findings illustrated that in terms of alignment of ecological SPs in ports, IMO legislation only focuses on the aspect of oil pollution, while other environmental implications go unaddressed in IMO's legislation. From a social perspective, social SPs in both ports and on ships only align partially. The health and safety of workers have emerged as the predominant focus of IMO legislation related to social sustainability, overshadowing other crucial components such as discrimination and poor working conditions. The end-of-life stage of ports is not addressed in IMO's legislation and therefore all our questions regarding the sustainability of the end-of-life stage of ports remain unanswered. IMO's legislation regulating the end-of-

life stage of ships aligns to a certain degree with sustainable development, however it leaves some room for improvement.

For strategic sustainable development, however, a system's perspective is required which acknowledges that social and ecological systems are complex and do not operate in isolation but rather form dynamic networks of relationships (Missimer, Robèrt, and Broman 2017).

Phase II

Our results demonstrate that practitioners within the field identify the lack of guidance from IMO as the main cause for the perceived inaction amongst shipping companies (e.g., not investing in new fuel engines due to the uncertainty of what the next fuel will be). For some interviews, shipping companies are underestimating the risks and opportunities that stem from such inaction. We also argue that, despite having an essential role within transitions, the regulatory landscape is limited in its ability to achieve systemic transformation towards sustainability, and thus change also needs to arise from a bottom-up perspective.

All interviewees presented examples of how collaboration may spark innovative ideas and solutions, be it amongst competitors, cross-sector organizations or across the value-chain. It was unexpected to note, though, that most participants did not point clearly to where collaborative strategies at scale need to be employed for a transition towards sustainability.

Another answer to our research question is the perception that a better-defined strategy to reach sustainability, including stricter regulations and more ambitious goals, is needed in maritime policy. Our findings illustrate a perceived need for more ambitious goals and legislation by the IMO, which is in line with the results of Phase I of this work.

Our findings demonstrate that practitioners perceive a need to bridge the disconnect of ambition and motives between countries in different developmental stages as one of the most pressing challenges for effective multilateral decision-making. But we further argue that an equitable and just transition also needs to stem from within the IMO, as literature points to unbalanced power dynamics which materialize in obstacles for NGOs and member states with fewer representatives to influence decision-making processes (Dorough 2021). Indeed, making well-informed decisions requires incorporating diverse knowledge forms and sources, that stem from different contexts.

The results also demonstrate a need for stronger protection of workers' rights, with several interviewees referring to a lack of permanent contracts and overall working conditions and one interviewee mentioning how foreign workers employed in Sweden were subject to less regulated labour conditions and contracts.

Two interviewees illustrated how fostering the proximity between shipping companies and their customers can encourage organisations to change, a strategy that has been gaining more visibility with the increasing pressure from companies to account for and report on Scope 3 emissions.

Conclusion

In this thesis, we have set out to determine the gaps in IMO legislation and how the industry perceives its transition toward sustainability. We thus asked two research questions: (1) *How aligned is IMO's legislation with a sustainable transition for the shipping industry?* And (2) *What do practitioners in the shipping industry perceive is needed for a transition towards sustainability?*

The findings of both questions are significant because they illustrate the need for a shared understanding of sustainability, a system's perspective of the sector, and cultivating sustainability competencies, both within IMO's legislation and private actors.

Unless these aspects are addressed in both legislation and the industry, sustainability will not be attained in the shipping industry. This, in turn, will have further impacts on the rest of the world, given that it is responsible for 90% of all trade and is predicted to grow. This makes the transition towards sustainability even more urgent.

Abbreviations

BC	Black Carbon
BWM	Ballast Water Management
CO ₂	Carbon dioxide
CO	Carbon Monoxide
CBDR	Common but differentiated responsibilities
ESG	Environmental Social Governance
EU	European Union
FAL	Facilitation of International Maritime Traffic
FSSD	Framework of Strategic Sustainable Development
GHG	Green House Gases
GDPR	General Data Protection Regulation
HFO	Heavy Fuel Oil
HKIC	Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ship
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Countries
LNG	Liquified Natural Gas
MARPOL	The Prevention of Pollution from Ships
MEPC	Maritime Environment Protection Committee
MLP	Multi Level Perspective
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organisations
NO _x	Nitrogen Oxides
NMFT	No More Favourable Treatment

OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PM	Particulate Matter
RQ	Research Question
Sox	Sulphur Oxide
SOLAS	International Convention for the Safety of Life at Sea
SIDS	Small Islands Developing States
SS	Sustainability Science
SGDs	Sustainable Development Goals
SPs	Sustainability Principles
TBL	Triple Bottom Line
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNFCCC	United Nations Framework Convention on Climate Change
UMAS	University Maritime Advisory Services
VOC	Volatile Organic Compounds
WEF	World Economic Forum

Glossary

Ballast Water: “Ballast water contains a variety of organisms, such as marine and coastal plants and animals from different regions of the world” (DNV 2021)

Ballast water system: “Ballast water is held in the ballast tanks and cargo holds of ships. It is used to provide stability and manoeuvrability during a voyage when ships are not carrying cargo, or not heavy enough cargo, or when more stability is required due to rough seas” (National Invasive Species Information Center n.d.)

Black Carbon: “Black carbon is the sooty part of particulate matter (PM) formed by the incomplete combustion of fossil fuels and biomass. It is particularly harmful as it represents a mixture of very fine, partly carcinogenic particles, small enough to enter the bloodstream and reach other organs.” (European Environment Agency 2013)

Common but differentiated responsibilities principle (CBDR): “principle of international environmental law establishing that all states are responsible for addressing global environmental destruction yet not equally responsible.” (Epstein 2019)

Equitable transition: “An equitable transition includes consideration of disparities between nations that would likely increase if the design and implementation of policy measures to address climate change does not explicitly seek to diminish them.” (UNCTAD 2022)

Fit for 55: “The Fit for 55 package is a set of proposals to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are into line with the climate goals agreed by the Council and the European Parliament.” (European Council 2022)

Framework for Strategic Sustainable Development (FSSD): A framework for tackling challenging issues in complex systems while moving strategically towards sustainability. (Broman and Robèrt 2017)

Greenhouse gas: “Any gas that has the property of absorbing infrared radiation (net heat energy) emitted from Earth’s surface and reradiating it back to Earth’s surface, thus contributing to the greenhouse effect.” (Mann 2019)

Just transition: “A just transition seeks to ensure that the substantial benefits of a green economy transition are shared widely, while also supporting those who stand to lose economically – be they countries, regions, industries, communities, workers or consumers.” (EBRD, n.d)

Least developed countries (LDC): “Least developed countries (LDCs) are low-income countries confronting severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human assets.” (United Nations 2017).

Marine Environment Protection Committee (MEPC): It is a committee dedicated to addressing environmental issues under IMO’s remit. (“Marine Environment Protection Committee (MEPC),” n.d.)

MEPC 80: MEPC 80 (3-7 July 2023) is a committee meeting expected to adopt the revised IMO Strategy for Reduction of GHG Emissions from Ships (“Marine Environment Protection Committee (MEPC),” n.d.)

No More Favourable Treatment principle (NMFT): “The NMFT principle refers to the port country implements applicable standards for all ships in its ports in a unified way, regardless of the flag it flies” (Dong *et al.* 2022, 09)

Scope 3 emissions: “Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly affects in its value chain” (US EPA 2016)

Shipping Companies: “A shipping company is a firm that facilitates seamless and professional cargo transfer between various destinations. This enterprise ensures that goods arrive at their destinations promptly and safely. Besides, it performs other essential duties that facilitate local and international trade” (OCTI 2022)

Small island developing states and areas (SIDS): “Small Island Developing States (SIDS) are a distinct group of 37 UN Member States and 20 Non-UN Members/Associate Members of United Nations regional commissions that face unique social, economic and environmental vulnerabilities.” (United Nations n.d).

Snowballing: “Snowball sampling is where research participants recruit other participants for a test or study. It is used where potential participants are hard to find. It’s called snowball sampling because (in theory) once you have the ball rolling, it picks up more “snow” along the way and becomes larger and larger” (Glen 2022)

Sustainability competence: “Comprise the entirety of individual dispositions comprising knowledge, skills, motives, and attitudes necessary to solve sustainability-related problems and advancing sustainable development in a range of different contexts, including private, social and institutional” (Brundiers *et al.* 2020, in Engle *et al.* ; Waltner *et al.*, 17)

Transition Theory: “Transitions theory' is an overarching term covering different, but similar, theoretical approaches that analyse the development of 'socio-technical transitions'. Here, 'socio-technical' refers to the co-evolution of social and technological relationships while 'transitions' refers to the dynamics by which fundamental change in these relationships occur (hence the relevance to sustainable consumption. In this model, the innovation process is characterised as a coupled dynamic of selective pressures and adaptive capacity in the dominant system ('regime'), in which a technology is embedded” (Rip, 1992, Smith *et al.* 2005).

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1. Introduction

1.1 The Shipping Industry and the Sustainability Challenge

The shipping industry is coined as the “backbone of international trade” and is responsible for the transportation of goods and people by sea (Serra and Fancello 2020, 1), connecting regions and countries (short-sea shipping and deep-sea shipping, respectively) (Christodoulou and Woxenius 2019). It has long been the most cost and energy efficient mode of transportation of goods, as the size of cargo ships allows for economies of scale, thus lowering costs per unit. Today, seaborne trade represents 80-90% of the total volume of global trade¹. The International Maritime Organization (IMO) estimates a 39% growth in demand by 2050, compared with 2019 levels (Serra and Fancello 2020).

The industry involves a wide range of activities, including shipbuilding and repair, shipping operations, port management, logistics, and maritime services. Consequently, different stakeholders are involved and connected by shipping: ship owners and operators, port authorities, logistics providers, shippers, and shipping companies² (Lorange 2009).

Shipping has had a central role in the intellectual, social, and economic integration of our globe (Kaukiainen 2014), being a key enabler for the development of many nations and reduction of poverty (Bergh and Nilsson 2014). Least Developing Countries (LDCs), which historically mostly exported raw materials to developed nations, have expanded their manufacturing and consumption capacity and are now home to the world’s leading maritime trade handling centres³ (UNCTAD 2022). Taken together, increased efficiency in cargo shipping, a reduction of costs in shipping and production, and increased disposable income, have led to a growth in demand for products, and operational capacity to meet this demand readily.

This belief that economies and social structures can continue to grow without consideration for the planetary boundaries has put humanity on the course of an unsustainable future (Robèrt, Broman, and Basile 2013). Social and ecological systems are complex, meaning that the elements that make up these systems are not static entities, but rather form dynamic networks of relationships (Missimer, Robèrt, and Broman 2017). Hence, the sustainability challenge is one of great complexity, classified as a super wicked problem: there is a sense of urgency, those who seek to solve it are also part of the problem, there is no central authority, and irrational discounting pushes action into the future (Levin *et al.* 2012). For this reason, acting on the sustainability challenge is a matter of great complexity, “requiring extensive coordinated collaboration across disciplines and sectors” (Broman and Robèrt 2017, 217). According to Avery and Hughes (2012) two core components need to be put in place to deal with the wicked

¹ In 2021 a total of 11 million tons of cargo were loaded in ports around the world (UNCTAD 2022).

² Throughout this paper, we will use the following definition of shipping company: commercial firm that is active in one or more of the following: shipowning; trading, including ship brokerage, forward freight agreement trading and liner shipping; operations; commercial and technical innovations (Lorange 2009).

³ In 2021, LDN were responsible for 55% of global loaded (exports) and 61% of goods discharged (exports) (UNCTAD 2022).

problems of sustainability: enhancing systems resilience and rethinking leadership to structures that are better suited to the complexity of collaborative approaches.

Shipping is responsible for 3% of global anthropogenic greenhouse gas (GHG) emissions and IMO estimates that under business-as-usual operations there will be an 130% increase of global emissions by 2050⁴ (IMO 2020). The dominant fuel in international shipping is Heavy Fuel Oil (HFO), a residual fuel from the oil refining process, comprising 79% of total fuel consumption by energy (IMO 2020). Apart from Carbon dioxide (CO₂) emissions, its burning releases high concentrations of other airborne pollutants such as sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC) and particulate matter (PM) (Serra & Fancello, 2020). SO_x and NO_x emissions result in changes in ocean chemistry, and consequently ocean acidification (Hassellöv *et al.* 2013). Black carbon (BC), one of the components present within PM, is a short-lived pollutant with a strong climate warming potential. Its effect is especially concerning in polar regions like the Arctic, where BC's warming effect is up to five times stronger than in other regions, significantly accelerating ice and snow melting (Sand *et al.* 2013).

These emissions have a quantifiable and preeminent impact on human health, especially within coastal communities and port areas. In fact, air pollution from international shipping is estimated to cause between 250,000-400,000 yearly premature deaths globally, a number that can be drastically mitigated through the use of cleaner fuels (Sofiev *et al.* 2018). Apart from air quality, ports also have impacts in water and soil quality and habitat conservation. Challenges also arise from large volumes of resource and energy consumption, waste disposal and noise pollution. This yields that ports have a very localised negative impact on communities within the port-city interface, whereas positive impacts usually materialise at a larger scale (regional, national)⁵ (Delphine *et al.* 2019).

A higher demand for seaborne trade also leads to an increase in maritime roads, which exacerbates the disruption of maritime ecosystems. Pirotta *et al.* (2019) stress that intense shipping activities pose a serious threat to maritime giants (i.e., whales) which play a key ecological role in the nutrient and biomass cycles across entire ocean basins. Particularly, noise pollution caused by ship's propulsion has negative impacts that are felt both at the individual organism level and the overall composition, health, and service functions of the ecosystems. For example, anthropogenic noise is known to reduce the catch rate of certain commercial maritime species, diminishing the provision of fishery (Peng, Zhao, and Liu 2015). On another hand, ballast water discharge is considered the larger species invasion vector, greatly contributing to the proliferation of non-native species (Seebens, Gastner, and Blasius 2013).

Ship breaking and recycling, the process of complete or partial dismantling of ships to recover materials, is an indispensable stage ship life cycle. What started as a highly specialized operation taking place in industrialized nations, has now relocated to LDCs, where labour costs are minimized (Hossain *et al.* 2016). Today, more than half of ship recycling takes place in Bangladesh, which depends on scraped metal for steel production⁶ (Rahman, Handler, and

⁴ Comparing with 2008 levels.

⁵ Economic impacts arise from regional economic growth and added value to a given area.

⁶ Up to 70% of steel production is from scrap metal feedstocks sourced from foreign ships (Rahman *et al.* 2016).

Mayer 2016). Despite contributing to the socio-economic growth of the country, the activity is conducted under poor planning, management, and lack of legislation and regulations (We use both words interchangeably in all upcoming chapters). This has resulted in the contamination of toxins in coastal environments, labour safety threats and occupational health problems, social unrest, and conflicts (Hossain *et al.* 2016).

The maritime industry is male-dominated, with women making up only 17% of the overall port working force and 7% in merchant shipping (Li, Zhou, and Yuen 2022). Given the shortage of skilled workers both at sea and in ports, accelerating female participation in the industry can be a way to strengthen its resilience (UNCTAD 2022).

On another hand, people working at sea face harsher environments and conditions: typically, seafarers work between four and six months on board, 10-12 hours a day and seven days a week, performing tasks that require constant awareness, and physical exertion (ICS 2021). This is known to have deteriorating consequences for their physical and mental health (Li, Zhou, and Yuen 2022). Despite this, these professionals are disregarded and even forgotten, an issue that was brought to attention during the COVID-19 pandemic.⁷ More recently, the International Chamber of Shipping, in collaboration with other 30 organizations, wrote a joint statement to the United Nations (UN) asking for the release of 331 seafarers that have been trapped in the Black Sea for more than a year while providing for a safe passage of critical grain and fertiliser shipments from Ukraine.⁸

1.2 Vulnerabilities of the Shipping Industry

Armed conflicts such as the war in Ukraine and the consequent energy crisis illustrate how shipping is extremely vulnerable to disruptions. The World Economic Forum (WEF) estimates that the three most severe risks in the next two years will be the cost of living, natural disaster, and extreme weather events and geoeconomics confrontations (which include trade wars). According to WEF, all these have a potential to disrupt the industry, namely by driving supply chain decoupling, potentially causing a widening of the developmental divide (WEF 2023).

Moreover, the Intergovernmental Panel on Climate Change (IPCC) reports that human-induced climate change has caused and will continue to inflict an increase in extreme weather events, such as draughts, heatwaves, extreme precipitation, and extreme sea level events (IPCC 2023). Shipping is, no doubt, vulnerable to these risks, through the disruption of global supply chains, threats to on-board safety or through the physical degradation of ports (Kawasaki *et al.* 2022). The industry is also known to be vulnerable to more punctual disruptions. A prominent example illustrating the vulnerability along the supply chain is the 2021 incident of the cargo ship Evergreen running aground in the Suez Canal and blocking passage for other cargo ships for six days. According to New Zealand Foreign Affairs and Trade, 12% of global trade traverses

⁷ The IMO estimate that during the COVID-19 pandemic more than 250,000 seafarers were stranded on commercial vessels, some for more than a year (IMO n.d.).

⁸ Open letter to UN Secretary General António Guterres: Shipping industry call for help to evacuate the 300+ seafarers still trapped in Ukraine ports.

the canal, and a blockage of it can cost USD \$400 million per hour in global annual trade growth (New Zealand Embassy in Cairo 2021).

In fact, the vast scale of operations within shipping and its strict interconnection with other systems make the industry more vulnerable to stressors and systemic disruptions, which can have a ripple effect on supply chains as a whole (Waddock 2013). Consequently, building resilience in an ever more complex society is a challenge that the industry faces. Holling (1973) defines resilience in social-ecological systems as “the persistence of relationships within a system and [as] a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist” (Holling in Waddock 2013, 99).

To enhance system resilience, it is necessary to create adaptability and diversity, thus shifting the system’s dependence on a limited number of elements and increasing its overall complexity. This means that the risks are distributed amongst a more complex web, diminishing the overall vulnerability towards disruptions. Consequently, this urges the need for collaboration and coordination across boundaries, allowing for co-created solutions that align different perspectives and account for redundancies and possible unintended consequences. Furthermore, this brings new demands for capacity building in leadership and innovation (Waddock 2013).

1.3 IMO: The UN Body to Regulate International Shipping

International shipping is unlike most industries, in that its commercial activities take place across borders, thus requiring an overarching “playing field.”⁹ The United Nations Convention on the Law of the Sea (UNCLOS) (UNCLOS 1982) sets the legal framework with which all activities within oceans and seas should comply, thus defining the rights and obligations of states and the foundation for international cooperation. Under UNCLOS, the IMO is identified as the competent body to regulate international shipping.

IMO is thus responsible for the safety and security of international shipping, the prevention of marine pollution from ships and facilitating international maritime trade. Environmental matters are regulated through the Maritime Environmental Protection Committee (MEPC), which develops and adopts international regulations¹⁰ and standards, and provides technical assistance and capacity-building to Member States¹¹. Governments are then responsible for ratifying IMO’s conventions and putting the laws into effect (Knudsen and Hassler 2011). Because regulatory measures set by the IMO are likely to impact international trade¹², decision-making considerations include the potential impact on states (especially LDCs), and the precautionary principle (Garcia, Foerster, and Lin 2021).

As a UN body, the IMO has committed to supporting the 2030 Agenda for Sustainable Development and integrating the Sustainable Development Goals (SDGs) into its programming and planning and as a general direction to support member states in a more tangible and targeted approach (IMO n.d). Despite this intention of providing a unifying framework and integrated

⁹ As is also the case for the aviation industry.

¹⁰ We are using regulation and legislation interchangeably.

¹¹ 171 Member States and three Associate Members, including all major ship-owning nations and all major coastal states.

¹² E.g., Strategies to reduce the sector’s emissions will impact global logistical supply chains (Garcia *et al.* 2021).

action towards sustainable development, the concept of sustainable shipping is still ambiguous. According to a comprehensive review done by Zhou, Li, and Yuen (2023), there are multiple definitions of sustainable shipping used within the industry, mostly rooted on the Triple Bottom Line framework (TBL), with more than half of the collected literature focusing on the environmental pillar (“green shipping”).

The focus on green shipping is also prevalent in IMO’s current Strategic Plan for the organization (2018-2023), with most discussions centred around decarbonization. This was the first time an emission reduction target was set for the industry: halving emissions by 2050. Recently, member states submitted proposals for what they perceived as the necessary ambition levels to be adopted in the revised strategy for the next six-year period. Annex A demonstrates the differences in ambition, with some states aligning with the Science Based Targets Initiative and the IPCC, and other states proposing their targets and overall support for the adoption of a 2040 target (Smith and Shaw, 2023). It also illustrates the misalignment between current ambition levels from the IMO and scientific recommendations, as well as among member states.

International shipping has been known to be excluded from major international agreements, such as the Kyoto Protocol and the Paris Agreement (Garcia, Foerster, and Lin 2021). Consequently, shipping is often associated with “hard-to-abate” emissions, that can hinder cross-sector efforts. Sharmina *et al.* (2021) demonstrate how the shipping sector is one of four critical sectors in keeping global warming below the 1,5°C and 2°C scenarios. The authors stress that the sector’s deep mitigation relies on a shift to low-carbon energy sources, associated technologies, and higher energy efficiency, especially between 2030 and 2040.¹³ Although some low-carbon shipping fuels are already being employed (most viable options are LNG (Liquified Natural Gas), biofuels, and hydrogen-derived fuels), they are currently not technologically advanced enough, require significant changes in supply chains, or are not affordable at scale (Smith and Shaw, 2023). This uncertainty about future technological developments and the most cost-efficient fuels, as well as the changing regulations and carbon prices, is illustrated by the increase in the age of the global fleet (UNCTAD 2022).

1.4 Transitioning towards Sustainability

Decisions concerning international shipping are complex, influenced by a large realm of stakeholders and have not always resulted in overall effective outcomes. Following a decision made in 2008, a new regulation from the IMO came into effect in 2020 to reduce the Sulphur content of fuel oil from 3.5% to 0.50%. To allow for this, the IMO promoted the use of low Sulphur oil and exhaust gas cleaning systems on board ships (also known as “scrubbers”) (IMO 2020). However, scientific reports submitted by member states and organizations to the IMO have provided evidence that the new fuels contain higher concentrations of BC, thus raising the question of whether this is a sound solution (MEPC 2019).

The same unintended consequences can be identified at the national and supranational levels. In 2021, the European Union (EU) adopted the “Fit for 55” policy package, containing four proposals for the shipping industry. A report by *Transport and Environment* has stated that “Fuel EU Maritime”, the regulation that has the highest potential to put the sector on track for

¹³ To achieve the 1,5°C target, there needs to be a 60% efficiency improvement, against a 2008 baseline (UMAS 2023).

decarbonization by 2050, currently jeopardizes the transition. According to the report the policy “will likely result in the acceleration of fossil natural gas uptake as the cheapest alternative fuel eligible until 2040, as well as biofuels from dubious origin” (Transport and Environment 2022, 4).

These concerns have also been voiced by some member states and NGO’s. In 2021, prior to a meeting with the IMO the Special Rapporteur on toxics and human rights called for a submission from all interested parties, of information concerning various topics from occupational health, maritime pollution, and impacts on local communities. Submissions were made from both states and Non-Governmental Organisations (NGOs), with the latter asking for freedom of participation and information¹⁴. Most called for more ambition and stricter regulations (e.g., regulate emissions based on life cycle of maritime fuels),¹⁵ and the employment of the precautionary principle, especially to dealing with oil spills. A submission also came from 20 federally recognized tribes in the Bering Strait Region in Alaska, to call for better distribution of power regimes. They stress how current power dynamics within IMO are currently failing the people of the Arctic and are part of a broader economic system that threatens to destroy Alaska Native cultural lifestyles. The Inuit Circumpolar Council, an indigenous people’s organization that promotes Inuit’s way of life and rights, has also called for an “effective, equitable, and meaningful” participation in discussions on Arctic shipping at IMO, through the acceptance of their application for consultancy status¹⁶ (Dorough 2021).

All of the previously mentioned examples of strategies and their unintended consequences depict the need for a more systemic and strategic approach to dealing with current and future challenges faced by the industry. This means that actions taken should account for the complexity of systems with which shipping interacts.

Throughout centuries, shipping shaped the development and global power dynamics of nations, while continuously transitioning and evolving in response to new demands: from the first experiments with steamships around the 18th century¹⁷ to the opening of the Suez Canal, the bulk revolution and later the container revolution. The current prevalent mode of long-distance freight shipping, liner-shipping,¹⁸ is a result of a mosaic of technological advances, niche developments, and political, economic, and physical landscape developments (Geels 2002).

The arguments that we have presented up until this point have led us to believe that we are slowly transitioning into a new era of shipping. While we cannot predict what the next transition will look like, we can understand the dynamics through which old systems are replaced by new ones, drawing from the Multi-Level Perspective (MLP) introduced by Geels (2002). This understands transitions of socio-technical regimes as an interplay of landscape developments (such as political, economic, and environmental), niche interventions and the dominant socio-

¹⁴ The Clean Arctic Alliance stresses that the IMO does not comply with the Aarhus Convention of securing the public’s rights through access to information, public participation, and access to justice for a healthy environment.

¹⁵ Known as the well-to-wake methodology.

¹⁶ A position paper for the UNFCCC COP 26- “Make space for Inuit in climate governance to protect the Arctic and protect the planet”.

¹⁷ That would later allow for the dawn of the ocean passenger transport (e.g., mass emigration from Europe in the 1840s)

¹⁸ The process of transporting goods and cargo from one destination to another by large ocean ships that move through regular routes on fixed schedules.

technical system that eventually transitions into a new one (Geels 2010). Furthermore, while we hold the uncertainty of not knowing what the next new dominant system for shipping will be, we can analyse the current guidelines and considerations for the transition and discuss the extent to which they are leading us towards a desired, more sustainable future.

1.5 Conceptual Framework: FSSD

As mentioned before, the most sought-after framework in defining sustainability within the shipping industry is the TBL (Zhou, Li, and Yuen 2023). This model places the economic, social, and environmental pillars in harmony, at the same level, and identify sustainability in the overlap of the three systems. This approach is, however, insufficient to capture the complexity of social or environmental systems. As John Elkington has stated, 25 years after coining the term, “The TBL wasn’t designed to be just an accounting tool. It was supposed to provoke deeper thinking about capitalism and its future, but many early adopters understood the concept as a balancing act, adopting a trade-off mentality” (Elkington 2018). Instead, a nested dependencies model gives a more nuanced understanding of the three respective systems, by recognizing their nested and interconnected nature (Giddings *et al.* 2002). It is different from the TBL in that it recognizes that these systems are co-dependent and operate within different boundaries: 1) society exists, depends and can only operate within environmental constraints and 2) economy is a subsystem within society and the environment, without which it can exist. The latter approach has been applied in different frameworks and guidelines, shaping the way the interdependencies between ecological, social, and economic systems are understood.

The Framework for Strategic Sustainable Development (FSSD) is an example of an approach that uses the three nested dependencies model, taking a systems perspective to sustainability. A systemic perspective to the sustainable challenge acknowledges that the “sustainability related impacts happen gradually over time as a consequence of utterly complex interrelationships between ecosystems and human societies and are not directly perceived by our senses” (Broman *et al.* 2017, 3). Thus, the true character of the challenge is unveiled by taking into consideration the complexity and interconnection of unsustainability problems, rather than listing them in isolation. This enables us to stop underestimating this challenge and avoid creating new problems for each problem we are trying to solve. Applying systems thinking to propose new pathways for the future also requires the ability to listen, make connections across ideas and people, which inevitably means developing skills to working collaboratively (Waddock 2013).

Through an FSSD lens, unsustainability is seen as the result of systemic errors in the societal design, that connect with each other in complex ways and systemically erode the socio-ecological system (Broman and Robèrt 2017). Thus, the sustainable development is seen as the transition between the current unsustainable society and a sustainable one, through the elimination of society’s systemic errors. Another important concept in FSSD is backcasting, which consists of creating a vision for the sustainable society we want to achieve by questioning “how does success look like?”. Then, one analyses the current reality to identify strategic measures that need to be taken to close that gap. Here, the concept strategic means that the focus is on the long-term success, rather than the short-term thinking and incrementalism that

significantly contribute to unsustainability. Small changes, though, are still necessary to employ as stepping stones for long-term goals (and to ensure return on investment).

In FSSD visions are created by employing basic principles for sustainability: boundary conditions that need to be respected for the plan to be successful (Robèrt, Broman, and Basile 2013). Sustainability principles (SPs) are derived from an understanding of the essential aspects of the ecological and social systems that, when eroded, undermine the capacity of humanity to fulfil their needs. The essential aspects of the ecological system have been inferred from scientific laws and knowledge from multiple fields. The assimilation and purification capacity, food production, climate regulation capacity and biological diversity are some of the aspects that need to be sustained. The three ecological principles ensure that nature is not subject to systemic increase of: 1. Substances extracted from the earth's crust; 2. Substances produced by society, 3. Degradation by physical means (Broman *et al.* 2017). To derive the social principles, it was necessary to identify the aspects that enable the adaptative capacity of the social system: trust, diversity, common meaning, capacity for learning, and capacity to self-organize. The five social principles safeguard that people are not subject to structural obstacles to: 4. Health, 5. Influence; 6. Competence, 7. Impartiality, 8. Meaning-making (Missimer, Robèrt, and Broman 2017). Table 1.1 provides a summary of the eight SPs.

While FSSD is not the sole framework that uses the nested dependencies model, it is unique in presenting a science-based principled definition of sustainability, based on key mechanisms of destruction of social and ecological systems. Because complex systems interact and behave in unpredictable ways, boundary conditions provide more flexibility to operationalise within changing contexts, such as a transition in the shipping industry. We also consider the possibility of having a shared definition of sustainability as facilitating the learning and coordination between different actors within the industry, making it possible to co-create a unifying vision for the future. We further elaborate on the benefits of using a principled definition of sustainability in Chapter 2.3.1 Phase I.

Table 1.1 - The Sustainability Principles

	<i>Sustainability Principle</i>	<i>What it means</i>
SP1	Nature is not subject to systematically increasing concentrations of substances extracted from the earth's crust.	Limited extraction and safeguarding so that concentrations of lithospheric substances do not increase systematically in the atmosphere, the oceans, the soil or other parts of nature.
SP2	Nature is not subject to systematically increasing concentrations of substances produced by society.	Limited production and safeguarding so that concentrations of societally produced molecules and nuclides do not increase systematically in the atmosphere, the oceans, the soil or other parts of nature.
SP3	Nature is not subject to systematically degradation by physical means.	The area, thickness and quality of soils, the availability of freshwater, the biodiversity, and other aspects of biological productivity and resilience are not systematically deteriorated by mismanagement, displacement or other forms of physical manipulation.
SP4	People are not subject to obstacles to health.	People are not exposed to social conditions that systematically undermine their possibilities to avoid injury and illness, physical, mentally and emotionally.

SP5	People are not subject to obstacles to influence.	People are not systematically hindered from participating in sharing the social systems they are a part of.
SP6	People are not subject to obstacles to competence.	People are not systematically hindered from developing competence individually and together.
SP7	People are not subject to obstacles to impartiality.	People are not systematically exposed to partial treatment.
SP8	People are not subject to obstacles to meaning making.	People are not systematically hindered from creating individual meaning and co-creating common meaning.

Source: Adapted from (Missimer, Robèrt, and Broman 2017).

1.6 Research Questions

The preliminary research conducted has demonstrated how the shipping industry both contributes and is vulnerable to the sustainability challenge we currently face. It is our position that a transition within the industry is not only necessary but inevitable. Although we do not know what the pace of change will be or what the next dominant system will look like, we can assess what aspects of sustainability are being addressed at the moment. Given the particularity of shipping being regulated by one sole entity, we recognise the central role that IMO plays in the industry in setting a level playing field for the industry and its transition. Nonetheless, we acknowledge that no systemic change can come merely by imposing strict policy, but rather agency must come from those working within the sector. Their thoughts and perceptions of what is needed for a transition towards sustainability are most relevant in understanding where it currently stands and where it needs to move towards.

Thus, we pose the following research questions (RQs):

- RQ1: *How aligned is IMO's legislation with a transition towards sustainability for the shipping industry?*
- RQ2: *What do practitioners in the shipping industry perceive is needed for a transition towards sustainability?*

1.7 Scope and Related Limitations

This thesis addresses the overarching topic of a sustainability transition in the shipping industry. The research we conducted is framed by Transition Theory¹⁹ and our analysis focus mainly on the socio-technological landscape, dominant system, and different views on the transition to a new regime. We do not debate or attempt to predict what specific niche system within the shipping industry will prevail in this transition. Regarding the Conceptual Framework, it is worth mentioning that applying SPs does not *per se* ensure a utopian society where sustainability is granted. Instead, the boundary conditions are the “bare minimum” for sustainability, which means that a higher level of ambition is desirable.

Throughout this study, we refer to shipping as the economic activity of seaborne trade. Our analysis and discussion focus on the aspects and implications of directly associated activities

¹⁹ We are using MLP as a transition theory in our research.

and processes (i.e., within ports and vessels). To answer RQ1 we consider a life-cycle perspective, including in our analysis different stages from manufacturing to end-of-life (e.g., ship building, ship recycling, port construction).

It is also worth noticing that, while the shipping industry is embedded within the transport sector, and is interconnected with other modes of freight, we are focusing our research solely in sea freight (with the exclusion of passenger transportation). However, we recognise that transitioning towards truly sustainable processes and social systems requires systemic changes across sectors, especially when taking into consideration the complexity and interconnectivity of supply chains.

The focus of our thesis is primarily on the regulatory landscape, blind spots of the strategies put forward by the sole regulator of international shipping and how these can be overcome by the actors within it. The most prevalent voices in our research are experts and practitioners within maritime management and governance. Their insights provide an understanding of the most pressing issues when considering this transition, how sustainable shipping should look like and where more ambition is needed. Despite recognizing the complexity of the industry and the widespread impact of its externalities on people and nature, to include all these stakeholders' voices, first-hand, would not be feasible given the timespan of our thesis. Our hope is that, by taking notice of the issues that were addressed and what remains to be voiced, we can shed light on the blind spot of this transition and where future effort should focus on.

The target audience of this thesis are shipping companies, policy makers, member states under IMO regulations, and the IMO. The broader audience is the entire shipping community, which is all of us since we are all dependent on and impacted by it. Shipping might be out of sight but cannot continue to stay out of mind.

2. Research Design

This chapter describes and discusses the research design used in this thesis. The first section outlines the qualitative research design, which is further clarified in the second section. The third section describes the methods utilized in detail, and the chapter ends with a discussion of the quality of the methods.

2.1 Qualitative Research Design

This thesis is rooted in Sustainability Science (SS), which deals with the complex relationships between natural and social systems. When designing this research, we aimed to align with the three main objectives identified for the field: “1) understanding the fundamental interactions between nature and society, 2) guiding these interactions along sustainable trajectories, and 3) promoting social learning to navigate the transition to sustainability” (Kates *et al.* 2001, 641). SS has a practical and transformational orientation, striving to produce knowledge that can inform better decision-making (Miller 2013), and is guided by a sense of urgency, advising society to construct and pursue sustainable visions.

The recognition of desirable future trajectories means that SS is a value-based science. Values guided by our decisions about pursuing this research and influenced some scientific inferences (Nagatsu *et al.* 2020). These values, or “ideas of the world that are held important”, are present, for instance, in concepts such as resilience, vulnerability, and planetary boundaries (Miller *et al.* 2014). Here, not only the researchers’ normative competence was taken into consideration, but also societal values through stakeholder's and decision-maker's voices.

The complexity of interactions within the socio-ecological system also calls for the integration of diverse knowledge and actors (Lang *et al.* 2012). Firstly, a multiplicity of knowledge fields has informed the design and execution of different phases of this research, bound together by the systems’ perspective through the FSSD framework (*see* Chapter “Conceptual Framework: FSSD”). Secondly, this research has enabled the involvement of actors from outside the academic realm (*see* Chapter “2.3.2 Phase II”), in an attempt to capture socially relevant problems, contribute to solution-oriented knowledge, and foster mutual learning (Gibbons 1999). This is rooted in the belief that the co-creation of scientific projects with elements of society unlocks practical and contextual knowledge that can be re-introduced in the learning cycle.

The research employed qualitative research, given that it “embodies a unique approach that can help researchers answer wicked questions about the human action and experience” (Savin-Baden and Major 2013, 18). A qualitative research strategy focuses on words and their meaning, contrasting with the focus on measuring values that stem from quantitative research. Qualitative research also seeks the big picture perspective, recognizing the importance of values, passion, and politics (Savin-Baden and Major 2013), which we understand is most compatible with a SS approach.

We followed Maxwell’s (in Savin-Baden and Howell Major 2013) qualitative research design model, which provides the flexibility to adjust design decisions in response to new

developments in a given aspect of the design (i.g., goals, conceptual framework, research question, and validity).

The research unfolds through three main sequential steps: research clarification (Phase 0), Phase I (allocated to answering research question 1), and Phase II (allocated to answering research question 2). This allowed us to create a learning loop, meaning that the results and discussions from Phase I were used to inform the design and content of Phase II. In the following subsections, we describe each research phases in turn.

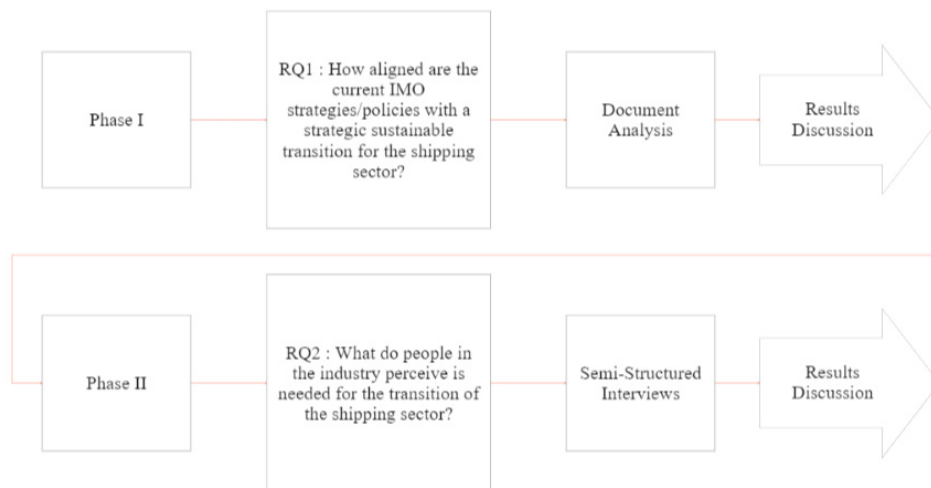


Figure 2.1 - Research questions design and respective methods

2.2 Research Clarification

A preliminary literature review mapped the different topics being discussed in the field, focused on the transition towards sustainability. Initially, individual understanding of the topic, curiosity, and personal and intellectual goals formed the basis of the topic. An example of a search queries used in this phase: ("Shipping Industry" AND Transi* AND Sustainab*). Simultaneously, three exploratory informal interviews were conducted to gain perspective on the industry and consider any other angles that could be explored. The interviewees include the vice president of the Sustainability and Development department of a Swedish shipping company, two researchers in maritime sustainability, and an expert/consultant of a Swedish maritime consultant company. Along with valuable insights, the explorative interviews and preliminary literature review shaped the research questions and overall research design.

2.3 Methods Used in Phase I and Phase II

The following section will outline the methods applied to answer each research question, namely in Phase I and II. The first section explains the data collection method of document collection, methodological framework, and data analysis of documents of Phase I. The second section explains the data collection method of semi structured interviews and ends with data analysis through transcription and coding.

2.3.1 Phase I

Phase I of the research was designed with the goal of answering RQ1 (*How aligned is IMO's legislation with a transition towards sustainability for the shipping industry?*). This part of the research was more concerned with *what* rather than *how* or *why* and followed a descriptive approach, which focused on describing a phenomenon and its characteristics (Savin-Baden and Major 2013). To answer the research question the primary research method employed was document analysis, using IMO's policies as a source of data. This method was chosen because it provided readily and credible primary data (Savin-Baden and Major 2013). Other methods (e.g., fieldwork, observation, interviews) were unsuitable, as they are more appropriate for studying individual perspectives and experiences. In the following section, elaborates on the different stages and methods applied in Phase I.

Data Collection: The website *IMODOCS*, a repository of official IMO documents, was initially used as the primary source of data collection. Here, different types of procedural documentation are accessed, such as committee decisions, transcription of conferences, and conventions, amongst others. This information enabled us to identify important pieces of legislation, but it did not provide access to the regulations per se. The second source of data was the official website of IMO, through which a total of 50 documents were gathered between 6-20th March 2023.

Because IMO's policy repository is not entirely open access, we were restricted by the documents that we could access. A way that we overcame this was by accessing policy documents that different stakeholders within the industry make available in their repositories. Still, our study falls short in providing a complete evaluation of all conventions under the IMO.

We identified three categories of documents containing specific data, namely Conventions, Protocols, and Strategies. Conventions are the most prevalent form of putting forward a regulation by the IMO and have most of the binding policies with which member states must comply. Protocols, which follow a specific convention, were used to outline the policies, guidelines, and regulations of the convention. Lastly, strategies or strategic planning were also a source of data. Annex B provides an overview of the gathered IMO Conventions.

Data Analysis and Methodological Framework: A content analysis was chosen to analyse the data previously gathered and select relevant pieces to be further analysed. It began with listing and organizing the documents using an Excel spreadsheet. Upon an initial read of each document, it was then determined if the document was relevant to answer RQ1, namely through an assessment of whether it addressed or had any implications to the aspects identified in Table 1.1. If not relevant the document was not subject to further analysis. In total, 36 documents were relevant to the research.

We then employed a deductive data analysis using the conceptual framework presented in Chapter 1.5 to create themes for coding. While inductive coding has the distinct advantage of "being loyal to the data" by creating codes based on the data (Skjott Linneberg and Korsgaard 2019, 64), utilizing a list of pre-defined codes allowed us to assess the data against our set of values (i.e., if the legislation addresses different aspects of the Sustainability Principles). To

our knowledge, this is a unique approach to analysing IMO's legislation, compared to other studies in existing literature.

The intention of using FSSD to create a methodological framework for the data analysis was two-fold. First, as mentioned in Chapter 1.5, FSSD is rooted in complexity theory and employs a systemic perspective to face the sustainability challenge. We argue that such an approach is needed in the context of a transition toward sustainability within the shipping industry. Secondly, it proposes a principled definition of sustainability, that can be easily operationalized in different contexts and sectors. This is especially relevant since previous literature has pointed to the conflict between different definitions of sustainability used within the sector (Zhou, Li, and Yuen 2023a). We further argue that the SPs facilitate the identification of the root causes of unsustainability, in other words, point to what can be the "first harm". This is, as we see it, a more effective way to leverage change, rather than addressing its symptoms. Also, by focusing on systematic degradations (ecological SPs) and obstacles (social SPs), the SPs deviate from temporary events or cyclical fluctuations, thus capturing structures that have potential system-wide and lasting effects.

The methodological framework was developed through a set of questions that follow the rationale of all eight SPs, presented in Chapter 1.1. The questions were tailored to the context of the shipping industry by combining the latter with the impacts of the industry identified by previous research (presented in Chapter 1.3). The questions were formulated according to three life-cycle stages, production and construction, use and maintenance, and end of life /Disposal, thereby employing a cradle-to-grave perspective instead of just focusing on the use stage. The three stages were applied to ports and ships due to their overall relevance in the industry and because of IMO's jurisdiction. The questions formulated are, thus, specific for each SP and category, allowing to identify gaps in sustainability aspects of IMO legislation.

To exemplify, here we include an excerpt from the methodological framework. For the use and maintenance stage of ships we would ask the following questions regarding SP2:

- Is the usage of ships systematically increasing the concentration of GHG in the atmosphere?
- Is the usage of ships systematically increasing the concentration of nitrogen oxides?
- Is the usage of ships systematically increasing the concentration of sulfur oxides?
- Is the usage of ships systematically increasing the concentration of particular matter?
- Is the usage of ships systematically increasing the concentration of volatile organic compounds?
- Is the usage of ships systematically increasing the concentration of invasive species?
- Is the usage of ships systematically increasing concentration of organic, biological, chemical and toxic pollutants in waterways (e.g., through oil spills and waste disposal)?

Annexes C, D, and E provide a complete overview of the questions considered for the production and construction stage, use, and maintenance stage and end-of-life stage, respectively. From the 169 questions, 70 are related to ecological SPs, while the remaining 99 on social SPs.

We then read the documents and recorded them in an MS Excel spreadsheet whenever a legislative document regulated that particular issue, thereby enabling us to answer ‘no’. The underlying assumption is that any convention addressing a specific problem identified beforehand would equal to it not being systematically increased, e.g., SO_x. Whether these conventions are ratified and enforced in the respective member states was out of the scope for RQ1.

In a second spreadsheet with the same layout as the first, we also recorded excerpts from the convention or document containing something specific for that SP in the category, to refer back to the exact passage addressing one of our questions. Table 2.2 provides an example of conventions containing regulations regarding use and maintenance stage of ships in SP2.

Table 2.2 - Example of application of the conceptual framework for coding.

<i>Question</i>	<i>Regulatory Documents</i>
<i>Is the usage of ships systematically increasing the concentration of GHG in the atmosphere?</i>	Revised Strategic Plan 2018-2023; HKIC; MARPOL
<i>Is the usage of ships systematically increasing the concentration of nitrogen oxides (NO_x)?</i>	MRPOL- Annex 6
<i>Is the usage of ships systematically increasing the concentration of sulfur oxides (SO_x)?</i>	OPRC; MARPOL-Annex 6.
<i>Is the usage of ships systematically increasing the concentration of particular matter (PM)?</i>	MARPOL- Annex 6.
<i>Is the usage of ships systematically increasing the concentration of volatile organic compounds (VOCs)?</i>	BWM; LC
<i>Is the usage of ships systematically increasing the concentration of invasive species?</i>	OPRC; CLC; ICCHASS.
<i>Is the usage of ships systematically increasing concentration of organic, biological, chemical, and toxic pollutants in waterways (e.g., through oil spills and waste disposal)?</i>	INTERVENTION

2.3.2 Phase II

Phase II of the research was designed to answer RQ2 (*What do practitioners in the shipping industry perceive is needed for a transition towards sustainability?*). This phase of the research allowed us to inquire about different perspectives on the phenomena of study. Data was collected through interviews with practitioners within the field. Instead of fact-finding or problem-solving, we intended to give voice and gather insights from people in the industry, inquiring about their visions of the future, struggles, and unique contributions. Interviews were most fitting for this, given our goals and constraints (e.g., time and geographical constraints). For example, focus groups would allow for an understanding of the relationship and collaborative capacity amongst different actors within the field, but limits the ability to go deeper into a given subject. Moreover, while enabling a larger sample of respondents, surveys

are less fitting to capture the intricacies inherent in human worldviews and perceptions (not only how they are worded). This method also does not allow for a discussion between researcher and participant, which we regard as relevant for grasping the nuances and complexity of the challenge being studied.

Semi-structured interviews were chosen over structured interviews or unstructured interviews. This is because semi-structured interviews allowed us to explore new issues, which would not be possible through structured interviews. Conversely, unstructured interviews are more time-consuming and result in data that is difficult to compare. Given our time constraints, semi-structured interviews were most suitable, as we spoke only once with each interviewee. This flexibility allowed us to prepare a pre-set of questions and build on them by incorporating new ones based on the interview and context (Savin-Baden and Howell Major 2013). A limitation of semi-structured interviews is that they do not always allow the participants to offer their own unique perspectives (Savin-Baden and Howell Major 2013).

We recognise that perceptions, however more diverse they might be, only allow us to harness the reality as seen by those who voice them. This does not mean to neglect how individuals perceive certain phenomena, but to remind us that it only gives us a mere interpretation and might not reflect reality. We argue that it is nevertheless important to access and discuss perceptions, as they inform our decisions and actions. In fact, understanding how a group perceives and makes sense of the systems in which they are can help identify e.g., limiting beliefs, communication gaps, mental models, personal motives, and desires.

Data collection: Nine semi-structured interviews were conducted between March 20th to April 10th, 2023. In total 15 shipping experts were considered based on LinkedIn profiles and associated companies. However, nine experts were able to accommodate time for an interview. All interviews were conducted online on Zoom, in English, and lasted between 60-75 minutes each.

To select the interviewees, we followed a three-step process. The first step involved identifying the people or groups that may offer the most pertinent data to address our research topic. In this step, we defined criteria to determine relevant candidates in our study. The criteria are as follows:

1. Professional active in the shipping sector for over 3 years.
2. Experience and knowledge about IMO policies.
3. Experience and knowledge about sustainability transition.

Based on the above-mentioned criteria, purposive sampling was employed to choose people pertinent to our study. Additionally, we used snowball sampling to increase the number of candidates for interviews by asking those who participated in the research to recommend new candidates. Finally, we contacted interview candidates through email and LinkedIn. All the interviewed candidates are based in Sweden or UK, and their work concerns the Northern-European context. This is a limitation of our empirical findings as it is more skewed towards the developed context and therefore their contextual perspectives. Table 2.3 provides an overview of the interviewees' expertise and geographical context.

Table 2.3 - Overview of expertise and geographical context of interviewees

<i>No</i>	<i>Expertise</i>	<i>Context of expertise</i>
1	Transport and Energy Research	Sweden
2	Business and Development	Sweden
3	Maritime and Sustainability Consulting	Sweden and Denmark
4	Communications and Partnerships	UK and Europe
5	Naval Architect and Project Management	Sweden
6	Climate and Environmental Policy	Sweden
7	Energy and transition, Competence Building	Sweden
8	Ocean Sustainability Research and Governance	Sweden
9	Energy Transition and Marine Policy	UK

As mentioned, the findings from Phase I informed the design and overall theme discussed in the interview. The themes and open-ended questions helped us accommodate the interviewees' perspectives within the field of their work and experiences (Savin-Baden and Major 2013).

The interviews were designed to be conducted by two researchers in designated roles –primary interviewer and secondary interviewer. The roles and responsibilities of each researcher were decided during the designing process of questions. The primary interviewer leads the conversation, by asking the prepared questions and incorporating new questions based on the insights. The secondary interviewer took notes, time keeping and asked additional questions (if needed) after the conclusion of the scripted questions. These roles and responsibilities carried on into the data analysis phase. At the end of the interview, both the interviewers captured insights, and thoughts and summarised key ideas from the conversation creating a “memo”.

The initial questions focused on the interviewee, their role, and associated organization associated with the shipping industry. The following questions were built around the future of the industry, how the interviewee works with sustainability, the role of IMO and its challenges, awareness of the need for transition in the sector, and social sustainability challenges of the sector. The scripted questions and their purpose are in Appendix A.

Data Analysis: We conducted the data analysis of the interviews in four major steps. First, we transcribed the interviews. Then, we coded the interviews in two cycles of inductive coding. In the third step, we analysed the raw data for the results.

Transcription: All of our interviews were transcribed manually by the “support” person or secondary interviewer that attended the interview, to ensure quality and rigor. After transcribing the interviews, the respective interviewees were sent the transcript and asked for permission to use their interview as data. They were also informed that they were allowed retractions.

Coding: To add rigor and quality to our coding, two people coded every interview independently from each other in two cycles of coding, then we reconciled in the group and discussed patterns and similarities and came up with a preliminary coding structure. The two people coding the data had also previously conducted the interview. The first coder was the one that acted as a support in the interview and who also transcribed the interview. The lead of the

interview was the second coder. The rationale for this was that they would still be able to recall the interaction and thus also consider nuances that are possibly lost in the process of transcribing the interviews, i.e., body language or tone of voice. For an overview of the coding process, please consult Figure 2.2.

Upon re-reading the transcript, each coder highlighted what seemed relevant to answer the research questions, the interview questions, and subsequently, the gaps we had identified. In the first-cycle coding, we assigned descriptive codes based on the content of those segments of the interview that we had previously highlighted (Skjott Linneberg and Korsgaard 2019, 265). In second-cycle coding, we explored patterns across the first-cycle codes, to analyze connections and classify the data (Skjott Linneberg and Korsgaard 2019, 266). Thence, we followed an inductive approach, thereby “being loyal to the data” (Skjott Linneberg and Korsgaard 2019, 263–64).

Given the limited number of pages of data we had ($N \leq 100$), we used MS Word’s highlighting and commenting function to assign codes. After coding each transcript twice, we exemplarily discussed one coding structure in the group and decided on a preliminary coding structure, which we recorded in a MS Excel table.

In the next step, the first coder adjusted her codes to the coding structure that we had previously discussed in the group. That entailed, e.g., adjusting the wording or summarizing two codes into one, if they were describing the same thing. Then, the second coder compared her codes to the first coder’s codes and had the choice to accept, challenge, or add to the first coder’s codes. The additions and challenges were then discussed in a reiterative process between the first and second coder until a consensus was reached. Once consensus was reached, the second coder recorded the codes and respective citations from the interview into the shared MS Excel table.

In the last step, the table was tidied, and codes that were describing the same thing were merged. Then, we summarized the results, emphasizing answers that multiple interviewees had given us, or that would further elaborate the findings.

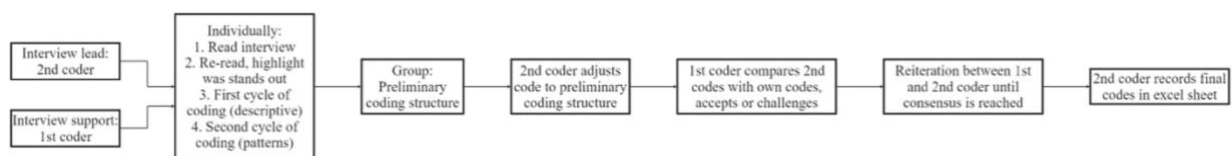


Figure 2.2 - Overview of coding process

2.4 Quality of Research Design

The following section discusses the ethical and normative considerations along with the limitations of the two phases in our research design.

2.4.1 Ethical and Normative Considerations

Ethical considerations should accompany every stage of qualitative research. This research followed Guillemin and Gillam's (in Savin-Baden and Howell Major 2013) framework for ethical considerations in qualitative research. The first consideration was for the efficacy of research design, namely the ethical obligation to design research that may contribute to knowledge development by exploring new concepts and ideas with realistic goals supported by a sound scientific basis.

Secondly, we strived for an excellent treatment of interviewees by conducting a just research process, from recruiting participants to data analysis and interpretation. Participants were given full liberty to make informed decisions about their participation in the research. This was secured by sending an invitation letter and consent form (Annex F) presenting the purpose, methodological protocols, and contextual parameters of the study. This entails transparency in terms of procedures, risks, and opportunities of taking part, the use of their data, withdrawal procedures, and how the research will be used. Further, we sought explicit verification of the informed consent at the beginning of every interview. Finally, we strived to reflect on the plausibility of the research products, implications of findings, limitations, and avenues for further research.

Appropriate processing of personal information is also a fundamental component of the ethical considerations of degree projects, namely following the European General Data Protection Regulation (GDPR). This implied making conscious and informed decisions about the type and purpose of personal data processed, adequate storing, and end of life (deleting or archiving). Thence, we committed to deleting the interviews' audio recordings and transcripts after the thesis has been graded. Furthermore, we have not used any interviewees' names in the analysis but have anonymized their identity by assigning a number to their person.

As mentioned before, the research approach taken in this thesis is not value-free. Instead, it is rooted in the belief that humanity needs to transition from its current unsustainable design toward possible sustainable futures. The acceptance and integration of values in SS can raise questions regarding scientific objectivity, a principle that other fields of science strive to comply with. Moreover, according to Nagatsu *et al.* (2020) by acknowledging multiple value sets, the resulting ethical frameworks can lead to unclear scientific outcomes, thus hindering the transfer and extrapolation of learnings from scientific projects. Thus, the legitimacy of non-epistemic values relies on the capacity of sustainability scientists to justify why such values are relevant in the context of each study. This has highly influenced the goals and research approach and will be reflected in the analysis and discussion.

2.4.2 Limitations

Phase I: Due to the limitations of *IMODOCS* repository, we realise we have chosen to explore only IMO conventions primarily. We did foresee that this analysis might be skewed towards the language and discourse of IMO conventions and misses out the other forms of documents it might offer (Meeting documents, conferences etc). We chose to focus on Conventions to create consistency and logic to the data collection, however we did not have access to all the relevant documents needed to analyse some Conventions. In such cases we resorted to the

Convention webpage in which the main content of a convention or piece of legislation is described. This would usually suffice to gain understanding whether a document would address an SP or not.

One limitation of using policy as data is that it only provides an understanding of the legislation, which might not correspond to the reality of practice within the sector. Moreover, the analysis is focused on policies applied at a global level and does not reflect the way this differs from country to country in national legislations.

Phase II: The sample size of our interviewees is a limitation to our findings, we did foresee the challenge with being able to generalise our findings. Also considering the practitioners are primarily based in the Northern European context (Skewed to the Swedish context) we acknowledge the highly contextual aspect to our findings and discussion. While our sample group consists of individuals from diverse companies, we are aware that their perspectives do not reflect the shipping industry on the whole in this context.

Another shortcoming of the research is that we as a team lack technical knowledge and expertise in the shipping field which may lead to some technical information being overlooked or the analysis to be inaccurate. Thus, it is important to evaluate the results with care and be aware of its limitations. Additionally, we acknowledge that our thesis takes place before the MEPC 80 that will take place this July 2023, and this meeting is expected to revise the strategy that can impact the regulatory landscape. The timing of the thesis is fortunate in a way but might miss the possibility of being critical of the regulations that will shape the coming decade.

3. Results Phase I

In this section we provide the results of the Phase I, the document analysis. Annex B contains a comprehensive summary of the analysed documents. In addition, Table provides a synthesis of the results obtained in Phase I. We will start by sharing the key results of the analysis, then present the findings based on the life cycle stages in the methodology framework.

3.1 Main Findings

A concise summary of the findings is provided in Table 3.1 showing the conventions that address each SP in all stages of ports and ships lifecycle. It is noticeable that IMO's legislation places its focus on ship usage and maintenance with an absence of the production and construction stage of ships and ports as well as their disposal. In fact, the ports themselves have little to no attention in the purview of IMO. Moreover, because a vast majority of the regulation addresses ocean pollution, aspects related to the systematic increase of substances produced by society (SP2) are given more attention. Overall, from 70 questions regarding ecological principles, only 13 were addressed by the regulations analysed. Regarding social principles, only 17 out of 99 aspects were addressed. Here, the focus was on health, as most regulations mentioned the safety of seafarers and port workers, disregarding the health of coastal communities. However, the investment in competence building of these professionals was also prevalent in the regulation landscape (SP6). IMO conventions superficially address the extraction of materials from the Earth's crust (SP1) and completely leave out meaning making (SP8) from its scope.

Table 3.1 - Summary of document analysis (simplified version).

Sustainability Principles	Production and construction		Use and Maintenance		End of Life / Disposal	
	Ports	Ships	Ports	Ships	Ports	Ships
SP 1		HKIC				HKIC
SP 2			BWM, OPRC, Reception facilities,	Strategic Plan (2018- 2023), HKIC, MARPOL, Protocol OPRC, BWM, INTERVENTION, London, OPRC, CLC, Biofouling, AFS		HKIC
SP3		MARPOL	BWM	BWM, AFS, MARPOL		HKIC
SP 4			SOLAS, FAL, BWM	SOLAS, FAL, BWM, FUND, HKIC		HKIC
SP 5			SOLAS	SOLAS		
SP 6		BWM		STWC, BWM, Protocol for OPRC, FUND		HKIC
SP 7				BWM, Strategic Plan (2018- 2023), FUND		
SP 8						

The following sub-chapters provide a more detailed overview of the results for each life cycle stage mentioned in the methodological framework.

3.1.1 Production and Construction Stage

Out of 28 questions related to ship production, only three aspects were addressed in the analysed documents, while the legislations completely overlook ports. The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ship (HKIC) is an example of a convention that establishes legislations guidelines for the designing and constructing of ships, which incorporate considerations that enable safe and environmentally sound recycling:

The design, construction, operation and preparation of ships so as to facilitate safe and environmentally sound recycling, without compromising the safety and operational efficiency of ships; the operation of ship recycling facilities in a safe and environmentally sound manner; and the establishment of an appropriate enforcement mechanism for ship recycling, incorporating certification and reporting requirements. (IMO n.d.)

Moreover, the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex 1 and Annex 2 also include measures to mitigate the systemic degradation of marine ecosystems and biodiversity (SP3). For ships larger than 400 gross tons, the IMO regulations restrict the direct discharge of oil wastes into the ocean to protect marine ecosystems by reducing the negative impact of the oil discharge (IMO 1983). It is illustrated in MARPOL Annex 1 as follows: “Every ship of 400 gross tonnages and above shall be provided with a tank

or tanks of adequate capacity, having regard to the type of machinery and length of voyage, to receive the oil residues (sludge)” (p.17)

3.1.2 Use and Maintenance Stage

Ports: Although ports play an important role in the shipping industry, IMO conventions neglect largely the regulations governing their use and maintenance. Notably, there is no single convention tackling the ports as a primary focus but rather a few conventions that mention them briefly. The International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), for instance, recognises the role that ports play in tackling oil pollution, but it does not provide any regulations or obligations on port states to prevent incidents. Additionally, even though IMO recognizes that to fulfil their MARPOL duties, the port states need to provide infrastructure and facilities to handle the waste generated by ships. However, there are no policies addressing the issue, thus not making waste management legally binding for ports.

Regarding the social aspect, most regulations address only the authority given to control officers to examine ships in ports and their ability to declare any violations and noncompliance with the regulations.

Ships: The stage of ships use and maintenance is the primary focus of IMO policies and regulations, and where multiple documents addressing the questions of our methodological framework. In the following, we will present the points that most relevant conventions addressed.

The systematic degradation of maritime ecosystems (SP3) is addressed in MARPOL Annex 1 (IMO 1983), even though the wording used is vague and unspecific. As seen in the following quotation, the regulation prohibits the release of any chemicals into the ocean that harms the marine environment or are introduced to evade the regulations governing discharge:

No discharge into the sea shall contain chemicals or other substances in quantities or concentrations which are hazardous to the marine environment or chemicals, or other substances introduced for the purpose of circumventing the conditions of discharge specified in this regulation. (p.22)

However, the amounts and concentrations of harmful substances remain unspecified within the regulation, in addition, a significant number of waivers and exemptions have been noticed within the regulation system, notably MARPOL as an example of such exception. In Annex 5, we observe that despite the overall ban on the discharge of all plastics into the oceans, some exceptions have been made for some waste categories. Exceptions that allow for the disposal of waste including floating materials if a certain minimum distance from the nearest landmass is met (IMO 1988).

The Facilitation of International Maritime Traffic convention (FAL) addresses standards for public health and quarantine, as well as measures against health hazards caused by the transport of animals and plants to ensure the protection of workers and neighbouring communities. Yet the convention does not require that governments conform to FAL standards if they can offer a credible justification for their non-compliance (IMO n.d.).

The Ballast Water Management convention (BWM) requires ships to maintain a book with records for ballast water management, however it does not provide guidance on how to choose designated areas where ballast water exchange is possible. The convention does not provide a comprehensive list of indicator microbes, which can be important as this convention aims to prevent the spread of invasive species as illustrated in the following: “[...] and discharge of the indicator microbes shall not exceed the specified concentrations. The indicator microbes, as a human health standard, include, but are not limited to [...]” (IMO 2020)

Moreover, the convention does not clearly define how IMO establishes the degree of harm in the following regulation:

Under regulation D-5 Review of Standards by the Organization, IMO is required to review the Ballast Water Performance Standard, taking into account a number of criteria including safety considerations; environmental acceptability, i.e., not causing more or greater environmental impacts than it solves; practicability, i.e., compatibility with ship design and operations; cost effectiveness; and biological effectiveness in terms of removing, or otherwise rendering inactive harmful aquatic organisms and pathogens in ballast water. (IMO 2020)

In terms of oil pollution, the OPRC requires that ships have an onboard oil pollution emergency plan. However, the convention does not a list of the elements that should be part of that plan as illustrated in the following:

Ships are required to carry a shipboard oil pollution emergency plan. Operators of offshore units under the jurisdiction of Parties are also required to have oil pollution emergency plans or similar arrangements which must be co-ordinated with national systems for responding promptly and effectively to oil pollution incidents. (IMO n.d.)

Despite the lack of the plan contents, the convention has addressed some preventive strategies and actions as described in the following: “The Convention calls for the establishment of stockpiles of oil spill combating equipment, the holding of oil spill combating exercises and the development of detailed plans for dealing with pollution incidents”. (IMO n.d.)

In addition, it is also notable that IMO refers to the social component as the “Human element” (IMO 2022). For instance, in the revised strategic plan for the organization for the period 2018-2023, where they include the strategic directions for the social part as follows:

Approves the revised Strategic Plan for the Organization for the six-year period 2018 to 2023, as set out in the annex to the present resolution, comprising: [...] the strategic directions for the Organization, including the strategic direction on the human element. (p.2)

3.1.3 End of Life/ Disposal Stage

According to our findings, the IMO legislation does not contain any regulation that tackles the end-of-life stage of ports, and we were unable to find any documents that address this topic.

The end-of-life stage of ships is addressed by only one convention, HKIC, and 9 out of 28 codes were covered by the convention. Their primary focus was on aspects that contribute to systematically increasing in nature the concentrations of substances produced by society.

The HKIC offers regulation that covers the disposal and reuse of diverse materials and separating those that cannot be recycled (IMO 2009). It also aims to safeguard not only the environment and the concentration increase of heavy metals, asbestos, and other toxins but also the health and safety of workers involved in the recycling process as well as communities residing near ship recycling yards (IMO 2009). The following quotes serve to illustrate these points:

All wastes generated from the recycling activity shall be kept separate from recyclable materials and equipment, labelled, stored in appropriate conditions that do not pose a risk to the workers, human health or the environment and only transferred to a waste management facility authorized to deal with their treatment and disposal in a safe and environmentally sound manner. (p.27)

And further in the IMO website : “[t]he Hong Kong Convention is aimed at ensuring that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risk to human health and safety or to the environment.” (IMO n.d.)

The convention also covers the learning and competence development of works in this stage. HKIC requires that sufficient training programs must be offered to workers engaged in ship recycling to guarantee that they carry out safely all activities associated with the recycling process.

Despite tackling the ship recycling issues, the convention does not provide enough detail on the issues being addressed. For example, the convention states the word “issues” in the following without providing any details to clarify the nature of the issues:

“[i]t intends to address all the issues around ship recycling, including the fact that ships sold for scrapping may contain environmentally hazardous substances such as asbestos, heavy metals, hydrocarbons, ozone depleting substances and others.” (IMO n.d.)

Asbestos, heavy metals, and ozone-depleting compounds are examples of ecologically dangerous substances that are acknowledged by the convention but do not provide recommendations on how to treat them (IMO 2009). The convention only requires that those materials be sent to proper facilities without specifying how those facilities should be regulated as stated in the following text: “[...]and includes associated operations such as storage and treatment of components and materials on site, but not their further processing or disposal in separate facilities.” (p.3)

As a result, the convention can be viewed as lacking in specificity when it comes to outlining how to solve the environmental and health issues raised by ship recycling.

4. Discussion Phase I

This part of the thesis discusses the findings from the document analysis presented in the previous chapter. Phase I aimed to answer RQ1 (*How aligned is IMO's legislation with a transition towards sustainability for the shipping industry?*). We developed and applied a methodological framework consisting of 169 questions relating to social and ecological SPs to identify which root causes of unsustainability are currently addressed in IMO's legislation to answer the research question. Our document analysis shows that IMO's legislation is, to a large degree, not yet aligned with a principled definition of sustainability and that many root causes of unsustainability are unaddressed legislatively. Following the same life-cycle structure as utilized in the document analysis, we first discuss the production and construction stage, discuss the use and maintenance stage secondly, and lastly the end-of-life stage.

4.1 Production and Construction Stage

Our findings showed that the IMO does not regulate the construction stage of ports. As mentioned in the introduction, ports have a negative impact on their direct surroundings due to air pollution, reduction of water and soil quality, habitat destruction, resource consumption, waste disposal, and noise pollution. For a strategic sustainable development, however, a system's perspective is required since it acknowledges that social and ecological systems are complex and do not operate in isolation but rather form dynamic networks of relationships (Missimer, Robèrt, and Broman 2017). Cao, Duan, and Zhao (2019) apply this idea of dynamic feedback to ports and argue that if environmental protection is not taken into consideration in the planning of ports, then it is also not applied in the construction, and that means that protection measures will not be taken during the usage of the port, therefore resulting in the aforementioned problems (Cao, Duan, and Zhao 2019, 1073; based on Bao *et al.* 2013). Ports designed to avoid this feedback are called “green ports” and they seek to reconcile social and environmental considerations with economic growth (Lawer, Herbeck, and Flitner 2019). A number of regional, transnational maritime organizations set out to regulate sustainable development ports, which has resulted in a “selective adoption of green port measures” (Lawer, Herbeck, and Flitner 2019, 5119) or tools, depending on the local context and availability of financial resources. We, therefore, argue that by including the construction of ports in IMO's legislation, IMO would strengthen its efforts to align its legislation with strategic sustainable development, as the construction of ports has spillover effects into the consequential usage of the ports.

While we only found three regulations addressing the production of ships, we found that HKIC demonstrates the understanding that different stages of the life cycle do not operate in isolation but shape each other (see Chapter 3.1.1 Production and Construction Stage). Thence, in the production of ships, IMO already aligns with the system's thinking perspective of strategic sustainable development, although there is still room for improving its legislation to cover ecological and social aspects more comprehensively.

4.2 Use and Maintenance Stage

By bifurcating our analysis into ports and ships, we also found that almost all regulations address ships, while there is barely any regulation pertaining to ports. This is problematic, as ports are known to be harmful to the environment, as well as to human health, and socio-economic activities (see, e.g., Borja 2020; Široka *et al.* 2021). Ports are also a vital system of the shipping industry, and while their regulation lies with member states, it is critical to include them in the IMO's regulatory landscape.

Our findings illustrated that in terms of alignment of ecological SPs in ports, IMO legislation only focuses on oil pollution, resulting other environmental implications that go unaddressed in IMO's legislation. As ports adapt to expanding maritime operations, they engage in land reclamation, air and water pollution, noise pollution, odours, and visual impact (Saz-Salazar, García-Menéndez, and Feo-Valero 2012). No conventions addressed the other 6 questions under SP2, which include the increasing concentrations of NO_x, SO_x, GHGs, PM, and pollutants in water. Ports also handle and store hazardous materials and depend on guidelines that match national and international standards. Considering the variety of ecological implications of ports, we argue that to align further with sustainability, ports should be included in IMO's legislation more comprehensively.

In terms of the social sustainability of ports, BWM and FAL address two out of three questions under SP4, and the International Convention for the Safety of Life at Sea (SOLAS) addresses one out of three questions under SP5. While giving voice to port officers to check ships can aid in reviewing operational requirements, ports have also been facing challenges with expanding due to resistance from surrounding communities. Incorporating their voices as regulations can help the sustainability transition of shipping ports. Traditionally, ports have been concerned with the implications of the environment on their operations rather than the other way around (Saz-Salazar, García-Menéndez, and Feo-Valero 2012). However, bringing a transdisciplinary approach to the planning, operating, and maintenance of ports will help tackle the different social and ecological impacts of ports.

From a social perspective, social SPs in both ports and on ships only align partially. The health and safety of workers have emerged as the predominant focus of IMO legislation related to social sustainability, overshadowing other crucial components such as discrimination and poor working conditions. As already touched upon in the introductory chapter, an important shortcoming of legislation in the shipping industry are the lack of regulation of labour rights, which includes issues such as fair wages, safe working conditions, and the right to organize and collectively bargain. Many seafarers work long hours in difficult and sometimes dangerous conditions and may face barriers to exercising their labour rights (ICS 2021). Addressing these issues is not only a matter of social justice but also critical to ensuring the long-term sustainability of the shipping industry. Our findings align with Srebaliene *et al.* (2019), which highlight that environmental concerns have received more emphasis than social considerations, particularly human health. Insufficient regulations regarding social considerations can result in poor health outcomes for seafarers and several human rights violations (Li, Zhou, and Yuen 2022).

Another shortcoming that we noticed was that ecological sustainability legislations of the IMO primarily focuses on CO₂ emissions of shipping, while neglecting other GHG, including methane, nitrous oxide, and BC. This skewed focus on CO₂ emissions misses out on the implications of the other gases on climate change as discussed in Chapter 1.3. This disregard, in turn, creates further challenges for the international community to meet the Paris Agreement, eroding confidence in global processes. Shipping activities have been identified as critical drivers of damage to marine ecosystems (Fauzi *et al.* 2023).

4.3 End-of-Life Stage

The IMO's legislation does not address the end-of-life stage of ports therefore, all our questions regarding the sustainability of the end-of-life stage of ports remain unanswered. Since ports use large amounts of steel and concrete in their production, both materials have the potential to be recycled and thus reduce their negative environmental impact (see for steel and concrete, respectively, Broadbent 2016; Ram, Kishore, and Kalidindi 2020). We argue that the IMO's legislation must regulate the end-of-life stage of ports. Historically, hubs of trade and the relating port cities have evolved and migrated, and from the point of view of transitions, this is likely continuing to happen. We need to acknowledge, however, that ports have a much longer lifespan than, for example, ships. We found little to no literature talking about the end-of-life stage because we assume that most ports of recent history are still in use. However, that sometimes can lead to a lack of financial support and outdated technology for ports that are a couple of decades old (Wan *et al.* 2018). Thus, from a perspective of a transition towards sustainability, it is crucial to include and regulate the last life stage of ports so this last stage does not create additional harm to society and the environment.

As presented in the results, IMO's legislation regulating the end-of-life stage of ships aligns to a certain degree with sustainable development, yet, it leaves some room for improvement. Ship recycling is hardly monitored now, and thus often “conducted haphazardly with very little scientific and technical knowledge” (Hiremath *et al.* 2014, 159), which endangers workers and leaves an environmental footprint much higher than necessary.

4.4 Discussion on Research Method

Regarding the methods used in Phase I, we acknowledge that our methodological framework utilised the SPs, one of the multiple core concepts within the FSSD framework. While this allowed us to assess the ability of IMO's legislation to address systematic ways of degrading the ecological and social systems, it does not take full advantage of other qualities of the framework (e.g., setting a robust vision of success, strategic guidelines on how to make decisions and prioritize).

It is important to acknowledge that, because IMO uses SDGs as their definition of sustainability, it was expected that we would identify misalignments when using an SP framework. It was not the intention to portray IMO as an unfitting or ill intended intuition. Instead, it was interesting for us to assess the regulations through a principled approach to sustainability, thus contributing to research by applying an FSSD “lens” to the shipping sector.

Moreover, while every question of the methodological framework was used during the coding process, by registering an entrance within the overall SP (and not to a specific question) we have limited our ability to portray the nuances and details of the framed questions. This had two consequences, one in the way we present the results, and the second in our ability to discuss them. First, this resulted in an unintended visual perception that a convention listed within one SP aligns with it entirely and that consequently all questions under said SP are addressed by legislation, which might not be the case. This hindered our ability to discuss the data nuancedly, given that we did not address how specific questions under each SP are contemplated within IMO's legislation. To counter this limitation, we have used terms such as "to a large extent" and "insufficiently" to discuss the extent and overall strength of the legislation's alignment with the framework.

We also want to reflect on the scope of the data analysed in Phase I. Regulations, particularly conventions, were chosen because these are main channels of action within the IMO and represent binding agreements amongst Member States (while codes and guidelines might be recommendatory). This made sense in our limited time frame, as it allowed us to assess the core legislation while staying closer to the actions that member states have committed to take. Consequently, many other legislation pieces were only partially addressed or not addressed at all, such as strategies and codes. This meant that our results did not capture the complete picture of IMO's framework of action, thus some of the identified gaps might be covered by policy instruments that are out of our scope.

4.5 Quality of Findings

As we conducted qualitative research informed by "different assumptions about reality and different worldviews" (Merriam and Tisdell 2015, 239), the validity of our findings are considered. To that end, we discuss our results in terms of strategies to enrich the trustworthiness of qualitative research, namely credibility, dependability, and confirmability (Yadav 2022, 686, based on Lincoln and Guba 1986; Merriam and Tisdell 2015). However, we opted to leave out transferability since we could not apply this strategy to these findings. The next subchapters discuss the previously mentioned strategies.

4.5.1 Credibility

According to Yadav (2022, 686, based on Lincoln and Guba 1986; Merriam and Tisdell 2015), mechanisms to prove credibility are triangulation, collecting data up to saturation, reflexivity, peer review, prolonged engagement and persistent observation. We shortly discuss each in the following paragraph, in terms of alignment and misalignment.

We triangulated the findings of Phase I by ensuring the multivocality of the researchers in the document analysis as well as the coding process. Furthermore, we cross-checked our findings by referring to other literature in the field in the discussion chapter. Preconceptions and biases that underpin our research were analysed critically. Lastly, we also discussed our findings with peers and supervisors and incorporated their feedback. Given that we were not able to procure all of IMO's legislative documents, we cannot claim that we have collected data up to saturation, and realistically new data could be found that could potentially add to or alter the

findings. Another shortcoming in credibility is that we lacked the time and resources for prolonged engagement and persistent observation.

4.5.2 Dependability and Confirmability

Yadav (2022, based on Lincoln and Guba 1986; Merriam and Tisdell 2015) defines dependability and confirmability as ensured by an audit trail, peer debriefing, triangulation of the research question, as well as reflexivity of the researcher's "preconceptions about the choice of the research domain, question, methodology, data collection, data analysis, and in the writing and presentation of findings" (686). Due to the nature of this work, we find that the first three mechanisms do not apply in this thesis. However, we believe we have demonstrated reflexivity in our choices of research domain and questions, the methodology, data collection and analysis, as well as in the writing, and presentation of findings. Please find these reflections in the respective chapters.

5. Results Phase II

As mentioned in the Research Design Chapter, the primary method applied in Phase II of this study was informed by the results obtained in Phase I. Thus, interview questions were formulated with awareness of gaps previously identified in IMO's policy. In turn, the gaps identified in IMO's policy informed the formulation of our interview questions.

This section of the results presents practitioners' experience and knowledge in the shipping industry. The chapter unfolds as individual themes with the most relevant quotes from the interviews. The most prevalent themes are presented below based on the clustering of codes from interviews. Additionally, we have compiled a supplementary collection of themes, included in Annex H, which although not directly aligned with our research questions, remain significant in shaping a sustainable future for the shipping industry. The results do not contain the interviewees' names when presenting the quotes, and use an attributed number from one to eight, as presented in Table 2.2. For reasons of readability and condensing the results, the references were abbreviated as illustrated by the following example: Interviewee one is cited as I1.

Table 5.1 presents a summary of the themes we found and a description of them based on the point of view of the interviewees.

Table 5.1 - Summary of the themes and description of main findings for RQ2.

No	THEME	DESCRIPTION
1	Sustainability competence	The knowledge, skills, and abilities needed for implementing sustainable practices within the shipping industry.
2	Just and equitable transition	The need to ensure fairness and equality during the transition towards sustainability within the shipping industry.
3	Impartiality	The need to ensure fair and unbiased treatment of individuals, particularly seafarers.
4	Health	The need to ensure physical and mental well-being of workers, particularly seafarers.
5	Societal demand	The influence of culture, society, and customer expectations on driving change.
6	IMO Goal setting	The establishment of targets and objectives by the IMO to address sustainability in the shipping industry.
7	Structural issues at IMO	The need to reformulate the organizational structure and decision-making process of the IMO.

8	IMO pace of change	The perceived slowness in the rate of progress and implementation of new rules and regulations within the IMO.
9	Better policy and stricter regulations	The need for enhanced governance and more stringent rules within the shipping industry.
10	Emission reduction of sector	The pressing need to decarbonize the shipping industry.
11	Complexity of the system	The intricate and interconnected nature of the system's operations and stakeholders, encompassing a wide range of factors and interactions that contribute to the industry's overall dynamics, thus posing challenges for the transition.
12	Collaboration amongst stakeholders	The collective efforts of various participants in the sector to work together towards common goals and address shared challenges.
13	Transparency in industry and organisational culture	The need for practicing of open and honest communication, sharing of information, and fostering a culture of accountability and trust
14	Members States position towards IMO and Sustainability	The stance of individual countries in relation to IMO and efforts towards sustainability in the shipping industry.
15	Economic Concerns of Stakeholders	The apprehensions and considerations related to competitiveness and business viability during the transition towards sustainability.

5.1 Sustainability Competence

Six interviewees (I1, I2, I3, I4, I6, I8) expressed a lack of sustainability competence within the sector. Two interviewees partially attribute this to a lack of vision from the IMO and a holistic approach to sustainability (I2, I3). I2 elaborated: “[w]hat I think IMO is missing in this is defining the vision, what would look like, how would shipping look like in a sustainable world.” Further, I1 shared what IMO also struggles with: “That shows the weakness with IMO. That it's hard to get an understanding and an agreement on things that are not really good for sustainability, but it might be good for the wallet.” Three interviewees mention the gap in knowledge and lack of understanding of sustainability (I1, I3, I6). When talking about the work conducted in the field of consultancy of shipping companies, I3 refers to how most shipping companies lack in-house resources for sustainability and do not allocate sufficient time to it. I9 elaborates further:

And that's exactly what's going to happen in shipping. There's this huge [...] failure to understand the nature of transition, huge complacency that the sector is too important, and no one is going to cut it loose. [...] [N]o one would do that because it's so essential and also a failure to look at this in a kind of systematic and [...] strategic and systemic way about how risk and opportunity can be calculated.

I9 argues that the need for sustainability competence in the industry is in line with the reality of other sectors, and “comes down to valuing the future”.

5.2 Just and Equitable Transition

Six interviewees (I2, I3, I4, I6, I7, I9) bring up a just and equitable transition in different ways when asked about who is leading the sectoral transition, the challenges IMO is facing, and how collaboration can be shaped. Three interviewees (I3, I4, I6) mention SIDS (Small Island Developing States) as an aspect to consider when IMO is creating regulations and access to renewable energy. Two interviewees (I2, I3, I9) discuss cooperation and working together with developing countries to foster a just and equitable transition. This challenge is illustrated by I3:

So, most of the [SIDS] are very concerned and if climate change is impacting them already, they are very progressive with what they want to see. But even a few of them apparently who are not but this is because they have overarching economic reasons. And then the [LDCs], who maybe aren't being impacted in the same [...] tangible and immediate way that the island states are, they are more economic drivers and I understand that they are concerned that alternative fuels [...] going to make trade more expensive and they feel their long way from their markets and this is going to make it less competitive, and it's going to eat into their ability to export.

I3 points out one of the underlying mental models that prevent just and equitable transition: “So, we're all very fond of ourselves in Europe and we are all, like, leading the way and we know how it is supposed to be. And in some of that is justified but some of it is not, we don't look out that much.” While I4 points out fragmentation as another challenge:

Some of the bigger companies are [...] moving ahead and making their own path. And essentially just saying we can't wait anymore. We're going to start putting money into different solutions and then we'll see what happens in. Ten, 15, 20 years. That's obviously not ideal because it means that then it's fragmented.

I9 further explains the potential of multilateral solutions in achieving equity, compared to regional and unilateral actions. The interviewee expressed the following about the new European policy package and *Fit for 55*:

[...] But in practice what they're doing is they're taxing shipping coming into the EU from the global South, and going from the EU to the global South, and they're taking that money and they're spending it in Europe [...] that's fundamentally inequitable [...] so increasing their transport costs, making them less attractive from export perspective compared to internal EU investments, and increasing their cost of living. (I9)

The interviewee also shared another example of a policy that might bring more equity, a differentiated carbon tax on a maritime root basis. The generated revenues could then be employed on investments in transition technologies in LDCs, loss and damage, and compensation for disproportionate negative impacts.

5.3 Impartiality

Five interviewees (I1, I2, I3, I4, I8) mention the aspect of impartiality as a challenge of the sector. The disregard of seafarers by society and shipping companies was discussed by I1, I4, and I8.

When asked about working with social responsibility, I8 brings up female representation, labor issues, and child labor as follows:

So, but what is happening in the developing countries is very different, again, from the developed world. How you see things are being produced in India. How ship recycling, for example, in Bangladesh? it's coming from the developed countries, right? So, we are sending them and there you have labor issues, there you have wage issues, there you have discrimination among the people, men and women in terms of labor wages, you have problems with deaths. Child laborers are being forced to work in shipyards and those are the ships that are being taken, you know, being towed from developed countries. (I8)

I2 voiced the important aspect of information sharing, inclusion, accommodating free speech and intimidation as follows:

It could be about challenges, mistakes, about incidents accidents, which could set them in a bad position potentially, could be about situation on shores which they have seen, a lot of things. As soon as you share things that are unpleasant, even if it is not unpleasant for yourself, it might have consequences for some in the future.

The interviewee shares how the background of the seafarer can come into play and the contracts they are under. Seafarers (Swedish, in this case) who are permanently employed are more likely to feel secure in their employment and more open to sharing mistakes and information, while those from the Philippines for example were defending their next contracts. I4 points out the different aspects of social sustainability that need to be considered by the sector to create a just and equitable means of transition and a more optimistic take on the future:

We are heading towards a sector that is more socially responsible in terms of the way that employees get treated, the way that seafarers get treated...So, I think that's something that's really forcing the industry to look at the way that it treats seafarers. The crew change crisis after the pandemic has led to a lot more awareness.

5.4 Health

The COVID-19 pandemic was mentioned multiple times to illustrate the severity and unveil the working conditions onboard ships. I1 and I3 referred to human rights violations of workers, unfair working contracts, and poor working conditions as ongoing threats to the safety and health of workers, particularly seafarers:

But then, there are other shipping companies who don't care so much about their workers which could also be seen at the pandemic. Some workers could not go on shore, so they had to stay on the boats for two years. (I1)

[...] there was a couple of people that died on board they couldn't offload them anywhere and there was one ship sitting around with the Italian dead Italian captain on board for a year and a half, I think you know the impact on the crew [is] just disastrous. (I3)

Conversely, these concerns are seen by another interviewee (I4) as being increasingly pressed on the agenda of shipping companies to tackle maritime labor shortages:

There is a lot of discussion right now about how shipping is going to have to compete with other sectors on workforce, and [...] it's going to be harder to convince people that they should take a contract where they're going to be at sea for a year with limited internet access, limited connectivity to their families, limited freedom in terms of being able to just get off the ship and go home anytime you want.

No one addressed the correlation between shipping emissions pollution and threats to health and premature deaths within coastal communities.

5.5 Societal Demand

Seven interviewees (I2, I4, I5, I6, I7, I9) discussed the importance of culture and society in the transition and aid of it. The most prevalent topic regarding culture and society was sea blindness mentioned by two interviewees (4,7). According to I7, “[t]here’s always customers that have not been thinking about ship transport.” I4 further elaborates:

So, shipping has tended to be a very insular industry. And it likes to talk to itself. But when it comes to kind of going outside of that bubble, it's definitely lacking and it's definitely something that needs more effort. I think it's also historically shipping has been out of sight, out of mind, and it's quite easy to forget.

Some interviewees talk about how in some parts of the shipping industry, proximity to the customer has forced them to make changes and have more awareness (I2, I6, I7). I2 argues “I would also say Liner traffic, which is closer to customers and end customers, cruise lines, ferries, are quite aware, there you have closeness to end customer.”

I6 illustrates the aspect of public pressure on organisations:

The trick, I think, or the difficulty sometimes is to also get on board those who are sitting further back in the room. That's, that's the challenge, I think. But also, they [...] also see that they are losing trade because they get the pressure from the society, from companies who are in need of green shipping.

5.6 IMO Goal Setting

All interviewees mentioned challenges with IMO goal setting. Four interviewees mentioned that the 2050 goal is not ambitious enough, and four interviewees declared the need for more ambitious goals. Five interviewees also mentioned that the existing regulations (not just the 2050 goal) were feeble. These findings are in line with the document analysis that we conducted. It was noticeable that all interviewees saw the importance of IMO goals in a signalling and leadership function to guide the sector, and that this is currently missing. Two interviewees also mentioned the need for interim goals, with I7 arguing:

[...] regulations and market need to come. An example of this, last year IKEA and Amazon others said, just to make shipping industry aware that we want fossil fuel free in 2040, my only thought was why not now? Why 2040? How is this going to happen in 2040? I mean you must take steps. We want 25% [in] 2025, 50% [in] 2035, and 100% [in] 2050.

This sentiment was echoed by I5:

I think it's not enough high ambitions. We very much want to be on a quicker path to sustainability. Also, I understand IMO who sort of have to unite all countries in the world, it's not an easy task, On the other hand if IMO should be relevant, they have to be more progressive than they are now [...].

However, the conversations focused solely on emissions here, and no one addressed the lack of regulations regarding social issues.

5.7 Structural Issues at IMO

Six interviewees talked about structural issues at IMO. Five people mentioned that IMO needs to provide more leadership. A reason for the lack of leadership was brought forward by four of the interviewees, and that was the decision-making process at IMO that requires reaching a consensus. According to I4:

Being a UN body and working on this sort of consensus basis. Also makes it quite difficult. Because it means that you can't go full steam ahead, super high ambition, without them leaving the smaller countries behind. But you also then don't want to encourage the first movers to move ahead and to really kind of go all out in terms of ambition level, which I think is one of the challenges that the IMO faces is how do we encourage things to happen while still kind of working in the background to make sure that everyone gets brought along. And that we're not leaving countries behind.

Addressing this, I9 does not mention a structural issue, but rather the very nature of the regulatory body:

But if the political level that then makes decisions and formulates them in multilateral agreements, doesn't agree that those Scientific limits are essential, then, the multilateral

process doesn't produce the policy that we need, and that's clearly happening at the IMO. There isn't the political will.

This resistance by some member states was also mentioned by three other interviewees.

A structural obstacle in reaching consensus was brought forward by I6, who mentioned the juxtaposition of Common But Differentiated Responsibilities (CBDR) vs. No More Favourable Treatment Principle (NMFT):

And that's the main principle which is in conflict with IMO principle is that [NMFT]. It means that whatever regulation IMO decides upon, it will apply equally to all ships, regardless of their flag. But now we have another principle which is being advocated quite strongly in IMO and has been done so for many years. And that's the CBDR principle. [...] and that comes from the UNFCCC, or it came from the Kyoto Protocol, where you sort of divided the countries between developed or developing countries, where the developed countries should take on a much higher responsibility. So, these two principles are in conflict with each other. And that's a huge difficulty to overcome at IMO.

This very concern is not shared by I9, who claims this is an “irrelevant concern that wasted a decade of discussions”:

And the IMO is a UN agency, so there's nothing stopping the IMO from, in legal terms, collecting a source of revenue and then using that revenue to spend on ensuring that states who do get major impacts, and don't have the economic means to manage those impacts, can be compensated and can do something about it. So that we have some recognition of an equitable transition or some reconciliation of the NMFT principle of CBDR.

5.8 Pace of Change within IMO

Next to the lack of ambition and overall structural problems at IMO, seven interviewees also mentioned that change was quite slow at IMO and that there was a need to accelerate the pace. Two interviewees mentioned that the slow pace is caused by the aforementioned reaching of agreements or consensus, and three interviewees said that it was due to the need to align stakeholders. I1 explained it as follows:

IMO, is a very slow-moving authority. So, it has historically been quite hard for IMO to set new rules and new legislations because there are so many stakeholders. There are so many countries involved and thereby, maybe not all countries want changes to happen [...].

This was also illustrated by I3:

[...] the ballast water treatment I believe that was first tabled in IMO in 1992 and it eventually was adopted by member states, was it the year before last [...] what everyone is worried about with the IMO is because it's such a talking show that is just going to

get nowhere, it's certainly in the time frame we don't have time anymore [...] We don't have 20–30 year timeframes to [...] make deep cuts into the emissions from shipping.

I9, on the other hand, explains that the industry could have a more effective and fast transition, when compared with others:

No, I think it's simpler [the sector]. I think shipping is the simplest. I mean the shipping and aviation, between them, are sectors which have a UN agency that regulates them. There is no other sector that does that. We regulate steel, cement, agriculture, through nationally determined contributions [...] So, when you look at them from a sectoral perspective, what you would need is each of the jurisdictions that have NDC [Nationally Determined Contributions], the national jurisdictions, to have some sort of coherent transition plan in place.

5.9 Better Policy and Stricter Regulations

Six interviewees elaborated upon the need for better policy and stricter regulations, apart from the 2050 goal. An interviewee said that Swedish shipowners “[...] are pushing the governments at IMO to develop and agree on strict rules and regulations, ambitious targets”

Five interviewees also mentioned the importance of EU “stepping up” and providing maritime regulation, “because IMO is not” (I7). This has a signalling function for the rest of the world “[...] it’s good if EU can run ahead and lead the way, then the rest of the world will be able to follow.” (I5).

I6 provided explained that in IMO policy exists a disconnect between technical knowledge and political goal setting. Historically, ex-seafarers would decide on IMO policy related to technical regulations, but since it has become more politicized in recent years, now regulations are done without technical knowledge.

An example that two other interviewees brought forward were scrubbers, which instead of solving the problem of pollution, “created a very large problem” (I7) of transforming air pollution into water pollution. I8 argued that there is a “science policy gap”, because of an “insufficient science policy interface, which means scientists and regulators are not communicating enough as they should.” The other implication is that non-political actors, such as shipping companies and their staff, “now find themselves in the background, having to listen to their climate negotiators”, with the problem being political illiteracy as there are “a whole new vocabulary in IMO, and new types of abbreviations, new words, which is for many quite unfamiliar.” (I6)

This disconnect between IMO policy and the industry’s stakeholders was also mentioned by five other interviewees, with four mentioning the disconnect between the technical and the political side, and two the disconnect between the commercial and the political side. One interviewee mentioned a lack of agency for non-governmental actors at IMO.

5.10 Emission Reduction of Sector

Four interviewees mentioned the need of decarbonization for the sector or stated that emission reduction was the main concern of the sector. According to I4, “shipping needs to decarbonize because it needs to continue existing”, alluding both to the sustainability challenge of finite resources, but also the importance of the shipping industry for world trade.

This recognition of the need to decarbonize also ignites the need for an alternative way to fuel ships, which seven of the interviewees touched upon. While still in the niche phase of innovation, the industry has recognized that there has to be an alternative to HFOs. What this will look like exactly, no one knows yet. One interviewee predicted that “we're going to face a future where we will see ships operating on various fuels. I don't think there's a one-size-fits-all solution for all ships. So, there will be a whole raft of different fuels in the future.” (I6). I1 mentioned that shipping companies are preparing ships with multi-fuel engines to be ready for the next fuel.

The development of alternative fuels, however, is hindered by the uncertainty of what comes next, which three interviewees mentioned. An interviewee expressed this concern, as they said that “early adopters should not be punished. If you invest a lot of, money you should not be punished by having to comply if you have an energy efficient ship.” (I7)

A niche experiment that four (I1, I2, I5, I7) of the eight interviewees mentioned is the project *Oceanbird* that the company *Wallenius* prototyped, which utilizes wind power as a way of propulsion. Using this, however, would require a new business model and customers that would be okay with the transport taking longer, as there would not always be a guarantee of wind. (I1)

5.11 Complexity of the System

Six interviewees defined shipping as a complex system. The number and diversity of stakeholders, their interests, and the specific connections amongst each other are pointed out as three underlying sources of such complexity. For example, companies operating within the shipping industry will face “different types of cargo, different consumers, and different areas, and they have different operating characteristics” (I6). This is also illustrated by the interdependences of shipping with the energy and transport sectors and the challenge of aligning multiple strategies. On the other hand, it was often mentioned that the different levels- regional, national, and international- of marine governance and action yield decentralization of strategies, which adds to the complexity.

5.12 Collaboration Amongst Stakeholders

All interviewees addressed the need for more collaboration amongst stakeholders within shipping, despite there being some dissonance between those who say that it has always been a challenge and others who say that there is a long history of collaboration. One reoccurring observation was that, because shipping is an extremely competitive industry, most collaborative efforts take place in “non-competitive” areas, such as safety. Another observation was the need for co-owned responsibility for the negative externalities caused by the industry. I3 described

how the debate within the industry is frequently populated by blame-shifting with the following words: “everybody has something to hit everybody else with, someone is trying to do one thing and someone else knocks them down”.

I1 stated the challenge between stakeholders as follows:

Because transport and energy involve so many stakeholders, so it's hard to have them all at the same table, and they, these individual stakeholders, they need to, they want to see a plan on how things should be done, otherwise they have a hard time to align with that

Generative dialogue is pointed as an opportunity for knowledge transfer and gaining more agency: as articulated by I1: "if the collaboration starts among stakeholders, then they will know better about sustainability as well. And then they can also have a stronger position at IMO to change things there".

When questioned about opportunities for collaboration, most examples given addressed emissions reductions. Five interviewees (I1, I3, I4, I6, I7) mentioned collaboration across the value chain as a low-hanging fruit opportunity that should be harnessed. Another example given was the potential for collaboration between modes of transportation, with two interviewees (I2, I4) mentioning the need for learning and collaboration between shipping and aviation. It was evident that all interviewees recognized the important role of a diverse number of organizations, like coalitions and cross-sector collaboration initiatives to spark innovative approaches and systemic change. There was no mention of collaboration specifically in favour of social sustainability efforts.

Eight interviewees bring up the importance of knowledge transfer or research as a form of collaboration within the sector and among different stakeholders (I1, I2, I3, I4, I5, I6, I7, I9). I1, I6, and I7 talk about the need for shared understanding when asked about collaboration, and how they work with sustainability.

I6 speaks about why this shared understanding is important:

I think there is a need to actually go further into discussions in order to understand where people or organizations are coming from, and why they think like they do, in order to try to find commonalities and solutions to whatever problem they have - for mental model and understanding

Apart from shared understanding, four interviewees (I1, I2, I4, I7) pointed out the need for research as a facilitator of knowledge transfer in the industry. I1 illustrates how the industry is in need of guidance and what IMO could do being the regulating body:

Provide guidance for organizations, stakeholders that don't know how to move forward because I think that there are many especially in the shipping, putting the heads down in the sand and just hope for solutions to come. [...] So I think that it's better for research to talk about solutions, provide methods and there was plans for how to move forward. Because if we only talk about urgency and how bad things are, then we will probably end up in that nothing happens.

I2 spoke about the importance of carrying lessons between different industries and companies:

[...] so suppliers are also kind of carrying technologies between industries. I guess many suppliers have carried technologies and information into shipping from other industries [...] there is a lot of learnings coming in...so in a way we are collaborating also outside of shipping. But in general, that collaboration be improved such as Learnings from different sectors, such as aviation.

5.13 Transparency in Industry and Organisational Culture

Three interviewees (I2, I3, I7) emphasised the importance of transparency in organisational and industry culture. I3 spoke of hierarchy as an obstacle in creating I2 spoke about the need for transparency as a sector as well:

In [...] aviation example, from the previous question why seafarers do not want to share mistakes. In aviation they have come so much further in that. In aviation everyone shares every mistake, it's part of their culture as it will save the lives of colleagues and others. They have come so much further in creating this cultural development. We have been looking at aviation in that respect, but we have not been able to come to the same level of reporting as they have.

Another interviewee (I3) also voiced the lack of transparency in IMO discussions and negotiations: “[...] sometimes we don't get to see all the underlying reasons that the countries have for resisting it and they may not want to expand on that very openly and clearly in this international scenario. So, it is rather complex.”

On this topic, I3 also referred to the challenge of regulating the maritime space, and how it hinders the ability to have effective mechanisms of action for sustainability:

The ocean largely is still ungoverned [...] and people do whatever they want out there [...]. And in my humble opinion, there is a failure to properly regulate globally in the ocean [...] and in that environment it's very hard to push some of the finer sustainability issues.

5.14 Members States position towards IMO and Sustainability

Four interviewees mentioned that the member state's position towards IMO and/ or sustainability was problematic, as there was a general lack of understanding, unwillingness to cooperate, or lack of interest in the negotiation. I4 explained the uniqueness of IMO and the thereof resulting problems:

So, I think, you know, the IMO is very unique in terms of a UN agency, in that they regulate one specific sector. [...] There's a lot of countries that don't necessarily have a presence or the presence may be in different places in the government. So, for one country, it might be the energy ministry that shows up. For another country, it might be the environmental ministry that shows up. For another country, it'll be the shipping [...]. So, I think it also makes it hard for everyone at the IMO to be on the same page. Because everyone's coming at it from different perspectives.

I9 also explains the complex relationship between member states as follows:

So at the moment we just have a basic standoff and a polarization of the global south going, look, if you can find a way to actually make sure that the money will go into the global South then we're with you. I mean, that's what their rhetoric is. Whether they mean it in practice I can't tell you. And the global North saying no. So therefore, we just sit and stalemate. [...] but it's fundamentally unhelpful for an industry that needs or would like to have clarity from the IMO. So, I would phrase it the other way, which is how does industry accept that the IMO is always going to be constructively ambiguous? And their job is not to try and wait for the IMO to give them dictation of what they need to do, but to understand the nature of multilateral processes, especially greenhouse gas ones.

Two interviewees also elaborated more closely on the significance that trade has on national welfare. "Shipping is what we call sometimes the lifeblood of trade. And trade is necessary, and it's really important [...] for our respective economies [...] to lift people from poverty." (I6). Thus, member states put up resistance to change, because they "[...] have legitimate concerns about the impact on their trade, on their economy, and that has been strengthened, or enforced, I should say, lately, because of, you know, inflation, conflicts." (I6)

Three interviewees also mentioned that if the shipping industry was included in the Paris Agreement, this would allow for more ambitious goals, and a net-zero goal by 2050, which is currently not in line with IMO's 2050 goal. Currently, international shipping is not part of Nationally Determined Contributions (NDCs,) and thus is not part of the Paris Agreement. This is a missed opportunity, as "most countries [...] in Europe, are aligned with the Paris Agreement, so that could be a good starting point [to reduce emissions]" (I1)

5.15 Economic Concerns of Stakeholders

It was noticeable that all interviewees perceived fear of being less competitive as the main concern hindering shipping companies from taking a firmer and more ambitious position in the transition towards a sustainable industry. Nonetheless, I4 and I6 emphasised how it can also be seen as a business opportunity. Firstly, given the growing pressure for the industry to reduce its impact, companies that are able to go beyond regulatory compliance will "win the race". This is reiterated by I4 as a key argument to secure sustainability investments:

I think for companies to invest in climate solutions, there has to be some level of self-interest, there has to be some level of 'there's an existential risk to us if we don't do something about it now, or there's a reputational risk to us if we don't do something about it now'. I think for big companies like Maersk, it's a combination of all of those things. I think they obviously have a much bigger kind of reputational risk than a lot of smaller companies, because they are by far the most visible company within the shipping space.

The same interviewee also points out that there will also be a race to secure transitional fuel sources, hence a company's survival will depend on long-term investments that account for shortages caused by external factors (e.g., climate change, extreme events, food shortages).

On the issue of future investments, I3 commented on the importance of IMO, as the sole regulatory body:

But if you want this billion-dollar investments to get off the ground you need some pretty good signals from the regulatory community, you know, you need some underlying support there. So, in terms of scaling up the development of alternative fuels fast enough the IMO really is, really is needed to move that needle to get this acceleration that we need to make the change quickly enough, certainly to be to have any hope of getting inside the 1.5 target.

Addressing this, I9 expressed that it is not realistic to expect clear signals from a multilateral decision-making body (“how does industry accept that the IMO is always going to be constructively ambiguous?”). I9 goes further to make it clear that companies do not need IMO to lead the transition, and that there is “a failure to assess risks and opportunities”:

It's pathetic to look at the IMO and expect the multilateral process to regulate their transition. Shipping companies and corporates are members of society, just like we are. We know what the climate science tells us. We know what the objective set in the Paris Agreement is of pursuing a 1.5°C transition. And we know exactly what the technology pathway at least cost us, we know it's hydrogen derived fuels for majority of deep-sea shipping [...] There's absolutely nothing whereby any individual company needs to wait for a multilateral regulatory framework to make the right investments.

6. Discussion Phase II

In this chapter, we summarize and discuss the main findings from Phase II of this research, to answer RQ2 (*What do practitioners in the shipping industry perceive is needed for a transition towards sustainability?*). Furthermore, we critically assess the findings, namely concerning how they relate to existing literature and an FSSD perspective. We further discuss the implications and limitations of the choices taken regarding research methods and their application to the findings.

6.1 Main Findings

We acknowledge that our findings for Phase II were rather dispersed, given our intention to understand how different practitioners perceive what is needed for this transition. As shown a wide range of topics were raised, some of which were mentioned by multiple participants. To guide the audience through the interpretation of the results, we specify to which finding we are referring to.

The results presented in the previous chapter confirm how the shipping industry (and its transition towards sustainability) can be placed within the super wicked problem of the sustainability challenge (*see* Chapter 1.1). In fact, most interviewees expressed a sense of urgency (“we don't have time anymore” I3), the absence of effective central decision-making authority (failure in the overall guidance and leadership provided by the IMO), how those trying to solve the problems are also responsible causing them (“someone is trying to do one thing and someone else knocks them down” I3), and an irrational disregard for future needs (“it comes down to valuing the future” I9).

For most interviewees, the general reaction to this challenge is a feeling of stand-off and lack of agency from stakeholders within the sector (findings 7, 8, and 15). Our results demonstrate that practitioners within the field identify the lack of guidance from IMO as the main cause for inaction amongst shipping companies (e.g., not investing in new fuel engines due to the uncertainty of what the next fuel will be). But not everyone agrees that this is a valid or even smart strategy. As I9 states, shipping companies underestimate the risks and opportunities that stem from such inaction. While uncertainty has always played a role in decision-making within shipping companies, it has become an increasingly complex and pressing issue (Kawasaki *et al.* 2022). This implies a need for fostering the capacity to adapt within organizations and the industry as a whole (Waddock 2013). We also argue that, despite having an essential role within transitions, the regulatory landscape (policy regime in the MLP) is limited in its ability to achieve systemic transformation towards sustainability, and thus change also needs to arise from a bottom-up perspective. This is supported by the MLP, which emphasizes the role of agency in transitions by recognizing that “trajectories and multi-level alignments are always enacted by social groups” (Geels 2011, 29).

All interviewees presented examples of how collaboration may spark innovative ideas and solutions, amongst competitors, cross-sector organizations, and across the value-chain (finding 12). Collaboration is, indeed, increasingly relevant since single entities are unlikely to provide robust solutions for wicked problems (Waddock 2013). It was unexpected to note, though, that

most participants did not point clearly to where collaborative strategies at scale need to be employed for a transition toward sustainability. On this note, most interviewees shared the perspective that collaborative efforts primarily occur in “non-competitive” areas, such as safety and pollution (finding 12). Literature also shows that strategic alliances are the most common type of collaboration agreement used by shipping lines, namely for operational efficiency and cost reduction (Ghorbani *et al.* 2022).

Another answer to our research question is the perception that a better-defined strategy to reach sustainability, including stricter regulations and more ambitious goals, is needed in maritime policy (findings 6 and 8). Our findings illustrate the perceived need for more ambitious goals and legislation by the IMO. This is in line with the results of Phase I of this work (*see* Chapter “3. Results Phase I). This finding is also consistent with other studies (*see, e.g.,* Bullock, Mason, and Larkin 2022; Serra and Fancello 2020; van Leeuwen and Monios 2022; Mallouppas and Yfantis 2021).

Most interviewees referred to decarbonization and mitigation efforts as a priority area of focus and goal setting for the sector (finding 10), which is in line with findings from previous research (Zhou, Li, and Yuen 2023; Garcia, Foerster, and Lin 2021). Despite this being a pressing issue given the direct impact of international shipping and the urgency of addressing climate change, we argue that a “carbon tunnel vision” might mean that other socio-ecological systems crises mentioned in Chapter 1.1 are omitted or insufficiently addressed (e.g., ecosystem degradation, biodiversity-loss, affected communities). A system’s perspective would allow a better representation of other thresholds that need to be accounted for the industry, and the whole society within the biosphere, to stay in a sustained dynamic equilibrium (Wadsworth 2007). Thus, allocating capacity and resources can have cross-system benefits and ripple effects.

The reasons presented by our interviewees for why goals and legislation were not as ambitious as they could be, surprised us. The first need that most interviewees touched upon were the discourse surrounding the process of reaching a consensus, which, according to our interviewees, is fuelled by two contradicting principles, CBDR and NMFT (finding 7). While most of our interviewees attributed the slow pace in IMO decision-making processes and the lack of ambition in existing legislation to this discourse, existing literature frames this issue differently. The United Nations Framework Convention on Climate Change (UNFCCC) has CBDR enshrined in its legal framework, whereas IMO follows the principle of NMFT. To ensure a just transition, developing countries may request technical or funding assistance from developed countries to reach the goals, however, there seems to be an unwillingness by developed countries to provide this assistance (Huggins and Karim 2016). A lack of accountability mechanisms to ensure that developing countries receive such assistance facilitates the failure of IMO’s procedural mechanisms. Thus, developing countries insist on CBDR, as it would ensure the actualization of what IMO’s NMFT principle promises but fails to achieve (Chen 2021). The explanation that the discourse only exists because developed countries fail to fulfil their obligations under NMFT was brought up only by one interviewee and contradicts the stance of other interviewees, which stressed the importance of more and better collaboration. Thence, despite most literature pointing that the main problem is not the seemingly contradicting principles, but rather the lack of accountability mechanisms in the prevalent NMFT principle, which was not reflected in our results. This is an example of how

practitioners' perceptions of policy might be reinforcing limiting beliefs, thus creating obstacles to effective action.

Another result we did not anticipate was the perceived disconnect between legislation and science and/ or technical knowledge, according to which legislation is not in line with the Paris Agreement, or some regulations result in unintended consequences, such as it is the case with scrubbers (finding 1 and 9). One interviewee claimed that a lack of understanding of the Paris Agreement had resulted in a less ambitious 2050 goal in the shipping industry. While we have no way to verify this statement, it speaks of a problem whose symptoms also appear in the aforementioned, unintended consequences of regulations: a lack of systems-thinking competence. This competence, according to Wiek *et al* (2011), describes the ability to consider “cascading effects, inertia, feedback loops and other systemic features related to sustainability issues and sustainability problem-solving frameworks” across “different domains (society, environment, economy, etc.) and across different scales (local to global)” (207). By attaining that skill, IMO's legislation could become more sustainable, and instead of a solution creating new problems, it could just solve the problem at hand. This requires also knowledge transfer from different disciplines, and in the case of IMO, for policymakers to also take technical aspects and scientific findings into consideration.

Another important finding was that, as perceived by the interviewees, parts of shipping still operate outside of legislation (finding 13). In I3's words “the ocean largely is still ungoverned [...] and people do whatever they want out there.” The sustainability challenge within the industry is thus exacerbated by the fact that shipping activities are, to a large extent, not scrutinized (Rudolph *et al* 2020). While regulating the vastness of international waters is a complex challenge in itself, we argue that this is imperative to establishing a fruitful landscape where the transition can truly take place.

It is also relevant to mention a perceived need to bridge the disconnect of ambition and motives between developed countries, LDCs and SIDSs, and the consequence dissonance of positions within the IMO (finding 14). This is in line with literature presented in the introduction section (Annex A). Our findings demonstrate that practitioners perceive this as one of the most pressing challenges for effective multilateral decision-making. Some interviewees expressed a positive anticipatory outlook towards the recently introduced IMO strategy for a just and equitable transition (finding 2). Despite it being in early developmental stages, the strategy is seen as fundamental to balance the effect of unilateral strategies already in place (in the EU and USA), seen merely as protectionism. Thence, there is a need for reenforcing mechanisms that channel financial and knowledge capacity to the Global South (Österblom *et al.* n.d.). But we further argue that this is also needed within the IMO, as literature points to unbalanced power dynamics which materialize in obstacles for NGOs and member states with less representatives to influence decision-making processes (Dorough 2021). This is a missed opportunity to reaching viable and effective agreements that take into consideration contextual different perspectives. As Senge (1990) noted, dealing with wicked problems requires “getting the whole system in the room”. This means that making well-informed decisions requires incorporating a diversity of knowledge forms and sources, that steam from different contexts. The examples given in Chapter 1.3 illustrate how there are already important stakeholder groups requiring a seat at the table.

The results also demonstrate a need for stronger protection of workers' rights (findings 3 and 4). Several interviewees referred to a lack of permanent contracts and overall working conditions, with one interviewee mentioning how foreign workers employed in Sweden were subject to less regulated labour conditions and contracts. One surprising result was the statement, from one interviewee, that even under a fair wage scenario, seafarers should not be isolated at sea over several month, implying the need for a drastic shift of how shipping activities are operationalized. This is in line with the findings of a study from University of Zadar, in Croatia, which involved surveying 298 Croatian seafarers working on cargo ships and concluded that job and life satisfaction levels were higher for shorter working periods on board, balanced ratio between work and non-workdays, and compliance with work contracts (Slišković and Penezić 2016).

Moreover, as in other sectors, public pressure and scrutiny can have a significant effect in the scope and pace of this transition (finding 5). Two interviewees illustrated how fostering the proximity between shipping companies and its customers can encourage organisations to change. This strategy has been gaining more visibility with the increasing pressure from companies to account for and report on Scope 3 emissions²⁰, in this case, related to transportation. Decarbonizing supply chains is identified by the WEF as a relatively untapped opportunity, which could have a significant impact in overall emissions with hardly increases of end-consumer costs. This would, the report says, accelerate actions in hard to abate sectors, such as shipping (WEF 2021). Despite the focus of these measures being mitigation efforts, we argue that more transparency in this particular issue could have a ripple effect in the overall scrutiny of shipping activities. Moreover, this fosters collaboration between different industries and brings a sense of agency and responsibility to shipping companies.

6.1.1 Other Considerations

In the following section, we discuss other considerations that do not directly address any findings or might not be perceptions of our interviewees, but rather ourselves, which we find worth mentioning regardless.

Given shipping's significant role in global trade, it is also worth discussing the paradigm of endless growth and how it might relate to a transition toward sustainability within the sector. First, none of the interviewees discussed this topic. We have already mentioned in the introductory chapter of this work that modern container shipping has fast-tracked globalization and facilitated new dimensions of international trade. We, therefore, found it challenging to delineate container shipping from trade and do not see shipping as an innocent bystander that merely follows the "endless" growth in trade. The theoretical approaches that underpin this work believe in dynamic systems that influence and shape each other, and we see this also with shipping and trade. Endless growth does not align with sustainability (Robèrt, Broman, and Basile 2013), and that does not only include shipping, but also trade and subsequently, consumption.

²⁰ Emissions not produced by the company itself or as a result of activities from assets owned or controlled by them, but for which it is indirectly responsible up and down its value chain.

A final significant result to discuss in this section is the lack of a unifying definition of sustainability among our interviewees. In our interviews, it became clear that different understandings of sustainability led to different foci of work, which meant that some aspects (e.g., social sustainability) remained largely ignored. This is corroborated by research, which has also found that the underlying challenge for sustainability is the absence of a definition and the range of synonyms used in literature (Moore *et al.* 2017). Even though this was not perceived by interviewees as a need for a transition towards sustainability, we argue that it should be a focal point. The lack of common language and understanding can question the level of commitment and collaboration (Broman 2017), as well as the applicability of solutions, since they would not address the society at large. A common definition, however, can strengthen the shipping sector and the actors within, giving space for more collaborative, co-creative, and transparent solutions, thus aiding the transition to a sustainable society (Hay, Duffy, and Whitfield 2014).

6.2 Discussion on Research Methods

While we set out to interview 15 industry practitioners, we only managed to interview 9 due to unavailability to meet in such a short time frame. Even though the interviews enabled us to draw results and discuss the findings, a larger sample would have provided for a more robust validity of our findings.

It is also relevant to state that the interview questions were on some occasions adjusted to the interviewee, namely her/his specific expertise. We did so to both respect what each participant could contribute and to capture high-quality insights from different fields of knowledge. However, we recognise that this might have dispersed the range of results that we gathered, thus diminishing their comparability.

Moreover, the purpose of this study prompted us to pose primarily technical questions, which best answer RQ2, while a smaller set of questions were personal. Therefore, we did not fully harness the power of questions as a research method, namely personal experiences, and feelings. Nevertheless, through more open-ended questions (e.g., how do you envision the future of shipping?) we were able to assess participants' personal stances (e.g., values, hopes, priorities).

Additionally, some of the questions were topic specific (e.g., a question addressing how the participant perceived collaboration within the industry). While this stems from the researchers' personal stance of acknowledging collaboration as an imperative tool in the transition toward sustainability (see Chapter 0), it might have forced the interviewees to address a topic they otherwise would not. It was our intention, though, to understand the interviewees' perceptions on how and where collaborative efforts should take place for a transition towards sustainability. It is also crucial to state that most interviewees came from organisations that are inherently collaborative platforms, meaning they might speak from a biased point of view. Since the Swedish maritime industry is niche and relatively small, most stakeholders are aware of each other's presence and therefore have been exploring collaboration for decades.

Lastly, because the methods employed in Phase II were informed by the results of Phase I, we recognise that our vision of the industry, namely the regulatory landscape, was biased by the analysis of results obtained in this phase. This resulted in our research questions reflecting our perceptions of the gaps within IMO's legislation and overall role as the sole regulator. This

might have influenced participants' answers and overall comfort during the interviews. Reflecting on this, we would now have reformulated some questions in a more neutral manner.

6.3 Quality of Findings

The following section discusses the validity of the findings of Phase II. Unlike chapter "4.5 Quality of Findings," this section discusses only credibility and transferability. The discussions on dependability and confirmability from Results I also apply here and therefore will not be repeated.

6.3.1 Credibility

Based on Yadav (2022, 686, based on Lincoln and Guba 1986; Merriam and Tisdell 2015), we discuss credibility in terms of triangulation, collecting data up to saturation, reflexivity, peer review, prolonged engagement, and persistent observation. Most of the findings we included were responses from multiple interviewees, thus including multivocality. For the purpose of triangulation, we cross-checked other literature in the prior discussion section to critically examine the findings. We also asked our interviewees to validate the transcripts to ensure sound representation. As discussed in chapter "4.5 Quality of Findings", we also critically discussed preconceptions and biases that underpin our research and also received feedback on our findings from peers and supervisors, which we incorporated. Further, we faced similar difficulties in prolonged engagement with the interviewees and persistent observation of identified themes, due to a constraint of time and resources. We did not include the collection of data up to saturation in this reflection, as we believe that the number of potential interviewees is too high to be realistically included in a qualitative study employing interviews.

6.3.2 Transferability

According to Yadav (2022, 686, based on Lincoln and Guba 1986; Merriam and Tisdell 2015), strategies to prove transferability include maximum variation, typical sampling, as well as thick description. We reflect on the shortcoming of the first two strategies in the limitations of methods (*see* chapter 2.4.2 Limitations) and shall abstain from repeating them here. We do, however, utilize "thick description" as we added descriptive and full citations of the interviewees to our results, which we hope allows the reader to capture the context of our findings and the findings to their surroundings Yadav (2022, 686, based on Lincoln and Guba 1986; Merriam and Tisdell 2015).

7. Conclusion

In this thesis, we have set out to determine what the gaps are in IMO legislation and how the industry perceives its transition towards sustainability. We thus asked two research questions: (1) *How aligned is IMO's legislation with a transition towards sustainability for the shipping industry?* And (2) *What do practitioners in the shipping industry perceive is needed for a transition towards sustainability?*

To answer these questions, we first conducted a document analysis in which we analysed 36 legislative documents of the IMO through a methodological framework using Sustainability Principles from the Framework for Strategic Sustainability Development. We found that the policy of IMO is, to a large degree, not aligned with a transition towards sustainability of the shipping sector. We found that a plethora of the analysed documents focused primarily on the use and maintenance stage of ships, whereas the production and construction, and end-of-life/Disposal stages remained largely unaddressed, particularly for ports. Our findings also point to a prevalence of policies addressing maritime pollution (SP2), whilst social sustainability mostly focuses on occupational safety.

To answer RQ1, we interviewed nine industry experts from Northern Europe to gain insight into what they perceive as needed for a transition towards sustainability. Using content analysis, we identified 15 themes of the main findings. Those included, e.g., the need for considerations of a just and equitable transition; the need for enhanced governance and more stringent regulations; as well as fair and unbiased treatment of seafarers.

The findings of both questions are important because they illustrate the need for a shared understanding of sustainability, a system's perspective of the sector, and cultivating sustainability competencies, both within IMO's legislation and private actors.

Unless these aspects are addressed in both legislation and the industry, sustainability will not be attained in the shipping industry. This, in turn, will have further impacts on the rest of the world, as this industry is responsible for around 3% of GHG emissions (IMO 2020), a loss of at least 250,000 lives due to pollution (Sofiev *et al.* 2018), disruption of maritime ecosystems and marine life (Hossain *et al.* 2016), spread of invasive species (Seebens *et al.* Blasius 2013), human rights violations on ships (ICS 2021), and in the recycling of ships (Hossain *et al.* 2016), as well negative impacts on coastal communities (Delphine *et al.* 2019).

Nonetheless, the shipping industry is responsible for 90% of all trade and is predicted to grow, which makes a transition towards sustainability even more urgent. This makes the unsustainability of the sector a super wicked problem, as it is both contributing to the problem while also seeking to solve it. We argue that further research in this field is needed to provide both a more complete picture of the challenge and future pathways for sustainability. This is further elaborated upon more closely in the next section.

7.1 Implications

This research has thrown up many questions in need of further investigation. Based on that, we respectively formulate implications for policymakers, practitioners of the industry, as well as researchers.

7.1.1 Implications for Policy

After an in-depth analysis of IMO's legislation and interviews with practitioners of the industry, we suggest policymakers to consider the following implications.

- Policymaking on the IMO level should be guided by systems thinking and improved by cross-disciplinary knowledge transfer.
- To reconcile the discourse between developing and developed member states, IMO could opt to:
 - Implement accountability mechanisms that would enforce developed countries to assist developing countries in their transition.
 - Collect membership fees that are then distributed as assistance to developing countries to reconcile for the lack of assistance under NMFT.
- To prevent unsustainability at its root causes, the life cycle stages of ships and ports should be taken into consideration when formulating policies and regulations regarding shipping.
- Redistribution of power within IMO, namely the recognition of consultancy status to indigenous communities and NGOs.
- Policymakers in IMO should work closely with academia to avoid unintended consequences.

7.1.2 Implications for Practice

This section addresses some of the implications of our findings to actors working within the shipping industry, and the considerations that we believe to be relevant for the transition towards sustainability.

- Shipping companies can make use the planning tool within FSSD to develop their strategic plan to become more sustainable.
- Design contracts that safeguard laborers, men and women seafarers that encourage them to feel safe and willing to share insights.
- Organisations can explore new forms of customer-client relationships, such as creating more points of contact, gathering feedback, and co-designing sustainable solutions.
- Port authorities can explore collaborations within its hinterland and communities that have a stake in the concerned ports.
- Cargo owners should be responsible for their scope 3 emissions and collaborate with shipping companies to limit their impact.

7.1.3 Implications for Research

In this section, we elaborate on possible avenues for future research, based on our results and limitations of this study.

- Research can explore the impact of the legislation introduced by MEPC 80, using the same methodological framework. This would help assess if the strategies born from this meeting are in alignment with a sustainable transition of the shipping sector.
- Application of the methodological framework to other IMO legislation pieces, for example strategies and guidelines.
- Application of our methodological framework to other major players in the shipping industry. This would help actors assess their sustainability strategies and frameworks.
- A parallel assessment between an indicator approach to sustainability (SDGs) and a principled definition of sustainability (SPs) within the industry to identify potential shortcomings and trade-offs and formulate further improvements in policies.
- The methodological framework based on SPs employed in our study of the shipping industry can be tailored to and tested in different industries as well.
- An SP analysis taking a systems perspective of the freight industry as a whole, thence contemplating the connections between seaborne trade and other modes of cargo transport.
- A study of the social sustainability of the shipping industry in practice, engaging with workers and communities. Our research focused on legislation, which does not showcase what happens in reality. Thus, gathering data on practices of the different activities of the shipping industry would provide empirical data.

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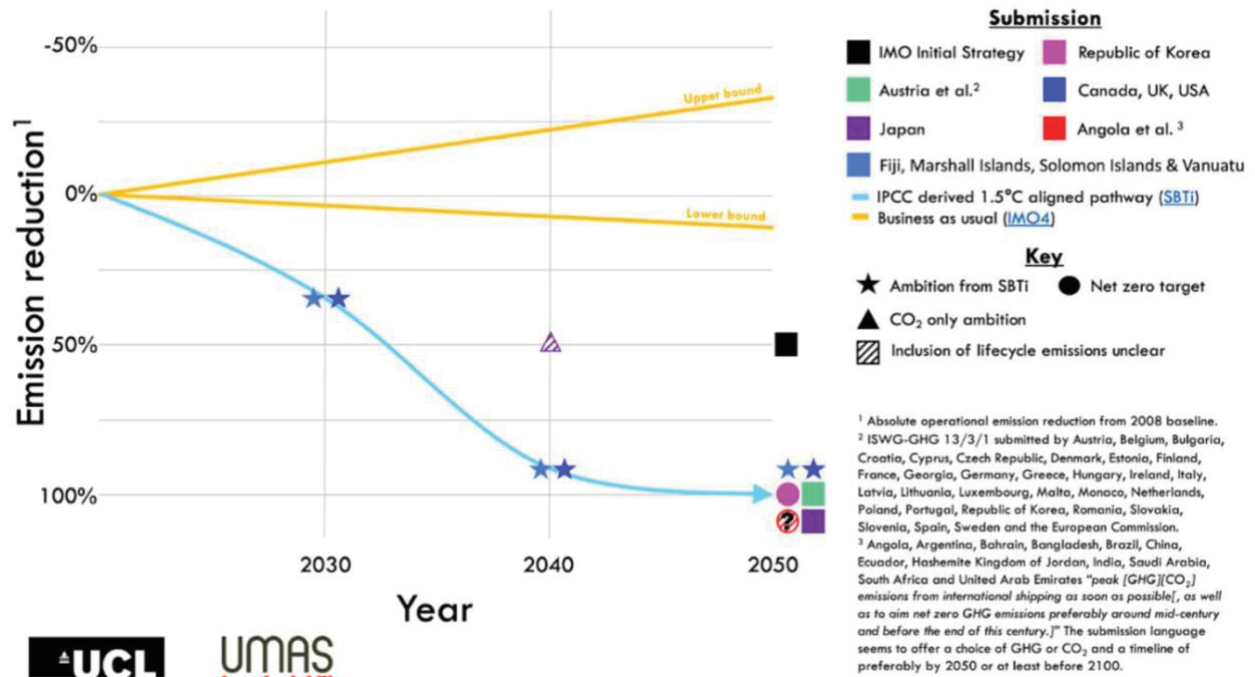
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Annex A

Ambition levels proposed in submissions (IMO and member states).



Source: UMAS 2023

Annex B

List of IMO Conventions.

<i>Abbreviation</i>	<i>Convention</i>	<i>Scope Of Convention</i>
SOLAS	Safety of Life at Sea	Specifies minimum standards for the construction, equipment, and operation of ships, compatible with their safety.
CLC	Civil Liability for Oil Pollution Damage	Includes regulations on covering pollution damage and made specifically for vessels carrying oil and cargo
AFS	Control of Harmful Anti-fouling systems on Ships	Includes regulations on preventing the future use of harmful substances in antifouling systems
MARPOL	Prevention of Pollution from Ships	Includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes.
STCW	Standards of Training, Certification and Watchkeeping for Seafarers	Prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.
BWM	Ballast Water Management	Provides rules for designing BWM system.
OPRC	Oil Pollution Preparedness, Response and Co-operation	Regulates the prevention of pollution from ships, by the means of dealing with oil spills appropriately.
FAL	Facilitation of International Maritime Traffic	Regulates the prevention of futile delays in maritime traffic to aid collaboration of Governments and establishes uniformity in processes.
LC	London Convention	Contributes to the international control and prevention of marine pollution by prohibiting the dumping of certain hazardous materials.
LL	Load Lines	Regulates how cargo is loaded on to ships
INTERVENTION	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties	Confirms the right of Coastal States to take mitigative or preventive efforts to protect their coastal line from any kind of relevant threats such as oil pollution.
FUND	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage	Convention is for providing funds to those affected by oil pollution and providing support to member states in training and material as assistance.
HKIC	Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships	To ensure that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risk to human health and safety or to the environment.

Annex C

Methodological Framework, Production and Construction Stage.

Sustainability Principles		Production and Construction	
		Ports	Ships
SP 1	Aspects that contribute to systematically increasing the concentration in nature of substances extracted from the earth's crust	Does the construction of ports require metal?	Does the construction of ships require metal?
		Does the construction of ports require concrete?	Does the construction of ships require concrete?
		Does the construction of ports require fossil fuel powered machinery?	Does the construction of ships require fossil fuel powered machinery?
SP 2	Aspects that contribute to systematically increasing concentrations in nature of substances produced by society	Is the construction of ports systematically increasing concentration of GHG in the atmosphere?	Is the construction of ships systematically increasing concentration of GHG in the atmosphere?
		Is the construction of ports systematically increasing concentration of nitrogen oxides (NOx)?	Is the construction of ships systematically increasing concentration of nitrogen oxides (NOx)?
		Is the construction of ports systematically increasing concentration of sulphur oxides (SOx)?	Is the construction of ships systematically increasing concentration of sulphur oxides (SOx)?
		Is the construction of ports systematically increasing concentration of particular matter (PM)?	Is the construction of ships systematically increasing concentration of particular matter (PM)?
		Is the construction of ports systematically increasing concentration of volatile organic compounds (VOCs)?	Is the construction of ships systematically increasing concentration of volatile organic compounds (VOCs)?
SP 3	Aspects that contribute to systematically increasing degradation of nature by physical means	Is the construction of ports systematically increasing concentration of organic, biological, chemical and toxic pollutants in waterways?	Is the construction of ports systematically increasing concentration of organic, biological, chemical and toxic pollutants in waterways?
		Is the construction of ports systematically the degrading marine ecosystems and biodiversity?	Is the building of ships systematically the degrading marine ecosystems and biodiversity?
		Is the construction of ports systematically causing sound pollution?	Is the building of ships systematically causing sound pollution?
		Is the construction of ports systematically degrading the biosphere due to land-use?	Is the building of ships systematically degrading the biosphere due to land-use?
SP 4	Aspects that contribute to structural obstacles to people's health	Is the construction of ports systematically degrading freshwater availability in the surrounding area?	Is the building of ships systematically degrading freshwater availability in the surrounding area?
		Are there health and safety concerns for employees working in the construction of ports? (excessive working hours, unsafe work environments, harassment and abuse of employees, forced/ child labour)	Are there health and safety concerns for employees working in the construction of ships? (excessive working hours, unsafe work environments, harassment and abuse of employees, forced/ child labour)
		Are there health and safety concerns for communities in close proximity to construction of ports?	Are there health and safety concerns for communities in close proximity to construction of ships?
		Are there contributions to insufficient living standards? (Wages that do not allow for a basic decent living and prohibitive pricing of basic goods)	Are there contributions to insufficient living standards? (Wages that do not allow for a basic decent living and prohibitive pricing of basic goods)
SP 5	Aspects that contribute to structural obstacles to people's influence	Are there practices that suppress employees' influence in construction of ports? (Lack of formal mechanisms to report up the command-chain, lack of acceptance of whistle-blowers, lack of bargaining rights)	Are there practices that suppress employees' influence in construction of ships? (Lack of formal mechanisms to report up the command-chain, lack of acceptance of whistle-blowers, lack of bargaining rights)
		Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the construction of ports? (Lack of formal mechanisms for the communities to give opinion and influence the aspects of the business that affect them)	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to construction of ships? (Lack of formal mechanisms for the communities to give opinion and influence the aspects of the business that affect them)
		Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to construction of ports in their community? (Reliance on political regimes that engage in suppression of free speech and does not have free elections)	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to construction of ships in their community? (Reliance on political regimes that engage in suppression of free speech and does not have free elections)
		Are there insufficient learning or development mechanisms in construction of ports? (Lack of opportunities for competence development, Lack of mechanisms for organizational learning and development and no development talks).	Are there insufficient learning or development mechanisms in the construction of ships? (Lack of opportunities for competence development, Lack of mechanisms for organizational learning and development and no development talks).
SP 6	Aspects that contribute to structural obstacles to people's competence	Are there practices that rely on, or promote, lack of education and competence development in the surrounding community? (Operating in regions or countries that do not support educational development)	Are there practices that rely on, or promote, lack of education and competence development in the surrounding community? (Operating in regions or countries that do not support educational development)
		Are there practices that promote false understanding? (False information and false advertising)	Are there practices that promote false understanding? (False information and false advertising)
SP 7	Aspects that contribute to structural obstacles to people's impartiality	Are there practices of discrimination? (Gender, racial or other discrimination)	Are there practices of discrimination? (Gender, racial or other discrimination)
		Are there practices that promote economic inequality? (Extreme differences in income)	Are there practices that promote economic inequality? (Extreme differences in income)
		Are there reliance on political regimes that support impartial treatment? (Reliance on political regimes that engage in discrimination, engaging in corruption and relying on corrupt regimes)	Are there reliance on political regimes that support impartial treatment? (Reliance on political regimes that engage in discrimination, engaging in corruption and relying on corrupt regimes)
SP 8	Aspects that contribute to structural obstacles to people's meaning-making	Is there lack of clarity in construction of ports? (Lack of a clear purpose and lack of clear roles and responsibilities for individuals)	Is there lack of clarity in construction of ships? (Lack of a clear purpose of the organization and lack of clear roles and responsibilities for individuals)
		Is there disrespect of employees' meaning-making? (Not allowing a particular cultural expression in the workplace)	Is there disrespect of employees' meaning-making? (Not allowing a particular cultural expression in the workplace).
		Is there disrespect of the community's meaning-making? (Disrespect of local culture and reliance on political regimes that engage in suppression of cultural expression)	Is there disrespect of the community's meaning-making? (Disrespect of local culture and reliance on political regimes that engage in suppression of cultural expression)
		Is there reliance on practices that alter meaning-making subversively? (Aggressive and misleading advertising)	Is there reliance on practices that alter meaning-making subversively? (Aggressive and misleading advertising)
		Are leaders inconsistent in relation to the purpose in construction of ports? (Not "walking the talk" and thereby putting a meaningful purpose in doubt)	Are leaders inconsistent in relation to the purpose in construction of ships? (Not "walking the talk" and thereby putting a meaningful purpose in doubt)

Annex D

Methodological Framework, Use and Maintenance Stage.

Sustainability Principles		Use and Maintenance	
		Ports	Ships
SP 1	Aspects that contribute to systematically increasing the concentration in nature of substances extracted from the earth's crust	Is the operation of ports dependant on fossil fuel powered machinery?	Is the operation of ships dependant on fossil fuel powered machinery?
		Is the operation of ports dependant on fossil fuel powered infrastructure?	Are plastics used to protect the ships during shipping? Are metals used to protect the ships during shipping?
SP 2	Aspects that contribute to systematically increasing concentrations in nature of substances produced by society	Is the usage of ports systematically increasing concentration of GHG in the atmosphere?	Is the usage of ships systematically increasing concentration of GHG in the atmosphere?
		Is the usage of ports systematically increasing concentration of nitrogen oxides (NOx)?	Is the usage of ships systematically increasing concentration of nitrogen oxides (NOx)?
		Is the usage of ports systematically increasing concentration of sulphur oxides (SOx)?	Is the usage of ships systematically increasing concentration of sulphur oxides (SOx)?
		Is the usage of ports systematically increasing concentration of particular matter (PM)?	Is the usage of ships systematically increasing concentration of particular matter (PM)?
		Is the usage of ports systematically increasing concentration of volatile organic compounds (VOCs)?	Is the usage of ships systematically increasing concentration of volatile organic compounds (VOCs)?
		Is the usage of ports systematically increasing the concentration of invasive species?	Is the usage of ships systematically increasing the concentration of invasive species?
SP 3	Aspects that contribute to systematically increasing degradation of nature by physical means	Is the usage of ports systematically increasing concentration of organic, biological, chemical and toxic pollutants in waterways (e.g. through oil spills and waste disposal)?	Is the usage of ships systematically increasing concentration of organic, biological, chemical and toxic pollutants in waterways (e.g. through oil spills and waste disposal)?
		Is the usage of ports systematically degrading marine ecosystems and biodiversity?	Is the usage of ships systematically degrading marine ecosystems and biodiversity?
		Is the usage of ports systematically causing sound pollution?	Is the usage of ships systematically causing sound pollution?
		Is the usage of ports systematically degrading the biosphere due to land-use?	Is the usage of ships systematically degrading freshwater availability in the surrounding area?
SP 4	Aspects that contribute to structural obstacles to people's health	Are there health and safety concerns for employees working in the use of ports? (excessive working hours, unsafe work environments, harassment and abuse of employees, forced/ child labour)	Are there health and safety concerns for employees working in the use of ships? (excessive working hours, unsafe work environments, harassment and abuse of employees, forced/ child labour)
		Are there health and safety concerns for communities in close proximity to use of ports?	Are there health and safety concerns for communities in close proximity to use of ships?
		Are there contributions to insufficient living standards? (Wages that do not allow for a basic decent living and prohibitive pricing of basic goods)	Are there contributions to insufficient living standards? (Wages that do not allow for a basic decent living and prohibitive pricing of basic goods)
SP 5	Aspects that contribute to structural obstacles to people's influence	Are there practices that suppress employees' influence in the use of ports? (Lack of formal mechanisms to report up the command-chain, lack of acceptance of whistle-blowers, lack of bargaining rights)	Are there practices that suppress employees' influence in the use of ships? (Lack of formal mechanisms to report up the command-chain, lack of acceptance of whistle-blowers, lack of bargaining rights)
		Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the use of ports? (Lack of formal mechanisms for the communities to give opinion and influence the aspects of the business that affect them)	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the use of ships? (Lack of formal mechanisms for the communities to give opinion and influence the aspects of the business that affect them)
		Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the use of ports in their community? (Reliance on political regimes that engage in suppression of free speech and does not have free elections)	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the use of ships in their community? (Reliance on political regimes that engage in suppression of free speech and does not have free elections)
SP 6	Aspects that contribute to structural obstacles to people's competence	Are there insufficient learning or development mechanisms in the use of ports? (Lack of opportunities for competence development, lack of mechanisms for organizational learning and development and no development talks)	Are there insufficient learning or development mechanisms in the use of ships? (Lack of opportunities for competence development, lack of mechanisms for organizational learning and development and no development talks)
		Are there practices that rely on, or promote, lack of education and competence development in the surrounding community? (Operating in regions or countries that do not support educational development)	Are there practices that rely on, or promote, lack of education and competence development in the surrounding community? (Operating in regions or countries that do not support educational development)
		Are there practices that promote false understanding? (False information and false advertising)	Are there practices that promote false understanding? (False information and false advertising)
SP 7	Aspects that contribute to structural obstacles to people's impartiality	Are there practices of discrimination? (Gender, racial or other discrimination)	Are there practices of discrimination? (Gender, racial or other discrimination)
		Are there practices that promote economic inequality? (Extreme differences in income)	Are there practices that promote economic inequality? (Extreme differences in income)
		Are there reliance on political regimes that support impartial treatment? (Reliance on political regimes that engage in discrimination, engaging in corruption and relying on corrupt regimes)	Are there reliance on political regimes that support impartial treatment? (Reliance on political regimes that engage in discrimination, engaging in corruption and relying on corrupt regimes)
SP 8	Aspects that contribute to structural obstacles to people's meaning-making	Is there lack of clarity in the use of ports? (Lack of a clear purpose of the organization and lack of clear roles and responsibilities for individuals)	Is there lack of clarity in the use of ships? (Lack of a clear purpose of the organization and lack of clear roles and responsibilities for individuals)
		Is there disrespect of employees' meaning-making? (Not allowing a particular cultural expression in the workplace)	Is there disrespect of employees' meaning-making? (Not allowing a particular cultural expression in the workplace)
		Is there disrespect of the community's meaning-making? (Disrespect of local culture and reliance on political regimes that engage in suppression of cultural expression)	Is there disrespect of the community's meaning-making? (Disrespect of local culture and reliance on political regimes that engage in suppression of cultural expression)
		Is there reliance on practices that alter meaning-making subversively? (Aggressive and misleading advertising)	Is there reliance on practices that alter meaning-making subversively? (Aggressive and misleading advertising)
		Are leaders inconsistent in relation to the purpose in the use of ports? (Not "walking the talk" and thereby putting a meaningful purpose in doubt)	Are leaders inconsistent in relation to the purpose of the in the use of ships? (Not "walking the talk" and thereby putting a meaningful purpose in doubt)

Annex E

Methodological Framework, End-of-life/Disposal Stage.

Sustainability Principles		End of Life / Disposal	
	Ports	Ships	
SP 1	Aspects that contribute to systematically increasing the concentration in nature of substances extracted from the earth's crust	Is the end of life of ports dependent on fossil fuel powered machinery?	Is the end of life of ships dependent on fossil fuel powered machinery?
		Is the concrete disposed of so it will not be re-used?	Is the metal disposed of so it will not be re-used?
		Is the metal disposed of so it will not be re-used?	Are other materials used in the ships disposed of so it will not be re-used?
SP 2	Aspects that contribute to systematically increasing concentrations in nature of substances produced by society	Is the end of life of ports systematically increasing the concentration of heavy metals (e.g. mercury, lead)?	Is the end of life of ships systematically increasing the concentration of heavy metals (e.g. mercury, lead)?
		Is the dismantling of ports systematically increasing the concentration of asbestos?	Is the dismantling of ships systematically increasing the concentration of asbestos?
		Is the dismantling of ports systematically increasing the concentration of toxins?	Is the dismantling of ships systematically increasing the concentration of toxins?
SP 3	Aspects that contribute to systematically increasing degradation of nature by physical means	Is the dismantling of ports systematically increasing the concentration of invasive species?	Is the dismantling of ships systematically increasing the concentration of invasive species?
		Is the end of life of ports systematically degrading marine ecosystems and biodiversity?	Is the end of life of ships systematically degrading marine ecosystems and biodiversity?
		Is the dismantling of ports systematically causing sound pollution?	Is the dismantling of ships systematically causing sound pollution?
SP 4	Aspects that contribute to structural obstacles to people's health	Is the dismantling of ports systematically degrading the biosphere due to land-use?	Is the dismantling of ships systematically degrading the biosphere due to land-use?
		Is the dismantling of ports systematically degrading freshwater availability in the surrounding area?	Is the dismantling of ships systematically degrading freshwater availability in the surrounding area?
		Are there health and safety concerns for employees working in end of life of ports? (excessive working hours, unsafe work environments, harassment and abuse of employees, forced/ child labour)	Are there health and safety concerns for employees working in the end of life of ships? (excessive working hours, unsafe work environments, harassment and abuse of employees, forced/ child labour)
SP 5	Aspects that contribute to structural obstacles to people's influence	Are there health and safety concerns for communities in close proximity to end of life of ports?	Are there health and safety concerns for communities in close proximity to end of life of ships?
		Are there contributions to insufficient living standards? (Wages that do not allow for a basic decent living and prohibitive pricing of basic goods)	Are there contributions to insufficient living standards? (Wages that do not allow for a basic decent living and prohibitive pricing of basic goods)
		Are there practices that suppress employees' influence in the end of life of ports? (Lack of formal mechanisms to report up the command-chain, lack of acceptance of whistle-blowers, lack of bargaining rights)	Are there practices that suppress employees' influence in the end of life of ships? (Lack of formal mechanisms to report up the command-chain, lack of acceptance of whistle-blowers, lack of bargaining rights)
SP 6	Aspects that contribute to structural obstacles to people's competence	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the end of life of ports? (Lack of formal mechanisms for the communities to give opinion and influence the aspects of the business that affect them)	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the end of life of ships? (Lack of formal mechanisms for the communities to give opinion and influence the aspects of the business that affect them)
		Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the end of life of ports in their community? (Reliance on political regimes that engage in suppression of free speech and does not have free elections)	Are there practices that suppress, or rely on the lack of opportunity to express, the communities' opinion in relation to the end of life of ships in their community? (Reliance on political regimes that engage in suppression of free speech and does not have free elections)
		Are there insufficient learning or development mechanisms in the end of life of ports? (Lack of opportunities for competence development, lack of mechanisms for organizational learning and development and no development talks)	Are there learning or development mechanisms in the end of life of ships? Opportunities for competence development, mechanisms for organizational learning and development and development talks
SP 7	Aspects that contribute to structural obstacles to people's impartiality	Are there practices that rely on, or promote, lack of education and competence development in the surrounding community? (Operating in regions or countries that do not support educational development)	Are there practices that rely on, or promote, lack of education and competence development in the surrounding community? (Operating in regions or countries that do not support educational development)
		Are there practices that promote false understanding? (False information and false advertising)	Are there practices that promote false understanding? (False information and false advertising)
		Are there practices of discrimination? (Gender, racial or other discrimination)	Are there practices of discrimination? (Gender, racial or other discrimination)
SP 8	Aspects that contribute to structural obstacles to people's meaning-making	Are there practices that promote economic inequality? (Extreme differences in income)	Are there practices that promote economic inequality? (Extreme differences in income)
		Are there reliance on political regimes that support impartial treatment? (Reliance on political regimes that engage in discrimination, engaging in corruption and relying on corrupt regimes)	Are there reliance on political regimes that support impartial treatment? (Reliance on political regimes that engage in discrimination, engaging in corruption and relying on corrupt regimes)
		Is there lack of clarity in the end of life of ports? (Lack of a clear purpose of the organization and lack of clear roles and responsibilities for individuals)	Is there lack of clarity in the end of life of ships? (Lack of a clear purpose of the organization and lack of clear roles and responsibilities for individuals)
SP 8	Aspects that contribute to structural obstacles to people's meaning-making	Is there disrespect of employees' meaning-making? (Not allowing a particular cultural expression in the workplace)	Is there disrespect of employees' meaning-making? (Not allowing a particular cultural expression in the workplace)
		Is there disrespect of the community's meaning-making? (Disrespect of local culture and reliance on political regimes that engage in suppression of cultural expression)	Is there disrespect of the community's meaning-making? (Disrespect of local culture and reliance on political regimes that engage in suppression of cultural expression)
		Is there reliance on practices that alter meaning-making subversively? (Aggressive and misleading advertising)	Is there reliance on practices that alter meaning-making subversively? (Aggressive and misleading advertising)
SP 8	Aspects that contribute to structural obstacles to people's meaning-making	Are leaders inconsistent in relation to the purpose in the end of life of ports? (Not "walking the talk" and thereby putting a meaningful purpose in doubt)	Are leaders inconsistent in relation to the purpose in the end of life of ships? (Not "walking the talk" and thereby putting a meaningful purpose in doubt)

Annex F

Interview Questions and rationale.

No.	Question/Instruction	Purpose
1	Introductions, presentation of participants. Thank the interviewee for their presence. Reminder of consent and recording of the session.	
2	Present the aim of the research and interview.	
3	How are you today?	To have a small check in
4	Could you briefly tell us about your role and the organization you are associated with?	To understand the background and expertise of the interviewee
5	In short, what would you say is the role of your organization in the sector?	To understand the purpose of their organization in the sector and how they work towards the transition (if they do)
6	Could you briefly tell us how you are working with sustainability?	To understand the interviewees definition of sustainability
7	In your opinion, is there a sectoral understanding for the need for sustainability transition? If so, who is leading this movement?	To understand the level of awareness in the sector and who they think are taking the most steps in this direction
8	The International Maritime Organization defines the regulatory landscape on an international scale. Are there any particular challenges in implementing IMO's strategies and policies? Do you expect any resistance or barriers?	To understand what the structural obstacles are for IMO in leading change for the sector
9	The shipping industry aims to reduce their emissions by half in 2050. So, this means fossil fuels will be there for a while. With the IMO not paving the way for transition, what can the shipping sector do?	To understand how they see other actors playing a role, and capture what bottom-up approaches are happening/can happen
10	What is your organization doing to include the voices of many who are unheard such as workers in ports and ships, communities and others that are affected?	To understand how their organization tackles social sustainability challenges in the sector (if they include this)
11	In your experience, what is the level of collaboration between different stakeholders inside the sector? What about the outside the shipping sector as part of the larger system?	To understand how collaboration is currently occurring in the industry and if there are collaborations occurring externally as well
12	How can collaboration be shaped in the journey to a sustainable shipping sector?	To understand what collaboration must look like in the future
13	How do you think the industry can reconcile the need for long-term investments, slow decision-making processes and the urgency to implement necessary changes?	To understand how they perceive the industry can still work through the current challenges and move ahead
14	What do you think should be the focus of the new strategies after the IMO council meeting in July 2023?	To understand what different actors hope for from this awaited meeting
15	Check out and remind interviewee that the transcript will be sent for reviewing and thank them for their presence and contribution	

Annex G

Synthesis of results from document analysis.

Sustainability Principles	Production		Use and Maintenance		End of Life / Disposal	
	Ports	Ships	Ports	Ships	Ports	Ships
SP 1 Aspects that contribute to systematically increasing the concentration in nature of substances extracted from the earth's crust		HKIC				
						HKIC
						HKIC
SP 2 Aspects that contribute to systematically increasing concentrations in nature of substances produced by society				Strategic Plan (2018-2023), HKIC, MARPOL		HKIC
				MARPOL		HKIC
				Protocol OPRC, MARPOL		HKIC
				MARPOL		
			BWM	BWM, INTERVENTION, London		
			OPRC	OPRC, CLC; Biofouling		
			Reception facilities	AFS		
SP 3 Aspects that contribute to systematically increasing degradation of nature by physical means		MARPOL	BWM	BWM;AFS MARPOL		
						HKIC
SP 4 Aspects that contribute to structural obstacles to people's health			SOLAS, FAL, BWM	SOLAS, FAL, BWM, FUND, HKIC		HKIC
			FAL, BWM	FAL, BWM		HKIC
SP 5 Aspects that contribute to structural obstacles to people's influence			SOLAS	SOLAS		
SP 6 Aspects that contribute to structural obstacles to people's competence		BWM		STWC, BWM, Protocol for OPRC, FUND		HKIC
SP 7 Aspects that contribute to structural obstacles to people's impartiality				BWM, Strategic Plan (2018- 2023) FUND		
SP 8 Aspects that contribute to structural obstacles to people's meaning-making						

No code

Annex H

Consent Form.

*Master's thesis "A Strategic Approach to a Sustainability Transition in the Shipping Sector –
Role of IMO and Shipping Companies"*

Consent to take part in research

- I.....voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves an interview which will be subsequently used for research purposes.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being recorded.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that disguised extracts from my interview may be quoted in this thesis and possibly a published paper.
- I understand that if I inform the researcher that myself or someone else is at risk of harm they may have to report this to the relevant authorities -they will discuss this with me first but may be required to report with or without my permission.
- I understand that signed consent forms and original recordings will be retained on the thesis team's personal hard drives which only members of the team have access to until the exam board will confirm the result of this thesis, presumably in June 2023.
- I understand that a transcript of my interview in which all identifying information has been removed will be retained until the exam board will confirm the result of this thesis, presumably in June 2023.
- I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

- Fee Stöcker, M.Sc., [<fesc21@students.bth.se>](mailto:fesc21@students.bth.se);
- Divya Kasarabada, M.Sc., [<dika22 @students.bth.se>](mailto:dika22@students.bth.se);
- Chaima Dalouhamouch, M.Sc., [<chdl22@student.bth.se>](mailto:chdl22@student.bth.se);
- Supervisor: Rachael Gould, PhD, rachael.gould@bth.se

Signature of research participant

.....

Signature of participant

.....

Date

Signature of researcher

I believe the participant is giving informed consent to participate in this study

.....

Signature of researcher

.....

Date

Annex I

Protocol form to be signed by interviewees.

Time of interview:

Date:

Place: Online

Interviewer:

Interviewee:

A Strategic Approach to a Sustainability Transition in the Shipping Sector: Role of IMO and Shipping Companies

Interview procedure:

You are being asked to participate in a research study investigating the sustainability transition of the shipping sector. The purpose of this study is to investigate the role of IMO and shipping companies. The study also will investigate what the future of the industry holds, what is being done now and the gaps between them. During this interview, you will be asked to respond to several open-ended questions. You may choose not to answer any or all of the questions. The procedure will involve taping the interview, and the tape will be transcribed verbatim. Your results will be confidential, and you will not be identified individually.

Informed Consent

Please sign the informed consent attached in the email for signalling your willingness to participate.

Questions

-
- In a nutshell, what does the future look like for the industry according to you?
 - Could you briefly tell us how you are working with sustainability?
 - Could you briefly tell us what do you think is the role of your research in the sustainability transition of the sector?
 - In your opinion, is there a sectoral understanding for the need for this transition? Who is leading this movement?
 - The International Maritime Organization defines the regulatory landscape at the international scale. Are there any particular challenges in implementing IMO's strategies and policies? Do you expect any resistance or barriers?
 - The shipping industry aims to reduce their emissions by half in 2050. So this means fossil fuels will be there for a while. With the IMO not paving the way for transition, what can the shipping sector do?

- What is your organisation doing to include the voices of many who are unheard such as workers in ports and ships, communities and others that are affected?
 - In your experience, what is the level of collaboration between different stakeholders inside the sector? What about outside the sector as a part of the larger system? How can collaboration be shaped in the journey towards sustainability?
 - How do you think the industry can reconcile the need for long-term investments, slow decision-making processes, and the urgency to implement necessary changes?
 - What do you think should be the focus of the new strategies after the IMO Council meeting in July this year?
-

Thank you for participating in this interview. We appreciate you taking the time to do this. We may contact you in the future for the purpose of follow up interviews or to review our transcript. Again, let me assure you of the confidentiality of your responses. If you have any questions, please feel free to contact us via email at: dika22@student.bth.s

Annex J

Additional results from Phase II.

Understanding of Sustainability

We asked interviewees how they worked with sustainability, in order to capture their definition of sustainability. Five definitions of sustainability came up, namely SDGS, Environmental Social Governance (ESG), Strategic Sustainable Development, Brundtland, holistic. Two interviewees (I4, I5) viewed sustainability from an environmental, social and governance (ESG) perspective: “We're not just interested in decarbonization, but we try to look at the social, environmental, and governance issues across different sustainability challenges.” (I4)

I5 explained it as follows:

Sustainability includes more than emissions to air, although that's a big thing in shipping actually. This includes also economically sustainable, sustainable for people and organization and other things too such as hydro acoustic noise or garbage antifouling paint and we are working with that too in this plan we have we are concentrating in emissions to air.

Two interviewees (I7, I3) also understood sustainability from a holistic point of view, also considering areas which might not be directly connected to shipping. I7 explained that up until this point, many solutions solved the problem at hand, but created a new problem entirely, such as e.g., scrubbers, which turned the issue of air pollution into an issue of water pollution. Thus, I7 concluded: “[s]ustainability is not about creating more problems.” I3 elaborated further:

The big chunk of the talk out there is about decarbonization reduction of greenhouse gas emissions but we very much see it as going beyond that and we have, for instance, thought a lot about planetary boundaries and how they are interconnected. So, it's talking about the maritime industry and perhaps the IMO [...]we are seeing it from a holistic view, we are trying to do anything we can really to help the maritime industry in this respect.

I1 defined sustainability in accordance with SSD, whereas I3 stated that they worked with sustainability as defined by the SDGs. I9 defined sustainability as consuming resources today without compromising future generations and staying within planetary boundaries-Brundtland definition.

In addition to providing conceptual understandings of sustainability, the interviewees also spoke to how they work with sustainability in practice. For example, I6 said that “when it comes to the climate issues, we have a lot of discussions internally with our members about all these issues, which is related to the climate, such as fuels, energy efficiency and accounting.” Similarly, I5 said that “in this plan we have, we are concentrating in emissions to air.” I4 spoke about how sustainability transferred into a roadmap for their stakeholders.

On the other hand, some interviewees also explain how sometimes the social aspect of sustainability fell out of their scope of work, even though their definitions cover it. Here is an example from I4:

Yeah, that's a little bit outside of the scope of what we do just in terms of because we are a multi stakeholder initiative and our members are companies, it's not necessarily the type of work that we do, to work with individuals or to work with individual communities that are affected. Well, it's definitely part of our work. So, we have a working group on seafarer's rights, and we did some work back in 2021, on developing a code of conduct for seafarers' rights, making sure essentially that. But again, this was targeted at companies, so we were targeting ship managers, ship owners, ship operators.

I7 summarized it with “[...] we include this in sustainability of course, this is dependent on who comes with proposals and if it comes up or not.”

Meaning Making

When asked about social sustainability, only two interviewees (I4 and I6) discussed this aspect in depth and provided examples from their experience. When asked about the future of the sector and what some of their work focuses on, I4 provided the following examples:

So, we were targeting ship managers, ship owners, ship operators. To make sure that they know what they need to be abiding by in terms of what are their responsibilities to their seafarers, what are their human and labour rights responsibilities, what are their kind of crew well-being responsibilities, like providing internet access, providing enough safe and clean water. Providing mental health services to seafarers and all of these different things.



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