HOW VIABLE IS SUSTAINABILITY IN THE SHIPPING INDUSTRY?

Research dissertation presented in partial fulfilment of the requirements for the degree of

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Candidate Declaration

Candidate Name: Keelah Gregan

I certify that the dissertation entitled:

How viable is the sustainability in the maritime industry?

Submitted for the degree of:

MSc in Procurement and Supply Chain Management

is the result of the my own work and that where reference is made to the work of others, due acknowledgment is given.

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Dedication

This work is for my wonderful family, who have always believed in me. Without their support throughout this master's degree, I would not have pulled through the challenging times.

Acknowledgements

This research would not have been possible without the help of my colleagues.

I would like to thank my supervisor Paul Davis for the guidance throughout my research and his wealth of knowledge.

I would also like to thank my employer for passing on the knowledge and expertise which has made me the professional I am today. I have learned so much about procurement and the supply chain, namely in relation to sustainability, from my managers and colleagues.

Laat, but not least, I would like to thank my family and friends. Thank you for being so understanding during my time at Griffith college.

Abstract

The shipping industry plays a crucial role in global trade, but because of this has had a significant impact on environmental challenges. This is due to the sectors reliance on fossil fuels for fuel and the emissions of greenhouse gases. There has been huge concern in the latter years for sustainability in the industry. This dissertation presents an in-depth analysis of the viability of sustainability in the shipping industry with a concentration on three keys areas. The primary focus will be on environmental impacts, seafarer sustainability and the concept of being profitable and sustainable simultaneously. I will delve into innovations, policy initiatives and operational practices with the aim to reduce the impact this industry has on sustainability environmentally, socially, and economically.

Various sustainability measures will be discussed that have been implemented in the shipping industry to date. These will include the proposal of technological advancements such as alternative fuels and improved vessel designs. Furthermore, international regulations will be assessed. These include the International Maritime Organisations Energy Efficiency Design Index (EEDI), the International Convention for the Prevention of Pollution from Ships (MARPOL), Monitoring Reporting and Verification (MRV) and International Maritime Organisation Data Collection System (IMO DCS). Such operational practices such as slow steaming will be examined in reducing fuel consumption.

Secondly, this analysis will address the importance of seafarer sustainability. The crew work under demanding conditions to ensure smooth operations of vessels across the globe. However, the well-being and rights of the men and women onboard have been overlooked in the past. This research will highlight the significance of the introduction of the Maritime Labour Convention in 2006. This further highlights the importance of fair and ethical employment practices, mental health and demanding physically challenges. Not to mention the impact of being so far away from home for prolonged periods of time.

Lastly, this research will highlight potential economic challenges and barriers of implementing sustainability into the shipping industry. It acknowledges the high costs companies must invest with adopting new technologies with limited infrastructure. It shows the need for collaboration of stakeholders alike. Can

companies truly be sustainable and profitable with today's regulatory pressures to do so?

Overall, this research aims to provide a comprehensive review of the viability of sustainability in the shipping industry. It examines the importance of technological advancements, international regulations, seafarers' rights and investing time and money into the environmental impact the sector is causing globally. By embracing these measures, the industry can potentially contribute to mitigating the environmental, social, and economic changes while maintaining its crucial role in international trade.

Key Words: Shipping, Sustainability, IMO, Environment, Seafarer, Profitability, Future, Pollution, Maritime, Crew, Impact, Vessel, Ship Owner, Regulation.

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1 Introduction

The topic that I have decided to explore for my dissertation research is the sustainability of the maritime industry. Sustainability in relation to supply chain is described as, by Luther, a '*companies' effort to consider the environmental and human impact of their products journey through the supply chain'*. (Luther, 2020) I have chosen to focus on this area as, from my research, the transportation industry is the second highest polluter in the world. (Howell, 2022) The shipping industry plays a vital role in global trade, connecting economies and facilitating the movement of goods across the world. However, the industry's operations have significant environmental and social impacts. These would include carbon emissions, air pollution and ecosystem disruption. As a result of this, there is a clear need to make the industry more sustainable.

The World Shipping Council (2023) refers to sustainability in the shipping industry as working with international organizations such as the IMO to adopt practices and strategies to protect human health and the environment by minimising negative environmental and social impacts while also promoting long-term economic viability. The industry needs to find ways to reduce greenhouse emissions, improve energy efficiency, promote fair labour practices, and ensure responsible sourcing throughout the supply chain. The shift towards sustainability has been driven by several factors. These includes climate change, stakeholders and economic advantages which will be discussed throughout this dissertation in more detail.

As the urgency to address climate change and environmental degradation grows, sustainability in the shipping industry is becoming an imperative. By adopting more sustainable practices, can the industry mitigate its environmental impact, contribute to global sustainability goals as set out by the UN? See below for a full list of their seventeen sustainable development goals.

Figure 1 – United Nations 17 sustainable Development Goals

Does the industry hold a responsibility for a more resilient and prosperous future for the maritime sector and the planet. If so, is it actually viable to be sustainable in such a highly polluting industry?

1.1 Research Purpose

The purpose of this research on the sustainability of the maritime industry is to gain knowledge and understanding of the environmental, social, and economic challenges companies now face and to develop strategies and solutions that promote a sustainable future. It is possible that, with the help of this research, we could make more informative decisions, drive innovation, and cultivate actions that contribute to a more sustainable world. It could provide the foundation for the transition to more sustainable practices that address the interconnected challenges of environmental degradation, social inequality, and economic viability.

1.2 Significance of the Study

Sustainability is highly significant in the shipping industry as it is one of the highest polluters in the world. This study is imperative to understand complex challenges in terms of sustainability. Oceana (2023) confirms that the industry is responsible

for a significant share of global carbon emissions, air pollution and marine pollution. Given the scale of the industry operations and its reliance on fossil fuels, sustainability will be crucial for minimising its impact on the world. Sustainability needs to be integrated progressively to ensure it can be conducted in a responsible manner. The analysis of regulatory compliance will be conducted to ensure shipping operations are held to the highest standard. The industry operates within a framework of international regulations and conventions aimed at ensuring safety, environmental protection, and fair practices. Consumers are becoming much more conscious of the environmental and social impact of the products and services they use. This is why stakeholder management is so important. Adopting sustainable practices in shipping can help build a positive reputation, attract responsible customers, and retain employees who work in line with these sustainable beliefs. The study of sustainability could potentially be a driver of innovation. This can encourage competitiveness within rival shipping companies. Companies that invest in sustainable technologies, fuel efficiency measures and emission reduction strategies could gain a competitive edge.

Given its global reach and environmental impact, the significance of this study could be crucial for protecting the planet, minimising pollution, meeting stakeholder expectations, seafarers' wellbeing and driving long term success.

1.3 Research Objective

1. Objective #1

To form ways in which the shipping industry can minimise environmental pollution.

The aim of the first objective is to explore the options for which the environmental impact of this industry can be minimised. During this research, different factors of the maritime industry will be explored to potentially benefit the global impact. The exploration of what alternative fuel options there are currently will be conducted. Is dual-fuel or fully electric engines a possibility? Will the introduction of environmental regulations help these efforts or just hinder companies' potential profitability factors?

2. **Objective #2**

To ensure sustainable working conditions for the crew members onboard vessels.

Prioritising seafarers' well-being, promote social justice and contribute to a more sustainable maritime industry. This not only benefits seafarers themselves but it can potentially improve operational efficiency, safety, and the industry's overall reputation. The aim is to see how recognising the importance of seafarer's welfare and taking proactive measures to create more sustainable working conditions is crucial for a viable and thriving maritime sector.

3. **Objective #3**

To establish if it is possible to be sustainable and profitable.

The main purpose of any company is to make a profit. Levitt said, '*the business of business is profits*.' (Levitt, 1958) This requires careful consideration on various strategies and approaches. While sustainability initiatives usually involve upfront costs, they could potentially lead to long term financial benefits and a competitive advantage. Regulatory compliance in the industry is driving technology advancements in sustainability. But is this sustainable for companies economically in the sector to invest their own money or should there be public funding to aid the cause. Do companies hold the cost of the responsibility they hold with being involved in such a highly polluting industry?

1.4 Structure of the Study

The structure of this study will follow a format to include several key sections. Finding a structure that suits your approach and topic is crucial. Not only for effective timing of the research, but to ensure all conductions have been carried out in a timely manner to ensure the final report is ready for the submission date. See Appendix B for table of structure for the research of the viability of sustainability in the shipping industry.

2 Literature Review

The literature review is an important part of research. From the below, the aim is to evaluate current research done on the topic I have chosen and subsequently debate on themes and findings from the literature. This could potentially lead to finding a gap in research that already exists for my own conduction to partake in. This section will analyse the following themes:

1. *Seafarer sustainability*
2. *Environmental pollution*
3. *The cost of sustainability*
4. *Stakeholder management*
5. *Purchasing practices*

2.1 Overview

2.2 Seafarer sustainability

Uncommon (2022) describe a sustainable workplace as striving to '*use resources not to impact the environment or employee's health*.' Improving employee health and creating a more friendly and productive environment are some of the ways they describe sustainability in the workplace.

The introduction of SOLAS, which is the Convention for the Safety of Life at Sea, has had a huge impact on enhancing the safety of workers in the maritime sector and reducing accidents at sea. The first adoption of the international treaty was in 1914 after the famous Titanic disaster. SOLAS primarily focuses on safety measures; however, it does indirectly contribute to seafarer sustainability by creating a safe working environment for the crew onboard. (IMO, 2023) SOLAS has significantly improved maritime safety and contributed to seafarer sustainability, it is important to note that seafarer sustainability involves various aspects beyond safety onboard. Fair working conditions, mental health, and social well-being but to name a few.

As per Carotenuto et. al (2012), stress is more apparent in long voyages and in younger seafarers. They also found a high correlation in stress and fatigue in deck crew members as apposed to masters and engineers. The nature of their work,

the long working hours, extended periods of time away from loved ones, and the demanding operational conditions can contribute to this.

The introduction of the Maritime Labour Convention in 2006, is an international labour standard adopted by the international Labour Organisation. It sets out comprehensive rights and protections for seafarers globally, aiming to ensure sustainable working and living conditions for the employed in their shipping industry. (MLC, 2006) This convention applies to all types of vessels at sea be it passenger vessels, cargo vessels or fishing vessels. It ensures the rights of seafarers regardless of their nationality. The convention establishes minimum requirements to seafarers including their well-being, employment contracts, accommodation, food working conditions and medical care.

As fatigue could be a huge issue in such a career, the convention sets out that seafarers can 'work up to eight hours a day, under normal circumstances, with one day as a rest day'. However, there is a maximum of fourteen hours in any twenty-four-hour period and a maximum of seventy-two hours in any seven-day period. It also stipulates that there is a minimum of ten hours rest in any twenty-four-hour period. (MLC, 2006)

After reading the latest issue of the Seafarer Happiness Index (2023) from last quarter, it seems the convention can put these issues into writing. However, it is unsure if these issues are being translated into real life. The Seafarer Happiness Index was a tool developed to access and measure the well-being and job satisfaction of seafarers in the shipping industry. It provides a quantitative assessment of various factors in it was set up to improve upon. It provides insight into their experiences and quality of life at sea. In the latest report there was mention of long working hours and mixed perceptions of rules and regulations. (SHI, 2023) Proper management of these hours with the addition of a heavy workload has been expressed that companies are not following these regulations as per the Maritime Labour Convention. If a member of the crew is not satisfied with his rights being met, they can make a report to the master of the vessel or the relevant external authorities. These include flag state, port state or the ship owner. If the complaint of the seafarer is successful, this can lead to serious sanctions. These can include the detention of the ship and the withdrawal of their MLC certificate. (Nautilus, 2022) It is in the best interest of the ship owner

to ensure the sustainability of their seafarers alike as this would not only interfere with operations and profitability but also their reputation.

The shipping industry is arguably at its most busy now. We saw a decline in 2020 due to the pandemic but they bounced back tremendously in 2021. UNCTAD (2023) predicts an annual growth of 2.1% until 2027. With this growth, demand on the crew to keep up increases equally. Seafarers are not the same as factory workers or someone who is based in an office. They do not have the same pleasure in going home after a long day's work. Their work-related pressures are tenfold compared to the normal labourer. They must deal with loneliness, time pressures, fatigue, and complex paperwork but to name a few. (Safety4Sea, 2022)

The garbage record book is an essential document onboard vessel for several reasons. It is up to the crew to ensure compliance with international regulations, such as the International Convention for the Prevention of Pollution. This will be discussed in more detail in the next section. Keeping a detailed record of this adds pressure on the crew as to ensure demonstration of compliance during MARPOL inspections. They need to provide written procedures for the minimising, collecting, storing, processing and ultimately disposing of garbage onboard. (EMSA, 2022) Compliance with the waste management regulations is assessed on accuracy of the recorded information. Ships with well-maintained record books are more likely to pass inspections smoothly and avoid deficiencies.

Brooks (2022) investigates further the toll on the demand of the crew having to comply with these environmental regulations. This adds to the already extremely heavy workload they face in day-to-day operations. To address these potential challenges, it is crucial for shipping companies to prioritize seafarer well-being and provide adequate support. This includes the correct training, sufficient crew onboard, clear procedures, effective communication, and regular assessments of the workload onboard. Promoting an open dialogue can help seafarers manage the demands of environmental compliance while maintaining their overall well-being.

By prioritising seafarers' well-being, rights and professional development, the shipping industry can potentially ensure the sustainability of its workforce and

contribute to a more responsible and resilient maritime sector. These additional initiatives, regulations and industry practices are required to address these sustainability issues and ensure the well-being of seafarers accordingly.

2.3 Environmental pollution

2.3.1 Policy's and Framework

MARPOL stands for the International Convention for the Prevention of Pollution from Ships. (Tanaka, 2016) This is a global treaty aimed at minimising the pollution generating by the shipping industry be it oil, chemicals, sewage, or garbage. As per the International Maritime Organisation (2023), their websites states that MARPOL currently have six annexes. These include:

- Annex 1 which relates to the prevention of pollution by oil from 1983.
- Annex 2 which relates to the control of pollution by noxious liquid substances in bulk from 1983.
- Annex 3 which is the prevention of pollution by harmful substances carried by sea in packaged from 1992.
- Annex 4 which is the prevention of pollution by sewage from ships 2003.
- Annex 5 which refers to the prevention of pollution by garbage from ships 1988.
- Annex 6 which is the prevention of air pollution 2005.

The introduction of MARPOL has been one of the most significant international conventions with concerns to marine environmental pollution. However, Mantoju (2021) has their concerns. Their article refers to the concerns with implementation of this convention. It is expressed that there is no actual way to monitor vessels when they are out at sea to prove that they are honouring the above annexes. Shipowners can produce all the valid certificates and pass the relevant inspections ashore, but what goes on out at sea is only at the seafarer's peril. They cannot prove if there has been any illegal dumping at sea. Any violations against this convention must be reported to the vessels flag state. MARPOL does not have the power to take direct action against such violations.

Mantaju (2021) brings up the point of the loophole of flag of convenience. This could hinder investigations of foul play or end in turning a blind eye completely from the investigation. Baur (2021) states that ship owners may take advantage

of these loopholes and the ambiguity of the international frameworks allowing them to bypass environmental legislation. This is when shipowners register vessels in countries other than their own to take advantage of more appealing regulations in different countries. These could refer to lower taxes, reduced enforcement, or reduced labour standards. Cost savings on a shipowner would be the most favourable option for this choice. The reading of such loopholes reenforces my curiosity as to how viable sustainability really is for the shipping industry.

As per MARPOL (2023), regarding annex 1 of oil pollution, this requires that a vessel process oil polluted water oil filtration equipment. An oil record book is always required onboard to record all oil transfer operations including the discharge of bilge water. (ILU, 2009)

EEDI refers to Energy Efficiency Design Index. It is recognised in the shipping industry to access the energy efficiency and environmental performance of ships. It was introduced by the International Maritime Organisation in 2013. The purpose of this metric is to promote the design and construction of energy efficient vessels. This is to further aid in the reduction of greenhouse gas emissions from this sector. It measures the amount of carbon emitted by a ship as per unit of distance travelled. It takes a multitude of things into account such as the size of a ship and its engine power. The standards are to become tighter every five years to encourage the adoption of more efficient technologies from the design phase. Therefore, contributing to reduction of carbon emissions and promoting an environmentally friendly maritime sector. (IMO, 2023)

SEEMP is an acronym for the Ship Energy Efficiency Management Plan. This is a mandatory requirement from the International Maritime Organisation. This is a mechanism that helps ship owners and operators to identify and implement measures to optimise energy efficiency and reduce fuel consumption. It provides a framework for accessing and improving the vessels operational efficiency throughout its lifespan. (IMO, 2023) This could be implemented in various ways such as optimising speeds of the vessel or hull cleaning. Each vessel, even sister ships, must have separate plans as each will operate under differing conditions. (Karan, 2019)

MRV refers to Measurement, Reporting and Verification which was introduced in 2017. This is now mandatory for all vessels over 5,000 tonnes in the European Union. (DNV, 2023) This regulatory framework requires vessels to monitor and ultimately report their fuel consumption and emissions to support the global efforts to reduce greenhouse gas emissions in the shipping industry.

The IMO DCS refers to the International Maritime Organisation Data Collection System which was introduced in 2019. How it differs to the MRV is, it is worldwide. You must submit information from all ports not just that of the European Union. The type of data to be submitted is the fuel consumed, distance travelled and hours underway for all vessels for 5,000 tonnes alike. (DNV, 2023)

The Paris agreement is '*a legally binding international treaty on climate change*.' (United Nations, 2023) It proves arduous for the shipping industry to be a part of international agreements such as this. It is difficult to allot the emissions to a particular country because the industry operates globally, crossing international boundaries so this would lead to jurisdictional challenges. (Harvey, 2023) It would be too complex to include this sector to a global agreement such as the Paris agreement as the IMO is currently responsible for regulating the shipping industry and addressing its environmental impacts.

2.3.2 Fuel Alternatives

As shipping companies are having to decide on what fuel alternatives to use from heavy fuel oil, LNG seems to be the place that ship owners are starting. LNG refers to Liquefied Natural Gas. It is a clear, colourless, and non-toxic liquid. This formation occurs when the natural gas is cooled. (Shell, 2023) However, as Buitendijk (2022) mentions in their article, the environmental movement as encouraged and outlined by the International Maritime Organisation was to completely ban the use of fossil fuels and thus the introduction of decarbonisation. With this introduction of Liquified Natural Gas, although it does burn clearer with less particles emitted, it does still emit carbon. As LNG is derived from fossil fuel, doesn't this defeat the purpose? Or is this a steppingstone to ensure the implementation of decarbonisation and the potential of zero carbon fuels.

CMA CGM have been one of the biggest investors in Liquid Natural Gas vessels with the reinvestment of LNG carriers to their fleet. It was confirmed this year that they have signed a three-billion-dollar deal with shipbuilders in China to expand their fleet with sixteen LNG fuelled container ships. (Gronda, 2023)

Liang (2014) describes slow steaming as '*deliberately slowing down the speed of a ship*' to reduce fuel consumption. Agren (2012) outlines in this article how slow steaming can potentially save ship owners money and be sustainable. Slow steaming is a practice in the shipping industry where vessels operate at lower speeds with the intention of saving on fuel costs and reducing greenhouse gas emissions. However, he does state that one negative is that when markets pick up after a slump that ship owners will just start to increase speeds again to keep up with industry demand. It brings to question why the industry has not implemented speed limits to the entire maritime sector. Earls (2018) claims that by reducing bunker consumption through this implementation of speed limits could reduce greenhouse gas emissions by as much as a third.

Probst (2022) says that Methanol holds the most significance as an alternative to the current use of fossil fuels. The current framework for shipbuilding provides a base for ships powered by methyl or ethyl alcohol. Methanol combustion produces lowers emissions of sulphur and nitrogen and carbon dioxide compared to traditional fuel such as heavy fuel oil. The other advantage is that methanol can be stored and transported like traditional fuels as opposed to Ammonia and LNG. This could influence ship owners to retrofit dual-fuel engines to provide flexibility during this transition period. However, Parkes (2023) just recently wrote about the current issue at hand. She states that methanol has the protentional to become a 'big problem'. Under the influence of Maersk, there is concern that more ship owners will order methanol dual-fuel engine ships. This should be a positive step for sustainability but as there is not enough methanol being produced to keep up with the demand, sustainability will take a step backwards as ships will be back running on just diesel.

While sustainability in the shipping industry still faces a lot of challenges, there is a growing recognition of the need to reduce the industries environmental impact. Governments, organisations, and companies are actively investing in sustainable solutions, as discussed above. While technological advancements are also being

made. With a combination of regulatory measures, technological innovations and industry collaborations, the shipping industry has the potential to achieve significant improvement in sustainability.

2.4 The Cost of Sustainability

One of the world's biggest shipping companies has shown commitment to the cause of sustainability by various initiatives. One being their investment of two hundred million for projects on decarbonisation. (Howard, 2023) CMA CGM want to be at the forefront of innovation, as you can clearly see from their corporate social responsibility report. (CMA CGM, 2022) If larger shipping companies with the capital could invest in these projects, this alliance would actively lead and drive advancements in the field of sustainability. This in turn would provide a competitive advantage for not only themselves but to aid smaller companies and the industry itself to promote an environmentally friendly industry.

Are private companies obligated into investing their profits into this innovation as CMA CGM have done as above or should the governments be driving this change? As per Gerretsen, (2022) the belief is that this funding for sustainability in the shipping industry should come from public funding. Is it fair that the private sector have to take on all the risk in relation to the investing of the future of the shipping industry?

The European Union have invested just under five and a half million euro into supporting sustainability projects of transport infrastructure across the continent. Although it will not solely concentrate on the shipping industry, they have confirmed one of the projects will be the upgrading of port infrastructure and the installation of onshore power supply. This in turn could help in the reduction of emissions while vessels are in dock. (European Commission, 2022)

Agren (2012) outlines in this article how slow steaming can potentially save ship owners money and be sustainable. Slow steaming is a practice in the shipping industry where vessels operate at lower speeds with the intention of saving on fuel costs and reducing greenhouse gas emissions as discussed previously. However, he does state that one negative is that when markets pick up after a slump that ship owners will just start to increase speeds again to keep up with

industry demand. It brings to question why the industry has not implemented speed limits to the entire maritime sector. Earls (2018) claims that by reducing bunker consumption through this implementation of speed limits could reduce greenhouse gas emissions by as much as a third. She also highlights a valid point in that if we reduce the speed of the worlds transport, there would be a shortage which in turn would drive freight rates higher than before. (Earls, 2018)

An introduction of a carbon levy could push ship owners into upgrading their fleets and seek cleaner fuels and/or technologies. (Harvey, 2023) Revenue generated from this carbon levy can be utilised to the maritime sectors advantage. However, this was not the outcome of previous IMO meetings. They want this levy to benefit the research and development of developing countries of which do not have fair advantage. Again, this promotes the attitude that private companies should fund this sustainability which might not be viable.

Overall, integrating sustainability into business strategies and operations can possibly create value, reduce costs, enhance reputation, attract investors, and contribute to long term profitability. By embracing sustainability, companies can position themselves for success in an increasingly conscious and environmentally aware market.

2.5 Stakeholder Management

Stakeholder management is crucial for sustainability. Stakeholder management is the process of identifying, analysing and actively engaging with stakeholders to understand and address their needs, concerns, or expectations. It involves building relationships and effectively communicating with stakeholders to gain their support and manage potential challenges. The key steps in effective stakeholder management are stakeholder identification, communication and relationship building. Identifying stakeholders in the shipping industry is especially complicated due to global presence. (Lie, 2018)

Lie (2018) found that reputation was the most important criteria when identifying stakeholders. It is essential to assess their reputation as it can impact their level of influence, potential impact on the organisation and the nature of their relationship with the entity. Stakeholders with a better reputation may have more power. They can appear more trustworthy and reliable. Trustworthy stakeholders

can contribute more positively to the organisation and work co-operatively towards shared goals such as sustainability. Furthermore, stakeholders with a bad reputation could pose more risks. While reputation is an important factor, it is crucial to consider other factors beyond reputation alone.

Corporate social responsibility is a business model that helps companies be accountable to itself, its stakeholders, and the public. (Fernando, 2023) With this in practice, companies can be aware of the impact they have on the world be it economically, socially, or environmentally. Adomako et. al (2022) found that high levels of stakeholder integration have a positive effect on a company's corporate social responsibility efforts. This further shows that ship owners should pay attention and manage stakeholders effectively to obtain the benefits of corporate social responsibility initiatives.

Technological advances can play an important role in stakeholder management. For example, Maersk and IBM came together to create TradeLens, to provide a platform to connect many stakeholders. (Merk, 2018) Effective communication can enable stakeholders to interact upon shared opinions, concerns, or feedback. Technology could aid the collection and analysis of stakeholders alike. By leveraging such tools, companies can gain key insights into stakeholders needs and expectations, enabling them to strategize more effectively.

Internal stakeholders in the shipping industry can vary depending on the specific organisation or company. However, some of the most common stakeholders typically found in this sector include ship owners, directors, employees. External stakeholders are individuals, or entities that have an interest or are affected by the operation, decisions, and outcomes of shipping companies. Some of the common stakeholders are the customers, suppliers, ports, regulatory bodies, financial institutions, and competitors. These stakeholders are often diverse and sometimes have conflicting interests. This can influence the decision-making progress and strategies of companies. Building upon these relationships and managing these stakeholders effectively can be essential for the success of a shipping company.

Parviainen (2018) found that stakeholders play a crucial role in shipping industry. They have significant influence on operations and decisions made to a company. The author says that with the low number of ship owners participating in corporate social responsibility related practices, the attitude of sustainability is not being enforced. The more stakeholders that put pressure on these changes, the more they can promote the implementation. Their collective influence and interactions can shape future policies and direction of the industry.

Yuen et. al (2020) suggests that the sustainability needs and expectations of the stakeholders are constantly changing and evolving with the changes to the competitive landscape. Be that of a political, technological, societal, or environmental nature. When this landscape changes, these stakeholders may reassess their priorities and demands.

To conclude, stakeholder management is integral to sustainability as it helps companies understand stakeholders' expectations, gain support, manage risks, and identify opportunities. Engaging stakeholders in a transparent and inclusive manner builds trust, enhances decision making and fosters collaboration. This ultimately leads to more effective and successful sustainability efforts.

2.6 Purchasing Practices

Sustainable purchasing practices in the shipping industry involve making environmentally responsible choices when procuring goods and services. Given the significant environmental impact of the shipping industry, adopting sustainable purchasing practices is crucial for the reduction of carbon emissions, promoting resource efficiency, and minimising ecological damage.

Sustainable procurement is a purchasing approach that takes into consideration the economic, social, and environmental impacts of a company's buying choices. (BITCI, 2015) Mecalux (2022) outline the benefits of sustainable procurement practices. These include cost savings, fewer risks from suppliers, environmental compliance, and optimising resources. Ship owners will need to procure a multitude of items such as provisions, consumable stores, paint, lubrication oil, spare parts, and safety items.

Kang (2017) claims the shipping industry needs to demand transparency to ensure sustainable procurement practices. Transparent supply chains allow

stakeholders to trace the origin of goods and raw materials. This is to ensure they are sourced responsibly. This transparency enables companies to then make an informed decision on choosing suppliers. The use of certification could aid in this to assist purchasers in making sustainable choices. Overall, transparency can drive sustainable purchasing by enabling stakeholders to make informed decisions. Promote responsible sourcing and reduce emissions.

Saric (2022) found that technology was the key to sustainable purchasing. Technology enables the collection of vast amounts of data related to products. These would include carbon footprints, environmental impacts, and performance. Companies can then make informed decisions based on accurate and up to date information. These data drive insights could potentially help identify area for improvement for the future which could aid in sustainability goals. This data could also help evaluate the environmental and social performance of suppliers.

Costa (2020) claims that efficiency goes hand in hand with sustainability. The introduction of the International Maritime Purchasing Association (IMPA) has had a positive impact in improving efficiency in maritime procurement. (IMPA, 2023) It provides a platform for collaboration, knowledge sharing and best practice exchange within the industry. The association has played a huge role in standardisation of maritime purchasing. By developing and maintaining standardised product codes, it facilitates efficient procurement processes and effectively streamlines communications between the buyers and suppliers.

Port state control inspections can indirectly contribute to sustainable procurement practices. While the primary focus of these inspections is to ensure safety, security, and environmental compliance of vessels, they can indirectly influence sustainable procurement practices.

Maersk (2021) writes that they are taking the next step in their sustainability journey in introducing sustainable procurement practices. As they are one of the biggest shipping companies in the maritime sector, this is a good example of companies paving the way to ensure compliance within the whole industry. Their procurement and content manager are looking into ways in which they can reduce their carbon footprint. One of the ways they have highlighted is by

working with their suppliers in reducing packaging and to promote a more transparent supply chain. (Maersk, 2021)

Assafina (2023) explores the industries initiative to ban single use plastic. The IMO outlines that if an aggressive action is not implemented, there will be '*more plastic in the sea than fish*'. The viability of replacing plastics water bottles with dispensers or reusable bottles should be considered. Buyers are encouraged to work with their suppliers to ensure solutions are produced to be line Annex 5 of MARPOL.

By adopting sustainable purchasing practices, the shipping industry can play a significant role in reducing its environmental footprint and contribute to a more sustainable future.

2.7 Conceptual Framework

The conceptual framework of research plays a central role in research. It provides the foundation for understanding analysing complex phenomena of certain topic. In this instance, the viability of sustainability in the shipping industry. This framework will help structure the knowledge discussed in the above literature review. This will make it easier to identify the relevant concepts.

Figure 2: Conceptual Framework

2.7.1 *Stakeholder Management*

Stakeholder management is a compelling aspect of a company's success in implementing sustainability. Effective management of stakeholders involves the understanding of expectations, needs and the varying interests of internal and external stakeholders. The above literature review combined with the primary research that will be conducted in chapter four, will enable a better understanding of the complexities involved with appropriate management of

stakeholders. The key steps in effective stakeholder management are stakeholder identification, communication and relationship building. However, Lie (2018) found that Identifying stakeholders in the shipping industry is especially complicated due to global presence.

2.7.2 *Working Environments*

Freeman theorises that '*organisations and corporations should always strive to do what is right for their stakeholders*'. (McAbee, 2022) There have been many advancements in auding the safety of seafarers in recent decades. Since the introduction of the International Safety Management Code, there have been far fewer personal injuries according to Storkersen. (2015) With the introduction of the Maritime Labour Convention, it is now in writing that seafarers must have good working conditions. These conditions include sufficient hours of rest, comfortable accommodation, food, and recreational facilities. (Bolle, 2006) With the aid of interviews, the exploration of the introduction of these conventions will be explored with relevant personnel.

2.7.3 *Environmental Issues*

Corporate social responsibility is a concept where a company can incorporate social and environmental responsibilities into the core of their business dealings. (Department of Enterprise, 2022) Shipping companies need to start thinking of the long-term effect they have on the pollution crisis. The emissions of carbon in the shipping industry are a matter for concern due to the significant contribution to global greenhouse emissions. Is there a more sustainable way of fuelling vessels in the maritime sector? Interviews will be conducted with engineering superintendents of vessels to formulate their opinions of the viability of sustainability in the shipping industry. The exploration of the options viable to the industry with regards to fuel alternatives or the prospect of hybrid or electric engines.

2.7.4 *Ethical Awareness*

As a major contributor to the global carbon emissions, the shipping industry should have an ethical responsibility to pursue sustainability. Ethics is knowing what is right or wrong. (George, 2018) In theory, anyone affiliated with the industry may know and understand what they are contributing to environmentally wise. However, goods still need to be transported as per the

demand of the consumer. Smaller shipping companies might not have the means to invest as heavily as bigger companies to aid these issues. Giving seafarers fair working hours and ensuring minimum wage requirements are met is ethically sound. However, should it be an ethical conundrum to reduce your environmental and social impact on the environment and the seafarers?

2.7.5 *Profitability*

Gurnani (2020) asks the question; '*can sustainability and profitability co-exist?*' The increased interdependence of these two topics is becoming the social norm. Is it a viable expectation for shipping companies to be equally sustainable and profitable? If not, the depletion of natural resources will ultimately be more costly to organisations in the long run. Not only by driving the costs of these resources higher if there is less of it, but also taking care of the earth we are inhabiting. The initial goal of operating a business is to make a profit but do we have to achieve that by destroying what is around us? Taking small steps into the investment of sustainability is what could make this a more viable option. Some companies might not have the capital for a more aggressive approach, as discussed above in the literature review. This will be explored further in chapter four.

2.8 Conclusion

In conclusion, the conceptual framework is essential for conducting accurate research. It also helps for the researcher to develop a clear and structured approach for the primary research design. It will provide the theoretical foundation for interpreting the method of research chosen which is interviews. The comparison of literature and primary findings will be discussed further in the findings in chapter four.

3 Methodology and Research Design

3.1 Overview

The below will outline the approach and plan used to conduct the research of my choice on the viability of sustainability in the shipping industry. It will outline methods, procedures and techniques that will be engaged with to ensure the collection and analysis on the appropriate research objectives and, ultimately, the research question.

3.2 Research Philosophy

My philosophy for this research is interpretivism.

This approach is most appropriate for this conduction as interpretivism proclaims that, according to Nickerson, '*understanding beliefs, motivations and reasoning of individuals in social situations is essential to decode the meaning of the data that can be collected around a phenomenon*'. (2022)

This is a broader approach than other philosophies, with the option of using a mixture of both qualitative and quantitative methods in their data collection. This would suit my chosen topic of the viability of sustainability in the shipping industry better. Presumably, there isn't a one size fits all answer to this research question. Sustainability must be unilaterally accepted for there to be a shift. This is why this philosophy suits this type of research as it focuses on understanding and interpreting human experiences and social phenomena. This paradigm will allow the conduction of the qualitative research that needs to be done to understand the above objectives. As quantitative research mainly deals with numbers, a qualitative approach would allow the conduction of several interviews to further understand the objectives as set out above in relation to the sustainability of the shipping industry.

As interpretivism is the opposite of positivism, where positivism is a narrow pathway to a single reality that can only be understood by observation, interpretivism holds that there are multiple viewpoints that could be established. (Rogers, 2020) The gathering of experience and professional opinions of relevant

personnel in this industry will be found by conducting interviews. Something such as sustainability could not be denoted using just statistics, but a more humane approach to this research would be more beneficial.

As the climate crisis is a man-made situation, societal norms and values on the supply chain industry must be changed. This is why it holds interest to conduct these interviews with personnel who oversee such departments in a shipping company.

3.3 Research Approach

An applied exploratory using a qualitative approach will be used for conducting this research.

My research approach will be exploratory. The purpose of this exploratory approach is to discover new ideas and insights on my research question which is on the viability of sustainability in the shipping industry. This goes hand in hand with interpretivism as is it flexible enough to offer an exploratory approach for my research.

Regarding my first objective of this research, interviews with the technical superintendent who is head of Monitoring and Reporting the emissions of vessels. For my second objective, speaking to the crewing manager to see how they assess seafarers working well-being onboard. Lastly, delving into such economic issues with procurement manager on how introducing this sustainability could possibly jeopardize on the profitability of a company. The aim of these interviews is to see if there are any common patterns or ideas that keep remerging when it comes to the sustainability of the industry or if they can offer any solutions.

As per Collis and Hussey, a qualitative approach will be used by the conduction of interviews which will then transcribed. These could also be turned into a quantitative if the frequency of particular words or themes were counted. Which would then be further analysed thematically. (Collis et al., 2014)

3.4 Implications for Research Design

When considering the implications of research design for this topic, several factors could be considered. Given the complex and interconnected nature of environmental, seafarer and economic sustainability in the shipping industry, a multidisciplinary approach is beneficial. Incorporating perspectives from various disciplines in the company will give a more comprehensive understanding of the issues that are to be researched. This is why I have decided to interview multiple people from various department for my research to ensure there is no one dimensional opinion or view.

The design could impact the validity of the findings. This is why it is imperative to ensure that the data collected is relevant and accurate to the topic being studied. This enables a more reliable and meaningful conclusion. By carefully considering the questions being asked in this interview, the validity could be enhanced. Time could also be an implication for this research design as the conduction of interviews could take several weeks. As a researcher careful consideration of available resources and time constraints need to be considered. The research design process is a critical element for a well-structured study. It could directly impact the validity and reliability of the research on the viability of the sustainability of the shipping industry.

3.5 Research Strategy

The type of data needed for this research topic will be extracted by means of interview. I would like to speak to experienced shipping professionals. Conducting interviews can offer several advantages. Interviews allow for more in-depth and detailed collection of thoughts and experiences. To further understand the topic, the offer of flexibility can allow researchers to change the direction of conversations if needed. Having already established positive relationships in the workplace with the participants, this could encourage to share more sensitive or personal responses to the question being asked. However, this data could potentially be influenced subjectively by their own personal views on such topics. Interviews are also very time-consuming as well as the transcription that follows.

This wouldn't be viable in a quantitative approach, for example in a dichotomous survey, once it is done it is done and there is no room for expansion on the answers given.

3.6 Nature of the Data

There are several main elements to my conceptual framework in relation to my research topic. These include stakeholders' management, working environments, environmental issues, and profitability. Between these elements, the nature of data required will be conducted through qualitative research in the form of interview with relevant personnel.

During conversations with the crewing manager, acquiring their views and vast experience on how they ensure safe working conditions for their crew could be explored. From my own knowledge, I know the crewing department have a 24/7 365 approach when dealing with their crew.

As interviewing members of my company might be highly subjective, interviewing personnel who I would not interact with everyday such as a captain, could be helpful in this data collection. A discussion on how Maritime Labour Convention aids the crew would be highly beneficial. From my understanding, crewing liaises with procurement to ensure there is always at a minimum of ten days of food onboard. Marine superintendents conduct inspections periodically to ensure safety practices and safety equipment is adhered to and up to date. If anything is expired or damaged, it is of the utmost urgency to replace. I want to know what the crewing manager, procurement manager and marine superintendent think of the conditions onboard.

Regarding the environmental issues, retrieving data from a technical superintendent would be ideal for my research. His views and experience on the environmental impact since the introduction of the Monitoring, Reporting and Verification report in 2017 would be beneficial. Has there been an actual improvement in greenhouse gas emissions or is it a money acquiring scheme? From my knowledge in our company, we have an extensive new build plan for the next five years. Did MRV have anything to do with this? Are these people

concerned about making changes for the environment or again, has this to do with long-term economic profitability?

3.6.1 *Data Collection Methods*

The method of data collection I have chosen is interviews and furthermore transcribing them. This is a qualitative strategy which gives me the most flexibility to collect data on my research topic. To collect this data, I will interview numerous members of the company that I work for as it is involved in the shipping industry. Our personnel have a wealth of opinions and experience which I would be an imbecile not to utilise.

Once these have been conducted with their consent, I record these conversations. I will then transcribe these interviews into a word document for analysis. From this, I would hope to conduct a thematic analysis to see if anything reoccurs in these professionals' views. I believe this qualitative and exploratory strategy offers the flexibility required for my research topic. I feel a survey would be too restrictive with yes/no answers. I would like to delve into the societal values and norms of people in the industry and their actual view of how this industry is affecting the planet.

3.7 Collection Primary Data

3.7.1 *Sources*

Interviews are commonly used as a method in research to gather data and gain in-depth insights into individuals experiences, perspectives, and subjective viewpoints. Through interviews, research can be a vast range of beliefs, attitudes, behaviours, and lived experiences. Careful planning, active listening, and rigorous analysis will help derive meaningful findings from interviews.

See below the participants in this study who will be interviewed:

Interview	**Title**	**Responsibilities**
1	Technical Director	Oversees all vessels and superintendents
2	Engineer Superintendent	Manages a number of vessels in the fleet, manages environmental compliance reports
3	Procurement Manager	Manages all purchasing of spares and consumables for fleet
4	New Build Superintendent	Oversees the new build program while managing a number current vessels simultaneously
5	Captain	Oversees all crew onboard vessel and its day to day operations
6	Crewing Manager	Manages all crew of the entire fleet - welfare and employment

Table 2 – Interview Participants including titles and responsibilities.

See Appendix C for the initial line of questions gathered, with room to expand on topics.

3.7.2 *Access and Ethical Issues*

As a researcher, adhering to ethical standards when conducting interviews on the viability of sustainability in the shipping industry is of the utmost importance. Respecting confidentiality, obtained consent, and ensuring anonymity are critical considerations in this research design. Sensitive industry information may be discussed and ultimately not used in the written report.

A consent form will be drafted before any interview is conducted in which we will both sign to ensure the above is addressed. Although all departments in the company would be sought after for interview, coercing personnel to be a part of this research will not be a method used. It is completely voluntary. Feeling at ease and safe during conduction is important. Names can be used if they consent but if they do not want the implications of their words to impact them negatively in the future, they do not have to reveal their identity. They can be assured that any recordings will be destroyed after relevant information is transcribed for this report.

As per the above, the participants need to feel like they are in a safe place. Once the consent form is signed and agreed to, it will be known to them that they can still withdraw at any time if they wish to do so with no issue from this side. The assurance that these interviews are done in a space that they feel comfortable and safe is essential.

3.8 Approach to Data Analysis

My chosen method of data analysis is narrative analysis. A narrative analysis approach is when a researcher tries to understand how the participants construct story and narrative from their own personal experiences. In this case, it will be that of interviews. Furthermore, I will then interpret their development of that narrative. (Delve et. al, 2020)

To present this data of interviews as results, I will firstly listen to the recordings of the interviews and then transcribe them. This will be used for my thematic analysis. Having interviews from recollection would not suffice as these memories could get misconstrued and not show their full truth. To organise this data, I will have these transcriptions saved as Microsoft word documents. To analyse, I will use a narrative and thematic approach. I will interpret their views, morals, and experience throughout the transcription to see if there are any commonalities or reoccurring themes.

Grounded theory could be used for these findings. This is when the researcher finds themes that are repeated and then codes the emanant themes by using buzz words or phrases. Coding, to put it simply is the process of labelling and

organising your data. This helps to identify the themes for the analysis. (Medelyan, 2022) Grouping those codes into concept and consider how they are linked together. Use these relations to build theoretical models and finally present the results using quotes from the conducted interviews. (Bernard, 2000)

4 Presentation and Discussion of the Findings

4.1 Overview

The viability of sustainability in the shipping industry is important for so many reasons. The industry plays a crucial role in global trade, but because of this has had a significant impact on environmental challenges. This is due to the sectors reliance on fossil fuels and the emissions of greenhouse gases. This research concentrates on the viability of sustainability in the shipping industry with the objectives lying in three keys areas. The focus will be on the environmental impacts, seafarer sustainability and the concept of being profitable and sustainable simultaneously. Throughout a multitude on interviews with the relevant experience, the findings will be presented accordingly below.

4.2 Findings

4.2.1 *Fuel Alternatives*

As per interview 1, we discussed Ammonia as a potential alternative fuel source for the shipping industry. But it does come with certain safety considerations for particular the crew onboard. Ammonia is a toxic substance and exposure to high concentrations can be harmful to a human's health. It could possibly cause respiratory issues or irritation to eyes, nose, and throat. It can also potentially be highly flammable. This would put a lot of pressure on the crew to handle the substance appropriately to mitigate the risk of fire or explosion. If this substance is mixed with the aur at a certain concentration, it could be very dangerous. Rigorous training of the seafarers would need to be ensued to ensure the safe use, transportation, and storage of the ammonia. The appropriate personal protective equipment would need to be purchased, maintaining proper ventilation, and implementing leak detection and emergency response systems.

It was discussed if this type of infrastructure was implemented in our company's new build program yet, but we are ways off. Bigger companies would be at the forefront of this innovation. The type of infrastructure onboard that would need to be considered would be the likes of specialised storage facilities, fuelling stations and the on-board systems. Designing and eventually implementing this infrastructure would be for safety to prevent future accidents and ensure safe inboard operations.

Ultimately, the successful adoption of ammonia as an alternative fuel in the shipping industry will require a comprehensive approach that prioritises safety at all stages. The most important aspect being that of human health. However, the impression I got from this interview is that we are a long way away from fuel alternatives.

The term 'green washing' also came up which was interesting. This refers to the practice of misleadingly promoting a company, or service in this instance, as environmentally friendly or sustainable. This came up upon asking why this company did not have a sustainability report if even for the board of directors. He believes these shipping companies that do, their actual practices may not align with those claims. This is deceptive marketing that would aim to lead to a more positive public image by emphasising their involvement in sustainable practices without showing true transparency.

4.2.2 *Policy and Regulation*

With speaking to interview 2, he is the expert in this field in my company. MRV stands for Monitoring, Reporting and Verification. This is a regulation that was implemented by the European Union to monitor and report CO2 emissions from vessels over 5,000 gross tons that call at European ports. This regulation requires shipping companies to collect and report this data, including CO2 emissions, fuel consumption, distance travelled, and cargo carried, for each voyage. He highlights that the purpose of this regulation is to promote transparency and accountability. At the end of every year, each vessel in the fleet is given a certificate so charterers can clearly see their emissions and then decide if they would like to do business with the company.

Under this regulation, ship owners are required to develop and implement a monitoring plan that outlines the procedures and methods used to collect and report the required data. This data is then independently verified by accredited third party organisations, for example Bureau Veritas. This is to ensure accuracy and reliability.

IMO DCS stands for International Maritime Organisations Data Collection System. This difference between this and MRV is that it is global, not just European as per

interview 2. It operates on the same basis that companies must collect and analyse data on fuel consumption, energy efficiency and CO2 emissions. It is also for vessels over 5,000 gross tons. It aims to provide the IMO with accurate and comprehensive data on emissions from a global perspective.

The data collected through the IMO DCS is used to establish a baseline for greenhouse gas emissions from the shipping industry and to inform future policy decisions and measures aimed at reducing these emissions. The system helps the IMO and member states gain a better understanding of the industry's environmental impact and progress in achieving the IMO's zero carbon goal for 2050.

Interview 2 claims that for shipowners to stay focused on emission reduction, both the IMO and EU have further proposals that would effectively be a money-making scheme, quiet to the contrary to the literature as discussed in chapter 3. Ship owners would have to offset their emissions using an Emission Trading Scheme. He says that the IMO is proposing to use data from the Carbon Intensity Indicator reports as the basis for their Emission Trading Scheme and the European Union would use the data from the MRV reports.

Interview 5 confirms the pressures Captain and crew onboard are under to comply with these new environmental regulations. He confirms that while everything is much more stressful onboard than ashore, the introduction of having to track and monitor and produce the correct paperwork adds to the strain of working in the maritime sector. For every voyage, it is up to the captain to upload certain documents to shore personnel so they can produce the report yearly to a third-party verifier, such as Bureau Veritas. The documents to be uploaded every voyage is the bunker delivery notes, fuel consumption, relevant deck logbook pages showing distance travelled and hours underway and the bill of lading.

4.2.3 *Sustainable Purchasing Practices & Stakeholder Management*

With talking to a maritime buyer with many years' experiences, their take on sustainability in the shipping industry from a procurement perspective was interesting.

Their take on sustainable procurement was this. If the vessel needs an item urgently onboard, it does not matter the cost or the impact on the environment. The demand for urgent spares onboard refers to the immediate need for replacement parts or equipment on a ship. These could address unforeseen breakdowns or damage to critical systems or components that could affect the vessels operations or safety. This demand can arise due to several factors. These could include mechanical failures, equipment damage or just normal wear and tear. In these situations, it becomes a necessity to quickly identify and replace the faulty or damaged parts to restore the vessels full functionality and minimise the downtime as to not incur any overtime costs. All that matters at that time, it that what is required is procured and delivered in a timely manner. This can relate to anything ranging from food, which ultimately relates to seafarer sustainability and is a Maritime Labour Convention requirement or an item for an engine or for the gantry cranes which is critical for the operations of the vessel. If either of these are not actioned, the crew will suffer, or operations will cease which will cost the ship owner more economically.

As the above is for more exceptional circumstances, the day to day procuring of items could potentially become more sustainable. Interview 3 contracts the ability for a transparent supply chain in the shipping industry. We do not have the luxury of picking and choosing suppliers based on their sustainability factors. Most parts onboard these classes of ships have only one or two suppliers that we can go to for the parts. Where we can, we try to find a cheaper, local alternative in the country that can duplicate.

Whenever possible, we try to prioritise local sourcing to reduce unnecessary transportation and the associated carbon emissions. We try our best to manage stakeholders, in this case our suppliers, to engage and explore new opportunities to support the local areas while simultaneously ensuring sustainability to minimise environmental impacts.

It was suggested in this interview that we should review our procurement practices to identify areas of improvement. Monitoring and measuring key sustainability indicators such as greenhouse gas emissions, the waste we generate, and supplier performances came up. To ensure this implementation, a target mist be set and continually track this progress.

The purchasing department for this ship owner also outlined that consolidating deliveries to vessels is a valuable strategy to enhance sustainability in procurement and logistics. Consolidating deliveries can allow for the optimisation of transportation routes and load capacities. This will reduce fuel consumption and in turn lower greenhouse gas emissions. Vessels can minimise the number of trips required to transport goods. Not only is this environmentally beneficially but can be economically beneficial too. If ten orders are sent together from the one supplier instead of ten different delivery fees, this could be huge for cost reduction.

She suggested, in her experience, another element of sustainable procurement would be bulk buying. This offers benefits of sustainability. When purchasing items in bulk, the packaging is minimised compared to buying a single item. By reducing this packaging waste, we are helping to aid in the reduction of waste sent to landfills or incineration. Some of the items that have been decided to bulk buy, after careful analysis from our procurement tool Kongsberg, is chemicals used on board and filters. With the help of the engineers in the company, a 'remaining on board' sheet was produced to ensure the optimisation of procurement of these goods. A minimum and maximum was set to ensure there is enough capacity onboard to store, and so that when they are in a good area to procure the maximum amount to ensure there is no waste in transportation and packaging as per the above.

4.2.4 *Crew free vessels*

This concept which had not been pursued in the literature review that was brought up with my interview with a new build engineer, interview 4. He believes the future of the sustainability in shipping are autonomous vessels. This type of vessel would be a technological innovation as they would be unmanned. This would have the potential to revolutionise the way goods are transported across the globe. Some of the potential perks of this type of vessel were noted during the interview. He claims that these unmanned vessels have the potential to increase efficiency like never before while reducing cots to the ship owner. They could run twenty-four seven without the need for crew shifts and times of rest. This continuous operation can therefore lead to faster delivery timers and increased productivity. However, this would also result in the loss of a huge number of jobs

in the maritime sector. Thus, the research conducted on sustainability of seafarers rendered null and void.

While the introduction of autonomous shipping is still relatively new, there are many hurdles to overcome before this practice would become commonplace. Some pilot projects are underway which interview 4 has been following with numerous companies and organisations actively researching and developing technologies.

4.2.5 *Seafarer sustainability*

Seafarers play a vital role in the industry, facilitating the movement of goods and connecting economies worldwide. Ensuring their sustainability is essential towards their well-being, job security and quality of life. They spend months at a time from their friends and families. They face unique challenges that people ashore are not accustomed to. These include long working hours, isolation, and mental health issues. Prioritising their rights and ensuring fair work conditions would be of the utmost importance to a shore side crewing manager.

As per interview 5 & 6, safety at sea is key to seafarer sustainability. As they are responsible for operating ships and ensuring safe navigation, it is imperative that proper training, rest period and maintaining physical and emotional well-being are maintained. Tired or stressed seafarers can lead to accidents, with the introduction of the ISM code and the Maritime Labour Convention this can be monitored and ultimately prevented.

Interview 6's philosophy with adding crew to a vessel, is to look at all personnel to see how they would fit together. She looks at who they have worked with before on previous vessels and how they got along. She believes that immersing alike cultures will bring sustainability and harmony to the crew onboard and ultimately lead to a happier working environment. Positive relationships among crew members can promote effective teamwork. This not only promotes a happier environment but can also leads to more effective working habits which benefits the ship owners.

Providing seafarers with sufficient rest and promoting a healthy work- life balance is essential to their well-being. Proper work hour management and adherence to rest-hour regulations is crucial. It is a requirement for the captain to submit these

hours to onshore personnel who will go through this meticulously and if there are any misconducts, it will be dealt with immediately to ensure the rights of the seafarer involved. She also outlines that there is an MLC complaints procedure posted in every messroom of every vessel so that the crew know how to get in contact if there ever was an issue.

Recognising and rewarding the efforts of the seafarers can boost morale and job satisfaction. As Filipino crew are onboard longer than their European counterparts, she says that they are usually allotted an entertainment fund to reward their hard work and time spent away from their families. This can be purchased locally or the purchasing team ashore can aid in this. They purchase anything from gym equipment to karaoke machines to get them through their time onboard and to have more fulfilled off time.

Inter 6 also mentioned that there are sensitivities to cultures when addressing sustainability of seafarers onboard. Cultural rules are established to promote a more harmonious and productive working environment amongst the crew members who come from diverse backgrounds and cultures. These rules help ensure mutual respect, effective communication, and good cooperation onboard for most of the time. For example, it was mentioned that Filipino men and women are a lot more sensitive than those of the western world. When she started in the shipping industry, there was a set of cultural rules sent to captains to ensure these sensitivities were addressed amongst crew members to ensure a better working environment for all involved. This might seem biased to one culture, but it was for their benefit.

She outlines that they have a 24/7 365 policy with all crew members. They are available anytime via phone if there is ever an issue. Onshore personnel provide the open communication to seafarers, so they are a trusted link to ensure sustainability. the needs of the seafarer are crucial, and she confirms that if anyone is not feeling right onboard and needs to come off, they will ensure they will be taken off at the next port. If a seafarer has a tooth ache, a dental appointment will be arranged, if it is a medical emergency, a doctor or hospital visit will be arranged. Though this interview, you can tell through her years of experience that the team care for the men and women onboard and will do anything required to ensure their sustainability and well-being.

4.3 Discussion

To successfully discuss the literature and findings, we must reconsider the original objectives in chapter 1. These were:

1. **Objective #1**

To form ways in which the shipping industry can minimise environmental pollution.

2. **Objective #2**

To ensure sustainable working conditions for the crew members onboard vessels.

3. **Objective #3**

To establish if it is possible to be sustainable and profitable.

The viability of sustainability in the shipping industry is a topic of significant importance. The environmental impact that this industry has is a significant contributor to global emissions, air pollution and marine pollution. A huge discussion in both the literature and the findings from the interviews conducted was that of reducing greenhouse gas emissions such as carbon dioxide. The International Maritime Organisation has set targets to reduce this carbon emissions for 2050 and is actively working on implementing measure to achieve these goals such as the adoption of EEDI, MRV and IMO DCS.

Larger companies and organisations are investing heavily into the research on alternative fuels. This includes the development and use of low-carbon or zero-carbon fuels such as LNG, methanol and ammonia as discussed above. Additionally, as discussed with interview 1, there is growing interest in wind-assisted propulsion that he recommends should be investigated further for the viability of sustainability in the shipping industry.

The industry does recognise that collaboration amongst stakeholders is needed to drive this sustainability, however Parkes (2023) just recently wrote about the

current issue at hand. She states that methanol has the protentional to become a 'big problem'. Under the influence of a big stakeholder in the industry Maersk, there is concern that more shop owners will order methanol dual-fuel engine ships. This should be a positive step for sustainability but as there is not enough methanol produced to keep up with the demand, sustainability will take a step backwards as ships will be back running on just diesel. This collaboration fosters innovation, but are we pushing the timeline too fast currently? Their attitude in interview 1 towards sustainability and investing into the future is directly linked to Parviainen (2018) idea that the dry bulk cargo shipping industry is 'lagging behind' with the idea of sustainability and their practices.

Ports play a crucial role in the sustainability of the shipping industry. Developing shore power infrastructure to enable vessels to connect to the electrical grid while at berth cold be a viable option if the investment into wind turbines was an option, as per interview 1.

As per interview 5 & 6, safety at sea is key to seafarer sustainability. As they are responsible for operating ships and ensuring safe navigation, it is imperative that proper training, rest period and maintaining physical and emotional well-being are maintained. Tired or stressed seafarers can lead to accidents, with the introduction of the ISM code as per Storkersen (2017) this can be monitored and ultimately prevented.

Day to day procuring of items can become more sustainable. As Kang (2018) found previously in chapter 3, transparency of the supply chain enables companies to make informed decisions on choosing suppliers. Interview 3 contradicted this. In the shipping industry, we do not have the luxury of picking and choosing suppliers based on their sustainability factors. Most parts onboard these classes of ships have only one or two suppliers that we can go to for the parts. Where we can, we try to find a cheaper, local alternative in the country that can duplicate.

As per Gerretsen, (2022) the belief is that this funding for sustainability in the shipping industry should come from public funding. Is it fair that the private sector have to take on all the risk in relation to the investing of the future of the shipping industry? Smaller companies, such as in the interviews, may be hesitant to invest

due to the high upfront costs and uncertain returns in this investment. Larger companies such as CMA CGM, who have the up-front capital to invest in such technologies and to invest capital into research projects, seem to be the collaborators for change in the industry.

One of the world's biggest shipping companies has shown commitment to the cause of sustainability by various initiatives. One being their investment of two hundred million for projects on decarbonisation. (Howard, 2023)

4.4 Conclusion

While there is significant potential for sustainability improvement in the shipping industry, there are also several limitations and challenges that need to be addressed.

Implementing sustainable practices in the shipping industry often requires the available of appropriate technologies and infrastructure. However, some of these technologies needed to contribute to this zero-carbon journey as discussed in previous chapters is just too early in development to be effectively evaluated. Scalability, cost-effectiveness and compatibility with existing vessels and infrastructures are still being assessed.

The cost implications of investing in some of these technologies and practices just aren't viable for smaller companies such as discussed with interview 1. The investment required to retrofit existing vessels with sustainable features can be significant. Alternatively, investing in a whole new fleet would not be an option for most companies. This cost factor can be a potential barrier for ship owners. The average lifespan of a ship is round twenty to thirty years. This means even with the introduction of new sustainable technologies; it would take time to replace the existing fleet with more sustainable vessels. Fleet renewal rates could potentially hinder the rate at which sustainability can be introduced.

The effectiveness of sustainability initiatives in the industry could potentially be influenced by regulatory and policy frameworks in place. Clear and supportive policies are necessary to incentivize sustainability practiced and create a level playing field for all industry participants.

We discussed the lack of government funding into the infrastructures of ports. The availability of sustainability infrastructure, such as ports with shore power facilities or alternative fuelling stations can be limited. The development and implementation of green port infrastructure require huge investments and coordination between stakeholders. This lack of infrastructure could hinder the adoption of sustainable practices. This would require tremendous collaboration between stakeholders. These would include shipping companies, port authorities, policymakers, and technology providers. If everyone has the same common interest this would be easy but, this potential worldwide collaboration could be challenging as stakeholders could have differing interests, limited information sharing and complex decision-making processes. As the shipping industry operates on such a global scale, this could present challenges too. Cooperation and coordination among different nations re necessary to ensure that sustainability efforts are effective and not undermined by jurisdictional discrepancies.

While the urgency of spare parts onboard vessels is essential for ensuring smooth operations, it does not necessarily outweigh the needs for a sustainable approach. It is important to strike a balance between immediate operational needs and long-term sustainability considerations.

To conclude, it is essential to recognise the above factors and address them head on through collaborative efforts amongst industry stakeholders and researchers. Overcoming these challenges will contribute to the gradual transformation of the shipping industry towards a more sustainable future.

5 Concluding Thoughts on the Contribution of this Research, its Limitations and Suggestions for Further Research

5.1 Implications of Findings for the Research Questions

Research on the viability of sustainability in the shipping industry has significant implications for stakeholders in the sector. It can be driving force for positive change in several areas. Some of these key implications include the following:

The significant environmental impact the industry has, especially in terms of greenhouse gas emissions. This research further confirms the urgent need for the industry to adopt sustainable practices and reduce its carbon footprint to mitigate climate change.

The above findings confirm the importance in which the compliance of environmental regulations as set out by the International Maritime Organisation. It highlights the need for ship owners to adapt their operation and practiced accordingly to meet these evolving regulations such as EEDI, MRV, IMO DCS and the introduction of carbon levy's.

The role of future technological advancements is a huge implication in driving sustainability in the industry. The adoption of alternative fuels and emission reduction measured are crucial to achieving sustainability goals as set out by the International Maritime Organisation. The findings highlight the importance of this research and the need for collaboration between industry stakeholders to do so.

The findings suggest that stakeholders increasingly expect the shipping industry to demonstrate their commitment to the sustainability efforts. To communicate these efforts with transparency can build trust and enhance your reputation.

The finding also shed light on the importance of seafarer sustainability. Ensuring the crews welfare is not only an ethical responsibility but also contributes to a more sustainable workforce and industry reputation. Considerations should include fair working conditions, correct rest periods, access to healthcare and overall well-being.

While there be huge upfront costs associated with adopting sustainable practices, there could be potential long-term savings through fuel efficiency, compliance with environmental regulations and improved market positioning.

The findings highlight the importance of finding the right balance economically through the viability of the environmental goals.

By bridging the gap between knowledge and practice, this research could potentially contribute to a transformative shipping industry towards greater sustainability and environmental responsibility.

5.2 Contributions and Limitations of the Research

Research on the viability of sustainability in the shipping industry faces several limitations. These limitations can potentially hinder the progress and implementation of sustainable practices for companies.

The first most notable limitation which was discussed in the previous chapter with Interview 1 are the economic constraints. Implementing sustainable practices in the industry often requires a significant investment in certain technologies, infrastructure, or operational changes. Smaller companies, such as in the interviews, may be hesitant to invest due to the high upfront costs and uncertain returns in this investment. Larger companies such as CMA CGM, who have the up-front capital to invest in such technologies and to invest capital into research projects, seem to be the collaborators for change in the industry. The development and implementation of these technologies can be quite complex. Finding these alternative fuels that are not derived from fossil fuels remains a challenge, as per the literature and in the primary research. Finding propulsion systems that are both environmentally friendly and economically viable remains a limitation.

The life span of vessels could be an economic limitation. As some vessels have longer life spans than others, they could be in operation for decades before they are phased out. That means that even if sustainable technologies are produced, it will take time for them to be adopted as companies might not have the capital to invest in an entire new fleet. This will ultimately result in a slower transition to sustainability.

Infrastructure could be a problem in sustainable practices if they are not invested in also. Sustainable shipping practices often require improvements in port infrastructure, such as the available if shore power, as discussed with interview 1.

If Liquified Neutral Gas becomes the steppingstone of fuel sustainability, safe and operational bunkering facilities will be required.

Collaboration amongst stakeholders, be it ship owners, ports, or governments, are crucial for driving the viability of sustainable change in the maritime sector. Collaboration can sometimes be hindered for selfish reasons such as competitive interests and lack of trust. This could potentially slow down the research and implementation of sustainable solutions if stakeholders do not come together for the greater interest of global sustainability as this is one of the most polluting industries in the world.

There are certain limitations on the research of the quality of life of seafarers. The literature found was often fragmented. There were numerous studies but only concentrating ion one specific area such as mental health or working conditions. The timelines of studies were also relatively short. Extended timelines of research in tracking seafarers onboard could be beneficial to the understanding of their sustainability. While these gave very valuable insights into the sustainability of seafarers, there is a need for more comprehensive research that considers the multifaceted nature of seafarer sustainability. However, this area of sustainability might receive the necessary funding compared to environmental concerns in the shipping industry.

As seafarers come from a multitude of different cultural backgrounds, language barriers could hinder effective communication and understanding if their own sustainability concerns. If it was possible to conduct research in multiple languages to ensure accuracy could be crucial in capturing their experiences and needs onboard vessels.

In depth research of the possibility of profitability while being sustainable could be limited as companies would not be willing to offer such sensitive information such as financial data. This lack of access to the data required could impede research in the analysis of the viability of sustainable practices and identifying the financial benefits of adopting sustainable measures in the shipping industry.

As open, semi-structured interview were used in this research, there were large amounts of information to be processed. If the interviews were more structured, there could have been more standardisation of the answers for comparison

purposes. There is high likelihood that interviewees would give different answers to the same questions as they would have a different perception of an issue.

Addressing these limitations will require huge efforts from various stakeholders. Collaboration, increased funding for research and policy incentives could be key to overcoming some of these challenges, environmentally, socially, and economically, to drive the push for sustainability in an industry that needs it. Fostering a culture of transparency and providing incentives for sustainable practices could contribute to the viability of sustainable practices and encourage more companies to invest.

5.3 Recommendations for Practice

To promote the viability of sustainability in the shipping industry, here are some of my recommendations from my research on the topic:

Ship owners must try, be it big or small, to invest in more efficient vessel designs for their new build programs. This could include improved hull designs or more environmentally friendly propulsion systems. They could utilise smaller changes such as LED lighting. These changes combined lead to more sustainable practices and will increase the overall viability or the future.

The adoption of alternative fuels will very soon be a requirement in the industry. Exploring the transition to such alternatives as liquified natural gas of methanal with lower carbon emissions will promote the development of sustainability in the maritime sector. If stakeholders decide to collaborate on this decision, it will push the industry forward to hitting their environmental goals. They will need the aid of onshore development of infrastructure with the aid of bunkering stations and the relevant trained personnel.

As discussed in interview 1, the investment of renewable energy would be wise for sustainable practices. Wind turbines could provide power needed for vessels during port stays. This in turn could reduce the reliance of fossil fuels and eventually decrease emissions.

To promote seafarer sustainability and enhance their well-being overall, the industry should ensure fair employment practices. With the introduction of the

MLC, the standards have rose. It is up to ship owner personnel and Captains to ensure these international standards are being adhered to. Adopting fair and ethical employment practices prioritise seafarers right to fair wages, reasonable working hours and ensuring they have adequate rest. Establishing access to communication 24/7 fosters a culture of safety. This encourages seafarers to report any concerns they have onboard without retribution.

By implementing these practices, the shipping industry could move towards a more sustainable and responsible future, balancing profitability with long-term viability. prioritising the sustainability of seafarers, not only the environmental impacts, ensures their well-being and long-term retention in the profession. This in turn will ensure compliance with environmental regulations.

5.4 Final Conclusion and Reflections

To conclude, it is uncertain if it is viable currently to be sustainable in the shipping industry. However, there are certainly a lot of measures in place to ensure the future of sustainability.

The above findings confirm the importance in which the compliance of environmental regulations as set out by the International Maritime Organisation. It highlights the need for ship owners to adapt their operation and practiced accordingly to meet these evolving regulations such as EEDI, MRV, IMO DCS and the introduction of carbon levy's.

The role of future technological advancements is a huge implication in driving sustainability in the industry. The adoption of alternative fuels and emission reduction measured are crucial to achieving sustainability goals as set out by the International Maritime Organisation. The findings highlight the importance of this research and the need for collaboration between industry stakeholders to do so.

The findings suggest that stakeholders increasingly expect the shipping industry to demonstrate their commitment to the sustainability efforts. To communicate these efforts with transparency can build trust and enhance your reputation.

The finding also shed light on the importance of seafarer sustainability. Ensuring the crews welfare is not only an ethical responsibility but also contributes to a

more sustainable workforce and industry reputation. Considerations should include fair working conditions, correct rest periods, access to healthcare and overall well-being.

While there be huge upfront costs associated with adopting sustainable practices, there could be potential long-term savings through fuel efficiency, compliance with environmental regulations and improved market positioning. The findings highlight the importance of finding the right balance economically through the viability of the environmental goals.

By bridging the gap between knowledge and practice, this research could potentially contribute to a transformative shipping industry towards greater sustainability both economically, socially and environmentally.

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Appendices

Appendix A – Sample Interview Transcript

Technical Director of a shipping company:

Gregan

What type of fuel do you currently use onboard our vessels?

Interview 1

Currently we're burning vlsfo which is very low sulphur fuel oil and gas are the alternatives now looked like initially possibly a mix of gas oil, fossil fuels and biofuel element which is known as B 20 or 30. The same wristwatch environment in your car. There's an element or a percentage in which that is a fossil fuel, your pair of cars petrol it's E 10 which is 10% which is an ethanol-based biofuel. So, ships we can burn up to without any modifications, whatever it is, you can burn up to 70% bio. That may be as a starting point that we cut our carbon output by 30% by burning 30% of our fuel's environment. But that's only a transition as well as energy. We're not seriously looking at LNG because it's only a transition fuel and the capital customers just to the two main front runners now for alternative fuels or methanol, and ammonia.

Gregan

Do you have a plan to put that into use anytime soon? or do any ships use them?

Interview 1

Companies are investing an enormous amount of money in infrastructure, the big boys like Maersk are building a plant to produce methanol in one of the ports that they will be going to. So, they can say to an engine manufacturer I need methanol engine. Here's my plan. for building the next six or seven ships that will become used in five years. You must have an engine ready for me by

then. And they will often start producing methanol for themselves and then you can sell it to other people and use it but that's the big question. Yeah.

Gregan

Do you think most companies are hesitant to go towards the alternative?

Interview 1

Timeline if I was to say tomorrow that I have a contract to build the ship and I want to push the engine and nobody now can say to me, there you go. Give me an engine with this certified methanol ready. What that means is sometime soon, there will be a kit or a package that I can install on my engine which allows me to consume some time they won't put a timeframe and they won't put a price. So, I cannot say tomorrow if I had a source of meds and all of them had to ship the story that it would have an engine, but methanol is the nearest solution. Ammonia is even further down the line. And they're only now discovering how much problems they're having with ammonia. It is highly toxic. Gas. Liquid 25 parts per million is where it starts getting dangerous 200 parts per million short term exposures potentially.

Gregan

Would that be for the crew, or the people that bunker? Or humans in general?

Interview 1

Humans or animals in general. It is also proving very difficult to consume it in a machine and engine that will not produce even more emissions. Not carbon base, but nitrous oxides. Ammonia is primarily a compound of hydrogen and nitrogen. And nitrogen when you burn it in the presence of oxygen combines short term long term which produce nitrous oxide. Nitrous oxides are greenhouse gases. So, there must be after treatment. So as far as I'm concerned, ammonia is slipping down the list of viable fuel options. So methanol in the last six or eight months, maybe longer initially looked like

ammonia was going to take over the long sea voyage. So that is the big container ships running from China to Europe. And methanol is going to take over the short term, the likes of our ships. But now methanol seems to be jumping into both of those areas. Because it's easier to store on board. It's easier to prepare for combustion and it's better in the long run. Coming out of the edge with one major caveat the component to methanol, currently all methanol is made from coal or LNG that's black or grey to produce green, five different colours. Don't ask me them all. But let's say we want good methanol. We must have enough windmills that are producing excess hydrogen and then use some sort of carbon capture system to mix that hydrogen with carbon from the air to reduce methane. It's a highly expensive and there's an awful lot of losses along the way. So, methanol is a big downfall as it still has a carbon compound, you're still producing carbon dioxide and there's no way around that unless you find a cheap way of making methanol from hydrogen from wind. So, the next alternative which may be coming down the future after those two is hydrogen wind power they're talking about eight gigawatts in Ireland alone to produce for wind power offshore. That would leave them something like three to five gigawatts excess energy, and the plan has always been to use excess energy to produce hydrogen and once you have hydrogen, you have a storable energy. The problem with electricity is you either use a real problem with hydrogen is it's incredibly difficult to store liquid or gas. And it's incredibly toxic.

Gregan

How would you store it on the ship then?

Interview 1

You have two methods. You can hide pressure gas, or you can supply it people's credit genetically storage is minus 200 and something degrees Celsius.

Gregan

Are the IMO investing in this or would it be all the private shipping companies?

Interview 1

Nobody or very few governments are investing in possible exception of the Norwegian government or in places like that, that will give companies assistance. The IMO is just a rules place where all the international organizations come together all the countries come together and decide on what the rules are going to be. The Irish Government have not put their hand in their pocket at all they have done nothing to help along the erection of wind turbines offshore. They will not have ports to get themselves ready for and what needs the project bear they will not build windmills.

Gregan

So, do you think this should be a governmental problem?

Interview 1

I don't think it should be a government problem. But I certainly think that they should aid. At some point, we will get to carbon neutral, but there's a road we must take. Some people seem to think you can jump across problems and go straight to carbon neutral without spending a penny. And that's just not going to happen. It's going to take a lot more if they would let us use more gas with the alternative. The same time to produce more wheat which will produce more hydrogen which you can then change into the gas system, and you will then have a carbon neutral future. All they're doing now is you must drive an electric car you must change your house to electric by the way we don't have enough electric until unless the winds are blowing. When the wind is blowing. You can turn on your dishwasher and every time somebody says I want to build a windmill this evening you can't do that there somebody says no and their current plan will barely keep up with what is needed in the country. And I'm not talking about data centres but they're a factor, but just about they want to do electrification of transport there will be no excess energy for the likes of aeroplanes, ships, that cannot carry electricity and on that on jump across the

batteries, for ships to if you cannot carry enough energy on the ship in a battery to get you very far.

Gregan

What about solar panels? Have we investigated that yet?

Interview 1

They're not viable. The maximum you can get on a square meter is about 350 watts. Let's say we had 100 square meters of solar panels. We do much for a second what we put propulsion on board.

People forget that when you're cruising along on the road your foot is not flat to the floor on your car. So, you're cruising at 100 120 You're using about q quarter of what your engines output to accelerate. When the ship was moving through the sea as its designed speed the flow of the forces metaphorically speaking about eighty percent. So, it's consuming an awful lot more fuel per hour, or it must have an awful lot more power. Resistance through offers a lot more than rolling resistance. And their biggest things too. Bad batteries just when we're talking about the price for kilowatt hour storage on the ship is 1000 euros and for us to run overnight on a ship with cargo operations let's see. Easy to install from eight o'clock at night at eight o'clock in the morning. We need a megawatt that's 1000 kilowatt hours. So just for battery bank, to keep us supplied with lights, water, just the day to day just overnight is ours. We would need a million euros worth of battery or we could use that for moving the ship for 45 minutes approximately. So, where people have put batteries on ships, what they're doing is they're sailing up to the entrance to ports. They're turning off the engine, turning on the batteries. And they're just making it to the harbour. So, let's say we've got a half an hour's worth of battery diversity and the ferries reusing them and they're saying they're you know, they're green while important and then they can plug in, charge up the batteries before and that leads on to the next problem. There's lots of problems.

I've been told that there's various in Norway and Sweden that use diesel engines whether it's seen but they fitted these battery banks that they will

switch across to when they enter the port to get them alongside them. And that's about 30 minutes, maybe an hour max.

European Union has decided that all ferries container ships by 2025 have to have the facility to take power from shore so they won't be put in corrupt or matrix nitrous oxides into the air in city so let's say Dublin you're very City Central in the port and all the ships they're pumping carbon dioxide and nitrous oxide and they want to do away with some of that conditioning and then all of it is deployed into ships. docking port can supply 11 megawatts 11,000 kilowatts into the grid Monday can supply that. There are four ferries regularly running internationally, not including any container ships. They need two and a half megawatts each just to supply them with power just when they're at their current configuration. So, without her the battery banks without any extra equipment on board that they could be using. Just to supply their hotel load test. All the passengers' lights, beer, coolers on the ferries, everything like that everything that needs a little bit of power is 2500 kilowatts. The import can only just supply 11 and they are being asked for 10. The 11 is keeping them going with the ESB and was asked for are showing numbers. They just said no, we can't do that. But that's going to be a legal requirement under reports as I talked to one of the ferry operators and he said what he wants to he wants to fit his ship with batteries that he can get an hour out of port and then say two hours on diesel to get to the other side to charge up his batteries on the other side. And now we're out on batteries and then another two hours that way he's cut his emissions by 1/3 straight off. It's great for him, but he's going to need electricity on both sides in vast quantities, he would need per ship 17.5 megawatts.

Gregan

Do you think it's counterproductive?

Interview 1

The infrastructure that we're talking about the government where they haven't done anything there talk to us, but to comply with rules that are already now in

place coming in 2020 2030. They're going to have to double the infrastructure for electricity to double port and that's just doesn't work that didn't include it. And straight off, you're going to get people that say, No, we do that too. We take away from other things or there's going to be more overhead lines that people objected. My biggest problem with all of this is every time somebody makes a proposal, somebody else says, why you can't do that. Because it's wrong. It's bad for the environment. We're going to struggle to keep up with the requirement, rules as a country as a shipping company. We're going to struggle to keep up with the rules as they get tighter and tighter and say we can burn diesel because it's a fossil fuel. But it isn't that clean alternative that works in our market. Methanol is the closest but it's going to be a struggle.

Gregan

What do you think is going to happen then if the rules are getting stricter?

Interview 1

Sanctions happening ships are getting slow reducing their speed to cut their emissions we're already doing that's obviously a finite limit, change do that. In the future, we'd have to, as I said, start with something like biofuels. So, we find a good supplier of biofuels and then we can say that we've reduced our emissions by 20 to 30%, depending on how much the biofuel we convert. It keeps going for a couple years.

Gregan

Do you get fined if your emissions are too high?

Interview 1

What would happen now with the current rules outside of Europe you have to come up with a plan. The system now which is only just enforced from the IMO is the carbon intensity indicator that were scored each ship is given a rating. It is

calculated from the IMO DCS MRV is a European equivalent of IMO DCS, which is slightly stricter. And the UK has its own MRP aside from all of those.

Gregan

Has it become better for the environment by any of the shipping companies partaking in the MRV and the IMO?

Interview 1

Because they're only just coming into force now the IMO DCS is only now being converted into that scenario scoring system. The scoring system will only be calculated at the end of this year or the middle of 2024. And from that, you will be dragged down now all that's happened as engines, power has been reduced.

The scores are the scores. If you get a D. It's a sliding scale. So, over the next 10 years, the parameters to get a beat become tighter and tighter until you save to a C and then you stick to t when you stick to a D or an E you must produce a plan which shows how you come back and at that point with IMO system. You must then start coming up with alternative fuels.

Gregan

Has anybody been stopped yet, or is it too new?

Interview 1

Nobody will be stopped because you must come up with an alternative. We've had to slow our ships down to comply but not stopped. The EU MRV is going to be stricter and that will come with financial penalties if they bring in the ETS the European trading system or the carbon trading to the EU or MRV is going to use to calculate how much carbon you produce and based on that you will have to buy carbon credits. Somebody to buy a forest. That's a metaphorical forest. It is a trading system. And the price goes up and down. If shipping comes in, then prices going to go up because it's already in place for industry. And they're

getting away with $90 a tonne of carbon or something like that. So, you bring in a whole lot more industries into it, then the price is going to go up. So, we're paying $500 a ton for our fuel. We would have to calculate that. Another 8090 $100 would be on because it's three tonnes of carbon per tonne of fuel. So, you could put another 50% on your price of fuel and that is going to have to be calculated into our running costs if we pay for the fuel at a certain rate, but that fuel then produces three times carbon we must cut we're going to have to pay that at the end of the year. For each tonne of carbon, we put into the environment.

Gregan

Do you think when people are chartering the cargoes, would these scores affect wanting to do business with you?

Interview 1

Both ways. Some companies when we lift cargo as far as they want our carbon output. So, they will come to us looking for how much we burned time which tons of cargo we carried her what was our distance and that goes on their own in their own records. We don't know yet if we'll be penalised or they're just recording for the sake of their company records, or their Board of Management wants to know how they're going to become sustainable. So, you will find the bigger companies are already recording it and they will also be looking at us and saying new ships. There we are scored already. So, our grams of carbon per cargo carried is quite low compared to the ships that are 15 20 years old. So, there are companies that will be saying we'll go to our club because there are new ships and they're more efficient and therefore they produce less current lifespan. But lifespan of a ship is a variable we work on 15 to 20. I don't have as comfortable in the future because I don't know how to build a ship or specify issue to spec the ship now for 15 to 20 years not knowing which view is going to be available consumable in the next five years. Never mind the next 15 years.

Gregan

What happens to a ship at the end of their life?

Interview 1

We have never scrapped a ship. We only resell. Somebody else buys them and they'll either trade them in our area or convert them into something else. A lot of our ships are converted to stone carriers in Norway for just carrying that suits us because we're not doing that work. You could easily get another 15 years. I was willing to spend the difficulty will be now they're inefficient ships and they're going to become difficult to run with the legislation itself. So where are you going to see a lot more ships come to scrap scrapping is a big thing for the IMO for your sustainability. Because a lot of ships were scrapped in third world countries and very dangerous conditions. India Pakistan scrapped a ship for us to open on beaches and coils and cold everywhere.

Gregan

Do you write up a sustainability report for the board?

Interview 1

It's not even that we don't have a specific report. Like we've looked at other companies' websites, and they're bragging about whether building ships that are agreeing or disagreeing that so do you think that's greenwashing like that isn't. Of course, it's an element of greenwashing. Because at the end of the day, there isn't an alternative fuel out there. We're building ships that are as good or better than them for efficiency. And that's pretty much all you can do now. There is just now happening a switch some ships are coming out with alternative fuel options for battery banks that we do on our own. And that is helping of course. But the only people that are putting battery packs on ships are those that are getting government sponsorships and we didn't get that from the government. When companies are asked about sustainability most of those companies are somebody that produces something if you produce a table,

where's your material source? We don't have a product like that with our service industry. So, when you're talking about sustainability, you're where you've sourced your materials don't have that. Problem and Solution. We can say that our ships are sourced sustainable. The steel is we were very limited in the materials we can use them Shipbuilding is highly regulated. So, it's not like it's a sweatshop in Bangladesh. But at the same time, I know a lot of the steel and materials are produced in China. So, you can see that it's highly regulated and certified every piece of steel. Everything that goes into ships must have a piece of paper. But at the same time, it is certified and produced in the likes of China. And the big steel mills. So probably could so we know how to go back to be the source of items, materials were restricted within our company as to what we can put on the mattresses have to be really marked. Everything must be certified. All the electronic equipment must have approval some things for us to try and figure out where they were sustainably produced. It doesn't matter we cannot just go around saying we're not buying from you because it's just impossible. Like will your electronics were produced in Russia, which we're having a problem with now some of our stuff is produced in Russia. But it's not like there's, you know, you can go down the road to a different supplier. That's where we must go due to the nature of the business.

Appendix B – Research Structure Timetable

	27.2.23	6.3.23	13.3.23	20.3.23	27.3.23	3.4.23	10.4.23	17.4.23	24.4.23	1.5.23	8.5.23	15.5.23	22.5.23	29.5.23
Description & Week Number	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Choose research area														
Preliminary research														
Decide on research topic														
Decide methodology														
Present proposal to tutor														
Finalise methodology														
Conduct primary research														
Analyse data														
Write up report														
Submit thesis														

Table 1 – *Research Structure*

Appendix C – Proposed interview questions

Procurement:

1. *Do you think stakeholder management is essential for a sustainable business?*
2. *Does where you source the items/origin of materials matter to you?*
3. *What do you think our suppliers can do to aid us in the sustainability journey?*

Working environment:

1. *What is a sustainable work environment to you?*
2. *What do you think this company does to ensure a sustainable workplace for its crew onboard?*
3. *What do the crew have to do to aid in environmental compliance?*
4. *Do you think the demand on the crew to partake in these regulations, takes a toll?*

Environmental:

1. *Does MRV and IMO help?*
2. *Is the current regulation in place helping the environment or is it a money scheme?*
3. *With an extensive new build program, what measures were put in place for the environment, if any?*
4. *Are you looking into the possibility of going fuel-less? Or is it possible at all? Opinions on LNG, Hybrid/Electric propulsion, or any other alternative ways of fueling ships?*

Profitability:

1. *Do you think a company can be profitable and sustainable at the same time?*
2. *Do you think it is wise to invest in sustainable practices now to ensure the longevity of the industry's future?*