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The capacity of banks to accelerate a sustainability transition in maritime shipping

By

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Abstract

The maritime shipping industry is fundamental to the global economy, but is responsible for a considerable share of worldwide greenhouse gas emissions. The International Maritime Organization has set ambitious industry targets to decarbonise to net-zero by 2050. Since 2050 is around the corner, the pressure to decarbonise shipping operations is growing. The sustainability transition requires significant amounts of capital to pursue investments concerning energy efficiency and newbuilding vessels operating less pollutive fuels. Banks have traditionally been the most important provider of capital to maritime shipping companies. Therefore, the aim of this research is to identify factors affecting the bank's capacity to accelerate a sustainability transition in maritime shipping. By doing so, the current paper conducted a review of existing academic research and the regulatory environment applicable to ship finance. Based on theoretical findings, several hypotheses were developed and validated with insights from practice. Consequently, four key factors affecting the role of banks were identified. Principally, the important and future proof strategic position of banks within the maritime industry was established. Secondly, it was found that technological development can be considered the main factor affecting the pace and direction of a sustainability transition. Moreover, technological development determines the magnitude of technology-related risks assumed by shipping companies and financiers. Third, regulatory risk was only considered to a limited extent by both banks and ship owners. Furthermore, regulatory pressure from supporting sectors to maritime shipping may affect the need for enhanced environmental regulations imposed by a central regulator to advance a sustainability transition. Lastly, the emergence of sustainable- and green financing solutions provides opportunities for banks to accelerate a sustainability transition in maritime shipping. Nevertheless, developments within the green financing space are yet to develop further to make a significant impact. As such, our findings contribute to a systematic discussion on the role of financiers within the maritime shipping sustainability transition.

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List of abbreviations

ECB	European Central Bank
ESG	Environmental, Social and Governance
EU	European Union
EU ETS	EU Emissions Trading System
GHG	Greenhouse gas emissions
HQ	Headquarters
IMO	International Maritime Organization
IPO	Initial Public Offering
LNG	Liquified natural gas
LTV	Loan-to-value
NZBA	Net Zero Banking Alliance
TEU	Twenty-foot equivalent unit
UNCLOS	United Nations Convention on the Law of the Sea
US$	United States Dollar

1. Introduction

Seaborne trade is fundamental to the global economy. The international shipping industry transports about 80% of global merchandise trade by volume (UNCTAD, 2023). At the same time, the industry is a major contributor to worldwide greenhouse gas (GHG) emissions, emitting three percent of global GHG emissions. As such, one of the maritime industry's key challenges is decarbonising its operations. However, the transition is costly. For example, in 2023 AP Moller-Maersk signed a US$ 1,15 billion contract for 10 methanol based dual fuel vessels, 9.000 TEU (Ang, 2023). In comparison, during the freight boom in 2021 Seaspan Corporation ordered 10 newbuilding 7.000 TEU post-Panamax vessels for US$ 860 million (Delaney, 2021). Both deals stipulate the price contrast between vessels operating conventional- versus alternative fuels.

Traditionally, bank financing has been the main source of capital for the shipping industry (Kavussanos & Visvikis, 2016). Specifically, bank loans with the vessels serving as a collateral to the loan, have been important financing structures for shipping companies. Financing newbuilding- or second-hand vessels is not a straightforward exercise due to some of the industry's distinct characteristics (Stopford, 2009). Principally, we mentioned that the maritime shipping industry is very capital intensive. Moreover, the cyclicality of the shipping industry requires a long term view from investors beyond cycles. That is, both freight rates and vessel prices are extremely volatile alongside movements in the shipping cycle (Kavussanos & Visvikis, 2016). In addition, vessels are mobile assets which can be deployed across different regions globally. Today, both financiers and shipping companies are committed to the sustainability transition. At the roots of the transition, the industry is facing challenges (Tcherneva, 2023). Such challenges relate to uncertainties regarding regulatory development and technology advancement. While preparing the investment case to acquire a vessel from a financier's perspective, one can distinguish between traditional ship finance considerations and environmental factors which are becoming increasingly important to advance the sustainability transition. Consequently, the impact from new regulations and alternative fuel technologies is affecting traditional ship finance decision making.

The current average age of the world fleet is over 22 years (UNCTAD, 2023). Considering an average lifetime for a vessel of 25 years, newbuildings are expected to enter the fleet during the coming years. The UNCTAD reports that just over one percent of the existing fleet is operating alternative fuel technologies such as LNG or methanol. It was reported that about one fifth of the vessels from the 2023 orderbook will hold certain alternative fuel capability. Based on these statistics, it could be argued that the sustainability transition in the maritime industry is at very early stages. Nevertheless, the industry is promising ambitious progress. The International Maritime Organization (IMO) specifies the industry's ambitions to achieve net-zero by 2050 (IMO, 2023). Without an alternative central regulator in maritime shipping, the IMO is considered to drive the pace of the transition from a regulatory point

of view. However, questionable is whether the IMO can enforce the industry to decarbonise at its envisioned pace. In addition, uncertainties on technological development affect the speed of transitioning. Currently, shipping companies seem hesitant to invest because of these uncertainties. As a result, projected GHG emissions from shipping are heading up (UNCTAD, 2023).

Overall, the ship finance sector can be considered rather conservative, with financiers becoming particularly risk averse following the 2008 financial crisis (Alexandridis, et al., 2018). Important to consider, a sustainability transition in maritime shipping involves significant risks. For the purposes of this research paper, we investigate the role of the financier as part of the sustainability transition in maritime shipping. By doing so, we ask: to what extent do ship finance banks have the capacity to accelerate the sustainability transition in the maritime shipping industry? Since 2050 is around the corner, the pressure to decarbonise shipping operations is growing. This research aims to introduce several factors affecting the capacity of banks to accelerate the sustainability transition within the maritime shipping industry. Based on a review of the selected literature, we consider four hypotheses:

1. Going forward banks remain well positioned to maintain their strategic support function in maritime shipping, despite high market volatility and industry cyclicality.
2. Enhanced regulations in maritime shipping are not required to advance a sustainability transition, as strict financial sector regulations put pressure on the sector to reform.
3. Technology risk is the primary factor limiting investments in alternative fuel operated vessels.
4. Increasing sustainable- and green finance product offerings by banks is an important condition to accelerate the sustainability transition in maritime shipping.

Firstly, it is important to understand the future role of the bank within the maritime industry. Traditionally, the bank is the most important provider of capital to maritime shipping companies. However, on top of typical industry challenges, new challenges related to the maritime shipping sustainability transition may affect the strategic role of banks. Secondly, the role of the regulator as part of the transition is valuable to consider. On the one hand, it could be argued that market based measures are required to incentivise sustainability related investments. On the other hand, increasing and stricter regulations could affect the willingness of banks to maintain or grow their shipping portfolios. Third, uncertainties on unproven technologies pose major risks from a ship finance perspective. Although, technological development could affect the pace and direction of the sustainability transition. Fourth, the role of sustainable- and green finance is closely related to sustainability investments. An emergence of green finance solutions could significantly affect the pace of the sustainability transition and the position of the bank within ship finance.

The remainder of this paper is structured as follows. Section 2 outlines the methodological approach, followed by a literature review on ship finance in section 3. Section 3.1 specifically examines

the legislative context concerning sustainability in maritime shipping and ship finance. Regarding the literature, since the 2008 financial crisis the academic research has seen important progress, particularly in the area of financial risk management. More recently, there has been a growing focus on sustainable- and green finance. The reviewed literature suggests that the financial sector aspires to fulfil an enabling role in the industry's transition. However, certain challenges remain underexplored. By integrating the legislative context and findings from the literature review, we develop a conceptual framework along with our hypotheses in section 4. To further contribute to the existing research, we conducted three interviews with industry professionals to validate our theoretical findings and gather practical insights. Section 5 presents the empirical findings, while section 6 analyses these findings in relation to the conceptual framework and overall research question. Finally, section 7 summarises our conclusions.

2. Methodology

This section discusses the applied methodology within this paper. Firstly, section 2.1 discusses the search methodology which was applied to select academic articles for the literature review. Secondly, section 2.2. elaborates on the approach for our empirical study.

2.1. Approach literature review

The articles for the literature review were searched and selected following a methodology as explained by Ke, et al. (Ke, et al., 2022). The process involved defining appropriate search terms, followed by an initial review of studies while applying exclusion and inclusion criteria. Additionally, we conducted a statistical analysis to gather basic observations on the diversity of collected studies. Finally, the approach involved a literature review in section 3 of this paper, which formed together with a review of the legal context the basis for developing a conceptual framework in section 4.

We used the database Web of Science to search for the literature. Firstly, we defined the following search terms: “ship finance”, combined with (i) “risk”, (ii) “sustainability”, and (iii) “environment”. Removing duplicate studies and filtering for articles only within the time period 2005-2024, we collected a total of 124 studies. We opted to filter for the 2005-2024 time period to capture the impact of the 2008 financial crisis on ship finance and to include more recent studies which likely include a sustainability focus.

Secondly, we narrowed down the list of studies based on an initial review while applying several search boundaries. The inclusion criteria include: studies focusing on ship finance methods, risk management considerations, impact on ship finance from economic events or trends in finance, sustainability and financing, and green finance. We applied various exclusion criteria, related but not limited to the following: leasing structures, trade finance, port and terminals, credit ratings, investment modelling, energy markets, forecasting, freight rates, freight forwarding, geopolitics, historical analyses, M&A, derivates, and other. We performed a first and second review of the filtered articles, resulting in a selection of 26 articles. Three studies were not accessible through the database. Finally, we selected a total of 23 articles.

After selecting the relevant literature, we obtained basic statistical observations. We aimed to validate that the literature review covers a broad distribution of journals, time periods and research categories. The descriptive statistics are included in Appendix A. Following from the distribution between journals, it shows that the literature selection covers a variety or journals with three journals containing more than one article. The articles appear to be distributed equally across time periods, with 2023 being a dominant year. Next, we identified four research categories at first glance, in line with the objectives of this paper. Nevertheless, the allocation of articles per category is not applied exclusively while reviewing the literature in detail.

2.2. Approach conceptual framework

As mentioned, the literature and legal review forms the basis for developing a conceptual framework. The purpose of developing the conceptual framework is to structure the interpretation of our literature findings and connect these to the overall research aim.

The conceptual framework was developed through identifying key concepts from the literature and legal review. More specifically, the analysis focused on identifying factors which could affect the position of banks within the maritime shipping sustainability analysis. The established conceptual framework consists of four identified factors, which allowed us to develop hypotheses. Thereafter, the hypotheses were tested through empirical research.

2.2. Approach empirical study

Following a literature review, this paper validates theoretical findings by conducting three interviews with industry professionals. We refer to section 5 for a summary of findings and to Appendix C. for interview notes.

It appeared challenging to contact suitable banks and shipping companies who were willing to participate in this research. Ultimately, representatives from two banks and one top-five container liner participated. The interviews lasted around one hour each, without strict guidance on timings. The interviews were guided by a one-pager, containing both details for a theoretical case discussion and a combination of statements and questions (see Appendix B.). The one-pager was shared in advance with the interviewees for context purposes, but was not strictly followed during the interviews. We believed it was important to leave room for interactions and applied a flexible approach. In all three interviews, the statements and questions were found most suitable and the case was not discussed. Despite a flexible interview approach, we made sure that the required information was covered sufficiently.

The statements and questions were designed following an initial assessment of the selected literature. As such, the conceptualised findings from the literature review constituted the basis for the interviews. The statements and questions are included in section 5.1.

3. Literature review

For the purposes of the current literature review, we selected a total of 23 articles resulting from our search as explained in section 2 of this paper. The selection of ship finance literature follows from the general aim of our research, which investigates the role of the bank within the sustainability transition of the maritime shipping industry. Given the traditional importance of bank financing within maritime shipping, it is critical to understand how banks assess risks and economic incentives related to sustainability investments in the industry. While literature focused on legislation or sustainability would provide relevant insights, it does not consider the same level of depth into the function of the bank and overall investment decision making in the maritime shipping industry. Furthermore, it is important to consider that only recently maritime shipping companies have been actively pursuing sustainability investments in light of the industry's environmental targets. Therefore, it is possible that previous research has not considered present views. Such present views may be raised during the interviews with industry professionals in section 5 of this paper.

By conducting this research, **we aim to introduce several factors affecting the capacity of banks to accelerate the sustainability transition within the maritime shipping industry.** These factors are conceptualised in section 4 of this paper and are limited to findings from the selected literature. Therefore, it could be possible that existing research outside the scope of this review describes additional factors which enrich the recommendations made in this paper. The literature review in this section is structured according to the following five buckets:

1. Legislative context;
2. General features of ship finance;
3. The role of the financier;
4. Risk management considerations; and
5. Sustainable- and green finance.

Even though the selected literature follows from a ship finance perspective, it is important to consider the overall legal framework that applies to sustainable ship finance. Therefore, the literature review first discusses important legislative context. Next, while assessing to what extent banks have the capability to accelerate the sustainability transition in maritime shipping, it is key to elaborate on the unique features of the maritime shipping industry and how these possibly affect ship finance. The distinct features provide conceptual understanding on investment decision making by ship finance banks. Moreover, the review of general features provides background on financial barriers and opportunities to enable a sustainability transition. Subsequently, emphasising the role of the financier provides insights into the importance of the bank financing function for maritime shipping companies. A focused analysis allows for understanding of the traditional and potentially evolving role of the bank in ship finance. Then, the literature review examines risk management considerations relating to ship

finance. It is valuable to analyse how banks address uncertainties, to evaluate how future sustainability investments can be realised despite underlying risks. Lastly, the emergence of sustainable finance and green financing product offerings could affect the pace of the sustainability transition. As such, it is key to understand how the perception of banks towards alternative (green) financing solutions possibly impacts the future shape of ship finance.

3.1 Legislative context

This review of the legislative context is not limited to an assessment of findings presented within the selected literature. Although, reference has been made to important regulatory bodies within various articles analysed. For instance, Tsatsaronis, et al. (2024), Morchi, et al. (2024) and Xue & Lai (2023) refer to various environmental regulations implemented by the IMO. In addition, Fricaudet, et al (2023) refer extensively to the Poseidon Principles. For the purposes of drawing a legislative framework which is applicable to the current research, this section directly refers to the relevant regulatory documents. In addition, few additional sources are introduced to provide necessary background information.

Parallel to other industries, the regulator plays an important role within the sustainability transition of the maritime industry. Although, it is not a simple task to point out a central regulator in maritime shipping (Stopford, 2009). Stopford implies that the complexity to identify the relevant regulator arises due to the global nature of the maritime industry. Shipping companies operate in many jurisdictions across the globe and their fleets are registered in various flag states (Haider, 2013). Moreover, port state regulations add another layer of complexity (Stopford, 2009). Lastly, it is relevant to consider where the company's headquarters (HQ) are located and where operations typically take place geographically.

Due to the complexity described above, different regulatory challenges exist within maritime shipping. For instance, imagine a theoretical shipping company with its HQ located in the European Union (EU). The company's fleet sails the flag of The Marshall Islands, a flag of convenience. Consequently, regional legislations like the EU Emissions Trading Scheme (ETS) may not apply to this company, despite its HQ are in the EU. For illustration, the scope of the EU ETS to maritime transport activities only applies to 50% of the emissions regarding voyages leaving or arriving a port within the EU and 100% of the emissions for voyages between two EU states, regardless of the flag which is sailed (European Commission, 2024). To summarise, it is evident that maritime shipping companies must navigate a complex set of international and regional legislations, resulting in regulatory arbitrage and leading to various disputes.

Broadly speaking, the United Nations Convention on the Law of the Sea (UNCLOS) draws the foundation of global maritime regulations (Stopford, 2009). The IMO was established as an agency under the UNCLOS to provide a regulatory environment pertaining to ship safety, pollution and security (IMO, 2019). In its capacity as global maritime institution, the IMO produces conventions that can be

adopted by states in their national laws (Stopford, 2009). One could argue that in the absence of a global maritime regulator, the IMO is guiding the sustainability transition in maritime shipping. That is, in 1997 the first IMO resolution was adopted which recognised that GHG emissions originating from international shipping have an adverse effect on the environment (IMO, 2023). Thereafter, the IMO adopted a resolution outlining the initial strategy on the reduction of GHG emissions from ships in 2018 (IMO, 2018). This strategy was eventually revised in 2023, and is now considered the most recent legislation (IMO, 2023) (hereafter referred to as the IMO 2023 Strategy). The IMO 2023 Strategy has the following objectives[1]:

- "Supporting global efforts to reduce GHG emissions from international shipping in line with the Paris Agreement and the United Nations (UN) 2030 agenda on sustainable development goal (SDG) 13 on climate action;
- Define suitable actions for international shipping, considering its role in global trade and potential impact on states; and
- Propose measures to meet these goals, including monitoring strategies."

The ambitions outlined within the IMO 2023 Strategy are the following[2]:

- "Reduce carbon emissions from ships by strengthening energy efficiency design;
- Reduce CO2 emissions by at least 40% by 2023 versus the 2008 baseline;
- Uptake of alternative fuels technologies to represent at least five percent of the energy used by international shipping by 2030; and
- Net-zero GHG emissions by 2050."

It is important to mention that the IMO's ambitions are not directly adopted by states in their national laws. Therefore, one can question the central role of the IMO in guiding the sustainability transition in maritime shipping. Although, the European Commission acknowledged the IMO's objectives and ambitions within the EU ETS directive (European Commission, 2024). The impact of the IMO in addressing environmental regulations through regulation was studied, while comparing maritime shipping to the aviation industry (Smith & Ahmad, 2018). It was mentioned that both shipping and aviation have developed enhanced environmental regulations over the past decades, but are facing challenges regarding air pollution regulations. The authors described that the IMO has a deeper prescriptive regulatory regime compared to the relevant regulator in aviation. As such, this could theoretically result in stronger enforcement of regulations by flag- and port states. In addition, it was mentioned that the legislative framework in maritime shipping is benefiting from successful enforcement of control regimes involving sub-standard shipping. Although, a particular challenge

[1] 2023 IMO Strategy, ANNEX 15 Resolution MEPC.377(80), page 5 (IMO, 2023)
[2] 2023 IMO Strategy, ANNEX 15 Resolution MEPC 377(80), page 5-6 (IMO, 2023)

within shipping can be attributed to the lack of practical connection with flag states, leading to difficulties to enforce regulations. This is not necessarily unwanted, since many states do not target to restrain economic growth of their transportation industry. Despite differences between transportation sectors and various challenges, it was described by Smith and Ahmad that delegation of policy making by states to the IMO should result in more efficient global orchestration of environmental regulation. To increase overall effectiveness, reaching consensus between member states on accepting delegated responsibility to the IMO could lighten adoption of regulations in national laws.

Various supporting sectors to maritime shipping have their individual decarbonisation targets. For example, from a ship finance perspective, the Poseidon Principles were introduced in 2019 to address and discuss the climate alignment on ship finance portfolios (Global Maritime Forum, 2024). The Poseidon Principles have been developed in line with IMO publications on the reduction of GHG emissions from international shipping. The Poseidon Principles are widely adopted across the ship finance sector. Globally leading banks, collectively accounting for 80 percent of global ship finance, signed the principles. The Poseidon Principles are drawn under four pillars[3]:

1. "Assessment of climate alignment: signatories commit to measure the emission intensity of their shipping portfolios on a yearly basis, being benchmarked against the IMO established strategy trajectories;
2. Accountability and enforcement: ensuring that signatories commit to adopting the Poseidon Principles within their internal financing policies;
3. Enforcement: requires reporting and compliance for banks, demonstrating progress and adherence to the Poseidon Principles; and
4. Transparency: signatories commit to certain disclosure requirements, providing quality control evaluations."

After four years of implementing the Poseidon Principles, the impact was studied (Rizou, 2024). The intention of Rizou's research was to provide future directions to banks regarding reinforcement of the Poseidon Principles within loan agreements. It was found that the Poseidon Principles are aimed at aligning the bank's shipping portfolio with IMO sustainability targets, largely through application of a standard covenant clause. However, the author mentioned that currently, such standard covenant clauses are lacking enforcement consequences. Therefore, it was concluded that especially regarding the enforcement pillar of the Poseidon Principles, steps have to be taken to foster effectiveness.

For the purposes of this research paper, the legislative framework considers the IMO 2023 Strategy and the Poseidon Principles, while taking note of regional regulations such as the EU ETS. Taking into account the important position of bank financing within the maritime shipping industry, the

[3] Poseidon Principles: 2023 Annual Disclosure Report, page 7 (Global Maritime Forum, 2023)

interplay between financial sector initiatives and IMO guidance results in a challenging dynamic. It is demonstrated that such institutions seek continuous alignment. Nonetheless, it appears that the IMO is leading and the financial sector is following. That is, the 2023 revision of the IMO's initial strategy from 2018 showed significant impact on the revised Poseidon Principles in 2024. However, the Poseidon Principles represent a broader baseline financial sector initiative, including many banks. Therefore, It could be the case that an individual banks' stakeholders require stricter guidelines or swifter reform as targeted by the Poseidon Principles.

3.2 General features of ship finance

This section aims to provide conceptual understanding on distinct maritime shipping features which are important to consider within ship finance. By doing so, general features of maritime shipping are identified from the selected literature, which could affect ship finance decision making by banks. As mentioned, the literature review in this research is limited to findings from the selected literature. Therefore, findings from alternative research could complement the analysis in this paper.

From the reviewed literature three key features of maritime shipping which could affect ship finance were identified: (i) volatile freight markets and asset values, (ii) industry cyclicality, and (ii) high capital intensity. Firstly, the volatility of freight markets creates a challenging environment for banks to manage their ship finance portfolios. It was researched by Albertijn, et al. (2011) how shipping banks manage their lending portfolios, given volatile operating cash flows and sharply fluctuating asset values of shipping companies. It was concluded that risk management strategies are of key importance for shipping companies in a post-crisis industry environment, in order to secure future financing from increasingly risk-averse banks. While section 3.4 of this literature review elaborates further on risk management considerations, Albertijn, et al. showed the potential impact of extreme market volatility on ship finance decision making. In addition, the authors mentioned that freight markets are impacted by the state of the industry cycle, demonstrating the importance of embracing cyclicality into financial decision making. This brings us to the second key feature which we identified in the literature. Drobetz, et al. (2013) explained the impact of cyclicality within the maritime shipping industry. By investigating whether shipping companies have a target capital structure, it was concluded that shipping companies are highly leveraged compared to other industries and thus assume higher levels of financial risk. In addition, the authors found that leverage within the maritime shipping industry behaves counter-cyclically and in line with the pecking order theory. Meaning, during freight booms, the allocation of equity financing is preferred over leverage by shipping companies due to lower cost and disclosure requirements. Evidently, the stage of the cycle is affecting the need for debt financing and therefore impacting the ship finance sector. Given the vast discussion on capital structures within the selected literature, a more in-depth review is presented later in this section. In the meanwhile, it can be noted that the importance of capital structure decisions result from high capital intensity of the maritime industry, the third key feature which we identified. As such, Alexandridis, et al. (2018) described that

the capital intensity of the maritime industry affects almost every aspect of shipping companies, including cash flow generation and corporate governance.

Mitroussi, et al. (2016) investigated credit risk analysis as a crucial part of ship finance. The authors recognised that important challenges for banks indeed arise from volatile freight markets, industry cyclicality and high capital intensity. Overall, Mittroussi, et al. examined various factors that could have an impact on the probability of default on bank loans. The study showed that factors affecting the probability of default on shipping loans is not limited to these three identified factors, but also considers criteria such as the borrower's industry experience, specific loan terms and the borrower's financial position. Furthermore, it was indicated that market risk can be directly identified as a significant factor affecting the probability of default on a loan. Whereas the industry's cyclicality and capital intensiveness were implied to determine the overall environment in which investment decision making takes place. Vessel specific characteristics such as age, carrying capacity and fleet size were found insignificant to the probability of default on a shipping loan.

It was argued that capital structure decisions are a strategic choice of great importance in the maritime shipping industry (Drobetz, et al., 2013). Hence, the level of debt versus equity influences operating cash flows and thus the ability to finance operations throughout the cycles. One reason to explain the high leverage ratios in shipping is the standardisation of vessel classes and sizes, which makes them relatively easy to re-sell and therefore constitute suitable collateral for loans (Albertijn, et al., 2011). The high amount of leverage in maritime shipping demonstrates the important facilitative role of the bank in the maritime industry (Mitroussi, et al., 2016). At the same time, high leverage ratios and reliance on bank financing could increase vulnerability to financial market disruptions (Gong, et al., 2013). One example of such financial market disruption is the 2008 financial crisis. Gong, et al. investigated whether banks with a shipping division in Hong Kong changed their lending practices and assessment criteria following the 2008 financial crisis. The authors found that banks significantly reduced their exposure to shipping, both through individual loans and as part of syndicate structures. In addition, a more cautious risk approach resulted in tighter credit assessment criteria. As a result, banks prioritised project quality and loan security over market share.

The 2008 financial crisis meant an abrupt end to a freight rate boom since the early 2000's (Opitz, et al., 2018). Opitz, et al. described in line with Alexandridis, et al. (2018) that over-capacity in maritime shipping led to a sharp decline in freight rates following a global decline in demand. At the same time, shipping companies were not able to (re-)finance their debt and this way involved shipping banks in the financial crisis. Opitz, et al. investigated crisis vulnerability using supply and demand factors, the order book and the world stock market index as conditioning factors. The authors found that crisis risk already increased prior to the tipping point in 2008. This resulted from a strong increase in supply, while demand was slowing. It was noted that the impact of the crisis in maritime shipping could

have been reduced if shipping companies and banks acted upon the warning signals of oversupplying the market. Afterwards, banks became increasingly wary of loan security and lesser so about expanding their ship finance portfolios (Gong, et al., 2013). The authors described that this resulted in a consolidation of the oversupplied industry, tightening of lending policies and enhanced corporate governance strategies. In addition, the crisis ignited the uptake of alternative capital sources to bank financing, for instance shipping bonds, IPOs and private equity (Alexandridis, et al., 2018).

As discussed, shipping companies seek to optimise their capital structure. In this regard, the willingness to provide debt financing is important to consider from the financier's perspective. Due to various developments within the maritime shipping industry, such as the 2008 financial crisis and environmental regulations, Maniati, et al. (2020) argued that ship finance decision making by banks has been affected. The authors investigated corporate finance decision making policies through indicating significant factors of an individual bank's operating environment and the overall maritime shipping market. The authors calculated a credibility coefficient to apply within their model and found that an individual bank's policy to provide shipping loans could be explained by the change of China's GDP rather than the overall dry bulk shipping market. For instance, the bank's policy to increase the number of shipping loans might mirror the growth of Chinese GDP if it holds an aggressive lending policy. The study showed that the willingness by banks to invest in maritime shipping could be affected by various elements such as economic crises.

Until now, this section reflected upon important ship finance considerations arising from the distinct features of the maritime shipping industry. In addition, research investigated the ship owner's perspective and evaluated concerns on how the debt is financed (Akgul & Cetin, 2019). The authors describe that the individual ship owner typically relies on two types of revenue streams: (1) freight income, and (2) capital gains from acquiring and selling vessels. Due to the cyclical nature of the maritime shipping industry, opportunities arise throughout the cycle to capitalise either one of the two income streams. Akgul & Cetin assessed various qualitative characteristics which are relevant to investment decision making by an individual ship owner. It was found that investments are carefully planned considering the current and anticipated state of the market. The volatility of freight markets could be detrimental to the loan-to-value ratio of a newbuilding vessel by the time it is delivered compared to the time of order. Second, investment alternatives are considered to seek optimisation of capital structures. Third, the technical features of a vessel play a determining factor. The shipyard, type of main engine and efficiency of design all impact the debt paying ability through either cash flow generation or re-sale. Lastly, the company's financial position and capacity to bear risks is a determining factor to acquire debt financing and not miss out on investment opportunities.

To conclude this section, we found that three main characteristics of the maritime shipping industry which could affect ship finance relate to the volatility of freight markets, industry cyclicality

and capital intensity. Collectively, these features draw the context of investment decision making by banks, including credit risk assessments. Furthermore, it was described that the maritime shipping industry is highly leveraged and is therefore exposed to relatively high financial risk. In this regard, capital structure considerations are important because of the impact on cash flow generation and hence the ability to finance operations. Lastly, the vulnerability of the maritime shipping sector to financial market disruptions was demonstrated by the impact from the 2008 financial crisis. However, shipping companies and banks could have reduced the impact of the crisis by closely managing market imbalances.

3.3 The role of the financier

This section of the literature reviews aims to demonstrate the important role of banks within the maritime shipping industry. We assess whether the role of the financier is subject to changes due to developments in maritime shipping, such as the sustainability transition.

In agreement with our literature findings presented in the previous section, it was mentioned that by means of providing significant capital investment, the financial sector traditionally fulfils a facilitative role within maritime shipping (Yu, 2020). Yu investigated the strengths, weaknesses, opportunities and threats faced by commercial banks in advancing their ship finance activities in China. The author found that the large scale of commercial banks provides a solid basis for partnering with shipping companies, as a condition to meet long-term capital demand from shipping companies. In addition, growing specialised expertise on ship finance allows banks to remain a trusted financial partner. On the other hand, the author noted that a clear disadvantage of a commercial bank's position is the general willingness to invest in maritime shipping companies due to high risks and long investment cycles. As a consequence, limited financial product innovation takes place within banks. Further, both opportunities and threats for Chinese shipping banks are tied to the economic development of China. As demonstrated by Maniati, et al. (2020) Chinese economic growth also impacts investment decision making by global banks. To conclude, Yu (2020) argued that opportunities for banks in ship finance mainly pertain to diversifying financial product offerings.

The traditional role of ship finance is affected by increased attention from a concept referred to as responsible shipping (Xue & Lai, 2023). Even though responsible shipping draws the lines of the overall ship finance sector, it affects the role of the financier. The authors explain that responsible shipping is often described as environmental- and social responsibility management, and relates to sustainable- and green finance. As such, Xue and Lai examined the general concept, main elements and performance enhancement opportunities of responsible shipping. It was concluded that responsible shipping can be considered the connecting factor to ensure sustainable consumption patterns by facilitating global trade. Key elements include responsible- policies, procedures, documentation, procurement, compliance and design. The authors noted that these elements characterise the extent of

responsible shipping by companies and provide directions for improving operations. As a concluding remark, it was stated that key performance indicators are necessary to be developed in order to monitor responsible shipping. Moreover, this would support policymakers with drafting sustainability norms for shipping companies and investors.

As described, sustainability and environmental related developments are affecting the maritime shipping industry. Ship financiers play an important role in the sustainability transition of maritime shipping (Fricaudet, et al., 2023). The authors argue that financiers shape the terms and conditions for ship owners to acquire assets, and hence influence the type of vessels being acquired. Moreover, it was mentioned that the ship finance market is highly concentrated with a small number of financiers. This reveals the potential influence of few financiers on the direction and pace of the sustainability transition in maritime shipping. Fricaudet, et al. investigated how financiers adapt their behaviour and expectations amid a great set of uncertainties relating to the sustainability transition. By conducting detailed interviews with twelve financiers, the authors found that the financing approach changes gradually due to sustainability focused measures, but is slow to adapt. Even though financiers aspire to fulfil a loyal enabler role as part of the sustainability transition, it was recognised that the current speed of transitioning will likely not meet short- to medium-term industry environmental targets. The authors described that financiers do not anticipate the transportation demand for fossil cargo to decrease sharply. Therefore, only to a limited extent do financiers currently adjust their financing approach. That is, fossil fuel related projects are continued to be financed due to the limited risk for stranded assets in the current business environment. It was mentioned that particularly the relationship driven nature of the ship finance sector, established trust by financiers in shipping companies. The authors concluded that financiers have created a supportive environment for shipping companies to undertake the transition, since only few financiers in their study indicated that they would either retreat from the shipping sector or redirect their attention to aggressive niche innovators. However, financiers stressed the need for market based measures, incentivising sustainability investments.

Regarding environmental reporting, it was indicated that in many cases shipping companies report their environmental, sustainability and governance (ESG) performance voluntarily (Tsatsaronis, et al., 2024). The authors observed that only limited initiatives exist, which boost the maritime shipping industry to higher levels of ESG performance. One of these initiatives being the Poseidon Principles. The study by Tsatsaronis, et al. aimed to provide a uniform ESG reporting framework for the maritime shipping industry. The proposed framework would affect ship financiers through allowing the opportunity to benchmark their projects from particular clients against industry examples. Within the proposed framework, prominent ESG factors include but are not limited to GHG emissions, energy efficiency measures, shore-based environmental impact and the extent of decarbonising operations. Aligning with our review of the Poseidon Principles in section 3.1, such unified ESG reporting framework shows the potential to impact ship finance decision making.

To conclude this section, we highlight our findings from the selected literature on the important role of the financier in maritime shipping. Firstly, the financier was described as a facilitator of growth for maritime shipping, underlying the significance of capital investments within the industry. However, the role of the financier is affected by challenges which are currently arising from the sustainability transition. A detailed study on financiers' perceptions amid the sustainability transition by Fricaudet, et al. (2023), set the scene for potential behavioural adjustments by financiers of maritime shipping companies. It was found that financiers seek to enable decarbonising investments with their longstanding clients, although the industry is transitioning at a slow pace. One way to support the sustainability transition would be through enhanced environmental reporting. Overall, it was found that financiers are only slightly adjusting their focus due to initiatives such as the Poseidon Principles. The role of the financier is not anticipated to change much, despite the maritime industry's environmental challenges.

3.4 Risk management considerations

This section reflects upon key risk management considerations regarding ship finance decision making. In particular, we aim to assess the selected literature for insights related to industry risks tailored to the sustainability transition of maritime shipping. Investigating these specific risks contributes to understanding the extent to which banks could accelerate the sustainability transition of the maritime industry.

In section 3.2 of this review, we found that the maritime shipping industry is both volatile and capital intensive. As a result, shipping companies incur significant market risk and financial risk. In this respect, Albertijn, et al. (2011) provided in-depth detail on risk considerations. The authors defined business risk as the potential decline in the value of a shipping company caused by changes in the major sources of uncertainty that affects its probability.[4] As such, business risk for a shipping company was segmented into cash flow risk and asset value risk. Albertijn, et al. clarified that risks related to operating cash flows arise from exposure to freight market volatility, fluctuating operating costs and counterparty risk. Whereas counterparty risk refers to the uncertainty regarding fulfilment of contractual obligations by the other party to the contract. In terms of risk mitigation strategies related to operating cash flow risks, the authors indicated that generally smaller vessels incur less risk compared to larger vessels due to operating flexibility. In addition, it was described that multiple year charter contracts are another way to hedge revenues instead of relying on the volatility of freight markets. Other risk mitigation strategies pertain to financial derivative implementation and capital structure management. Risks related to fluctuating asset values were noted to be significant. Up to 32 percent volatility was observed for second hand bulk carriers during 1990 up to 2011. The authors established that significant factors to compare asset value assessments refer to the state of the freight market, size and age. Efficiency of design and

[4]Definition provided in (Albertijn, et al., 2011), page 3

GHG emissions were not considered by the authors. The implications for shipping banks was specified by the necessity to continuously monitor asset values during the loan term and closely manage the overall shipping portfolio.

This literature review elaborated on crisis risk and the impact of the 2008 financial crisis on the maritime shipping industry. In this context, one could argue that the ultimate risk for banks is the probability of default on a loan. Within a study focused on corporate failure, it was investigated whether default against individual financial instruments can signal early warnings of overall corporate failure of listed maritime shipping companies (Haider, et al., 2019). With individual financial instruments, the study referred to financial ratios such as liquidity-, profit- or cash flows related. The authors applied several distinct features of maritime shipping within their model, but only found significant correlation between higher gearing ratios and corporate failure. It was shown that gearing ratios above 40 percent imply higher risk of corporate failure between 6 to 30 months ahead. However the authors established a difference between shipping companies owning vessels and companies which do not own vessels. The latter showed to be more prone to corporate failure. Thus, default against individual financial instruments could signal early warnings to banks of corporate failure in the short term. Related to the study by Haider, et al., debt paying ability was analysed for shipping companies in Taiwan (Lin, et al., 2010). The authors noted that because of the high capital intensity of shipping, high leverage and significant financial risk, it is important to assess debt paying ability of firms. Out of 14 analysed shipping companies, five showed relatively high debt paying ability. Differences were found between shipping sectors, with for example container carrier companies showing higher debt ratio's versus tramp shipping companies. This can be explained by the differences in capital intensity per shipping segment.

It was indicated in section 3.1 that environmental regulations are increasing and becoming more stringent. One example pertains to the Poseidon Principles, shaping the ship finance sector. It was noted that despite evolving regulations, the lack of a central regulator in maritime shipping adds to the level of regulatory uncertainty in the industry. Fricaudet, et al. (2023) described that banks which are active in ship finance emphasised the need for financial incentivisation of sustainable technologies by regulators. Given these needs, one study illustrated the impact of GHG emission pricing on investment cases of greening technologies (Metzger, 2022). The authors referred to market based measures as either a direct carbon tax on GHG emissions or an ETS. The study assessed various carbon pricing scenarios on the valuation of sustainable technologies. The model showed that market based measures are not necessarily required to develop profitable business cases for sustainable technology investments. Although, the authors indicated that non-volatile fuel prices and constant carbon prices are key limitations of the applied model. For example, a sharp increase in either fuel prices or carbon prices could advocate the necessity of market based measures to develop profitable business cases. In addition to Metzger's study, other research established the complexity of investment decision making given

uncertain fuel prices (Sun, et al., 2023). The authors proposed various quantitative models to mitigate critical uncertainties when investing in new technologies.

As said, the study by Metzger (2020) consisted various limitations according to the author, among which the evolvement of fuel prices. Hence, this is partly a technology related limitation as shown by Sun, et al. (2023). It was described by Sun, et al. that various uncertainties exist for new technologies and these result in restraining factors for investing in alternative fuel operated vessels. An additional uncertainty related to new technologies is the availability of the required port infrastructure (Glavinovic, et al., 2023). The infrastructure development projects in ports are costly. Glavinovic, et al. studied the challenges related to installation of cold ironing technologies in ports. The authors explain that cold ironing refers to the technology which allows ships to connect to shore based power sources while at berth. The benefits arise from reduction of GHG emissions because the main engine does not have to run at berth. Following from the case study in Croatian ports, it appeared complicated to connect vessel power inputs with the power grid due to unstandardised voltage and frequency characteristics. Without going into too much technical detail, the case study conducted by Glavinovic, et al. provides a grasp on the complexity of port infrastructure developments, while such projects are of key importance to facilitate the sustainability transition in maritime shipping.

Within the study by Fricaudet, et al. (2023) technological obsolescence risk was widely recognised by financiers. Although, this risk was considered minimal due to the expected slow uptake of alternative fuel operated vessels. Nevertheless, one critical note was placed, the risk of stranded assets could increase when technology develops faster than anticipated. In this scenario, the sustainability transition may be guided into the direction of a certain alternative fuel technology. Important to consider is that vessel ordering remains a strategic decision that is depending on the individual outlook by the ship investor and the collective actions of competitors (Papapostolou, et al., 2017). Papapostolou, et al. investigated herding behaviour in the newbuilding and scrap markets of the dry bulk shipping industry. By doing so, the authors distinguished between intentional and unintentional herding behaviour. With regards to ordering newbuilding vessels, the authors found that maritime shipping investors demonstrate unintentional herding behaviour. Moreover, herding behaviour showed to be more significant in down cycles. It was mentioned by the authors that taking note of herding behaviour in maritime shipping may support designing fleet strategies for shipping companies while avoiding market imbalances due to irrational decision making. Herding behaviour was not discussed in relation to ordering alternative fuel operated vessels.

This sections started by establishing traditional ship finance risks, pertaining to operating cash flows and changing asset values. We found within the literature that main risks assumed result essentially from high capital intensity, high leverage ratios and volatile freight markets. Furthermore, banks could take into consideration differences among shipping segments when looking at the risk of

default on financial instruments and debt paying ability. Furthermore, the review in this section established that regulatory- and technology risks arise in relation to the sustainability transition of the maritime industry. Regulatory uncertainty was linked to the need for market based measures. However, it was found that the need for market based measures to develop profitable investment cases is not structural and can depend on the evolvement of fuel- and carbon prices. Technology risk relates to infrastructure availability, uncertainties on future fuel prices and the pace of technological development. As such, technology risk could affect operational performance and financing decision making. Lastly, it was indicated that unintentional herding behaviour exists for ordering newbuilding vessels in the dry bulk market. Although, herding behaviour was not discussed in light of the sustainability transition.

3.5 Sustainable- and green finance

Up until now, the literature review covered general features of maritime shipping, the important role of the financier and several risk management considerations, including regulatory and technology risk in light of a sustainability transition. Section 3.3 discussed the development of responsible shipping and found that this is related to sustainable- and green finance. Furthermore, section 3.4 elaborated on carbon financing in context of its implementation uncertainty, possibly due to the lack of a central regulator in maritime shipping. Based on these findings one could argue that emergence of sustainable- and green finance could have an advancing impact on the pace of the sustainability transition in maritime shipping. By assessing the selected literature, we aim to understand the developments within the space of sustainable- and green finance and how such developments affect the future shape of ship finance.

Despite indicated earlier that uncertainties exist regarding the implementation of market based measure on carbon finance, the relationship between such market based measures and the maritime shipping industry is important to discuss. Moreover, local and regional regulators are anticipated to increasingly consider carbon finance measures as an instrument to reduce GHG emissions from maritime shipping (Meng, et al., 2023). The authors investigated co-movement between the carbon finance market and maritime shipping markets. By doing so, time frequency dependencies, time varying dynamics and spillover effects between carbon finance and maritime shipping markets in the period from 2008 up to 2021 were taken into consideration. It was found that both markets show strong dependencies, with the carbon finance market leading. In other words, carbon finance related measures influence maritime shipping markets. The relationship showed to be stronger during crisis times. Moreover, from the various carbon finance markets analysed, the EU carbon market showed stronger dependencies than the global carbon finance market. The authors explained this by the relative maturity of the EU carbon finance market. Lastly, dry bulk and fuel shipping segments showed the strongest dependencies. Overall, the analysis by Meng, et al. demonstrated that carbon finance measures have an impact on maritime shipping markets and hence may have the ability to affect the sustainability transition in maritime shipping.

Section 3.4 discussed the need for market based measures to develop profitable business cases for new technology investments, as studied by Metzger (2020). To pursue sustainable or energy saving investments in maritime shipping, investments cases encounter various economic barriers (Longarela-Ares, et al., 2020). Longarela-Ares, et al. investigated what factors and how affect investment decision making in maritime shipping, given that principal agent problems arise in the relationship between ship owner and charterer. The authors found that vessel age showed to be a significant determining factor. Energy efficiency investments were not likely to be pursued for older vessels, possibly due to the shorter useful life time of the vessel to recover the investment. Furthermore, regulatory guidelines by the IMO were found to be a driving force of energy efficiency investments. Lastly, it was concluded that vessel size and the type of contract were important to consider but less influential. As such, larger vessels with high operational frequency and thus relatively high levels of GHG emissions are more likely to receive energy efficiency investments. Despite the limited significance of a contract type variable, it was found that vessels under time charter contracts were more often subject to sustainability investments compared to voyage contracts. The significance analysis of contract types showed how principal agent problems affect ship investments. That is, under time charter contracts the charterer benefits from fuel savings, not the ship owner. Under voyage contracts, the charterer did not pay voyage costs and could exhibit opportunistic energy consumption behaviour, disadvantaging the ship owner. The findings on economic barriers for energy saving investments by Longarela-Ares, et al. are important to consider in order to determine the extent to which the maritime shipping sustainability transition can be accelerated.

Besides the many challenges faced by the maritime shipping industry due to increasing environmental concerns, the sustainability transition provides opportunities for the financial sector at the same time (Morchio, et al., 2024). The authors investigated the state of green financing in bulk shipping. Firstly, it was described that the concept of sustainable finance is emerging within the dry bulk shipping sector. Especially stakeholder pressure raises attention to pursue sustainability investments. Secondly, green strategies were grouped in four categories: (i) hard green investments, referring to for instance alternative fuel operated vessels or decarbonising equipment; (ii) soft green practices and procedures, referring to for instance speed optimisation- and fuel consumption strategies; (iii) carbon finance markets; and (iv) market based measures. Morchi, et al. note that lenders play a key role in facilitating many of these green strategies. As such, it was described based on a Bloomberg (2022) statistic that the global green debt finance market reached 750billion US$ in value during the first half of 2022. Thirdly, popular green finance products included in the study are shown in table 1. The authors concluded based on multiple business cases that dry bulk shipping companies are benefiting from the emergence of green financing options. Moreover, it was found that sustainability linked- bonds or loans are most popular for achieving longer term corporate sustainability goals by shipping companies. On the short-term, green- loans and bonds were found to be more suited to finance ad hoc projects. Lastly, the increased attention on sustainable finance in shipping and various green product offerings by banks

is affecting behaviour of finance departments within maritime shipping, thus contributing to shaping the sustainability transition.

Table 1 Green finance products (Morchi, et al., 2024)

Product	Description
Sustainability-linked bonds	Issuance is subject to transparent sustainability credentials, incentivising pre-agreed achievement of ESG objectives and contain clear KPIs and targets[5]
Sustainability-linked loans	Incentivising the borrower to achieve pre-agreed sustainability targets[6]
Green bonds	Similar to common bonds, but committed to raising capital for green projects[7]
Green loans	Use of funds is exclusively linked to green projects, including research and development projects[8]

In a nutshell, Morchi, et al. (2024) highlighted opportunities for the financial sector to explore sustainable- and green finance solutions with their clients, and analysed the overall attitude towards green financing in the dry bulk shipping sector. In line with this research, various business cases were investigated on the overall uptake of green bonds in Norway and Sweden during the period from 2013 to 2019 (Torvanger, et al., 2021). More specifically, the authors examined drivers of the green bond market in these countries. In general, it was found that the type of economic activity within a country plays an important role to develop the uptake of green bonds. For instance, Norway's economy is dominated by oil- and shipping activities. These fossil fuel related activities showed not to be straightforward candidates for green bond financing. Partly because of this reason, the green bond uptake in Norway was found considerably less compared to Sweden. Additionally, the authors conclude that green bond markets can be stimulated by regulators and a proactive financial sector. The study by Torvanger, et al. draws a practical perspective on the earlier mentioned opportunities for the financial sector in the green finance space. Torvanger, et al.'s findings suggest that green financing solutions in maritime shipping are less developed versus other industries, and this is likely to remain if the industry sticks to fossil fuel related activities.

Overall, the review in this section contributes to understanding both the development of sustainable- and green finance in maritime shipping and what the potential implications are to ship

[5] Sustainability linked bond principles, page 1 (The International Capital Market Organization, 2024)
[6] Guidelines for sustainability linked loans, page 1 (Loan Market Association, 2024)
[7] As described by Morchi, et al. (2024)
[8] Green loan principles, page 1 (Loan Market Association, 2023)

finance. Various economic barriers for current investment cases and opportunities in the space of sustainable- and green finance were discussed. It was found that factors such as vessel size, age and operations affect investment decision making for energy efficiency related projects. Moreover, principal agent problems arise with regards to contract types which could hinder sustainable investment motivation. Nevertheless, it was indicated that the emergence of sustainable- and green finance could have the ability to accelerate the sustainability transition in the maritime shipping industry. However, a recent study on the uptake of green finance products in Norway and Sweden demonstrated limitations. Nevertheless, research showed that the role of the regulator could be influential. As such, market based measures on carbon finance demonstrated a direct relationship with shipping markets.

4. Conceptual framework

Following our review of the selected literature, this section introduces various factors which could affect the capacity of banks to accelerate the sustainability transition in maritime shipping. We did not identify a systematic debate among scholars on a collective set of factors influencing ship finance from the perspective of the bank. However, Fricaudet, et al. (2023) provided empirical insights on the beliefs and aims of financiers regarding their future role in ship finance. With our current research, we aim to contribute to the existing knowledge by validating hypothesised factors which could affect the sustainability transition in maritime shipping.

The remainder of this section elaborates on these hypothesised factors, while summarising related findings from the literature review. Firstly, section 4.1 develops a hypothesis covering the important role of the bank as strategic partner to maritime shipping companies. Secondly, section 4.2 constructs a hypothesis regarding the need for regulatory involvement, enhancing sustainability related investment cases. Third, section 4.3 elaborates on the importance of technology risk assumption and proposes that mitigation of this risk is key to advance investments in new technologies. Fourth, section 4.4 proposes a hypothesis on the potential role of sustainable and green finance in driving the maritime shipping sustainability transition. In addition, we present a graphical representation of the collective factors which one could assume. Afterwards, section 6 discusses the empirical findings in light of the conceptual framework and hypotheses developed within this section.

4.1. The role of the bank as strategic partner

The bank fulfils a critical role within the maritime shipping industry, partly due to high capital intensity (Alexandridis, et al., 2018). It was found that banks have traditionally been the main capital provider to maritime shipping companies and played an important role as growth facilitators. Although, research showed that the financing function is affected by the volatility of freight markets and the cyclical industry nature (Albertijn, et al., 2011). Therefore, financiers in maritime shipping must have a long term view across cycles (Stopford, 2009). Relative to other industries, we found that maritime shipping companies typically operate with high gearing ratios, thus relying heavily on debt financing (Drobetz, et al., 2013). However, capital structure decision making showed to be affected by the stage of the cycle. During strong freight markets, for instance the period pre 2008, it showed that banks may contribute to overstimulating the market with excess capital (Opitz, et al., 2018). This development happened prior to the 2008 financial crisis and led to significant oversupply. Hence, the maritime shipping industry demonstrated to be exposed to (extreme) volatility and vulnerable to crisis risk. As a result, post 2008 many banks reduced their shipping portfolios or left the industry. It was described that the reluctancy by banks to finance the maritime industry, contributed to popularity gains of alternative capital sources (Gong, et al., 2013). For example, bond financing and IPO's replaced some market share from banks (Alexandridis, et al., 2018).

Based on our findings from the reviewed literature, it is fair to argue that banks must navigate a complex ship finance market in a high risk environment. Nevertheless, the role of the financier was characterised as relationship driven (Fricaudet, et al., 2023). Research described that longstanding relationships between banks and maritime shipping companies contributed to strong knowledge sharing. Banks have become strategic partners for their maritime clients, experienced at navigating market volatility and cyclicality. In view of the above, **we hypothesise that going forward banks remain well positioned to maintain their strategic support function in maritime shipping, despite high market volatility and industry cyclicality.** This hypothesis is important to consider in light of answering our research question, to what extent banks have the ability to accelerate the sustainability transition within the maritime shipping industry.

4.2. The need for regulatory involvement

From the literature review it was found that both maritime shipping companies and banks are committed to decarbonising their operations and portfolios (Fricaudet, et al., 2023). As such, banks aspire to fulfil a loyal enabler role as part of the transition. At the same time, it was shown that the current sustainability transition is developing slowly and short term IMO targets may not be met. The maritime shipping community expressed the need for market based measures to advance sustainability investments. Research described that sustainability related investment cases require financial incentives to enhance project economics, given the capital intensity and uncertainties on future fuel- and carbon prices (Metzger, 2022). In addition, the need for a unified ESG performance reporting framework was identified (Tsatsaronis, et al., 2024). Nonetheless, as mentioned in section 4.1, experienced maritime shipping banks do not shy away from typical industry- and market challenges. Besides, it was indicated that technological progress could increase the pace of the sustainability transition (Fricaudet, et al., 2023). Therefore, the implied need for financial incentives to develop profitable investment cases may not be structural. Moreover, research found that market based measures are not principally required to build profitable sustainability related investment cases (Metzger, 2022). Of course, this is depending on the assumptions of variables involved. In addition, banks have their own sustainability targets and these are proactively pursued by, for example, the implementation of the Poseidon Principles (Global Maritime Forum, 2023). Based on these considerations, one could argue that the outspoken need for enhanced regulations and market based measures to advance a sustainability transition is questionable.

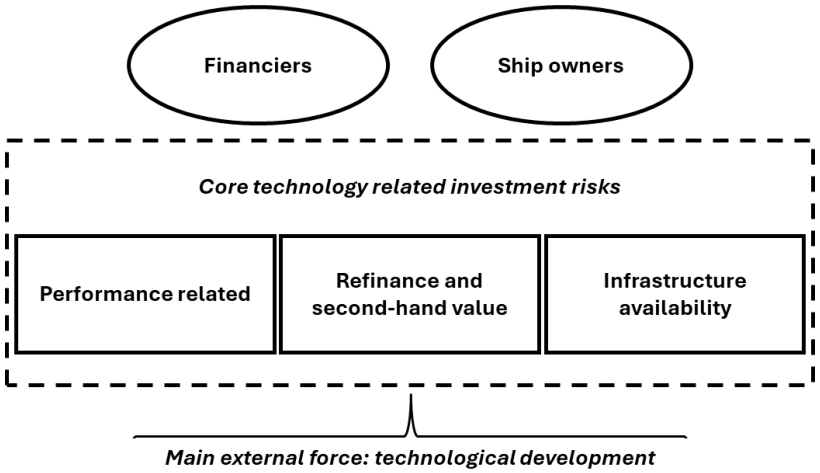
Meanwhile, studies on the impact from the 2008 financial crisis on ship finance showed that enhanced regulations may affect the willingness of banks to extend loans to maritime shipping companies (Opitz, et al., 2018). That is, behavioural changes by financiers were established in the literature (Gong, et al., 2013). Hence, **we hypothesise that enhanced regulations in maritime shipping are not required to advance a sustainability transition, as strict financial sector regulations already put pressure on the sector to reform**. In fact, increasing and stricter environmental regulations from the maritime sector could discourage banks from extending loans to

shipping companies due to increased investment complexity. Overall, the role of the regulator is important to consider in answering our research question, since legislation may affect the position of the banks amid a sustainability transition in maritime shipping.

4.3. Impact of technology risk

The literature showed that various technological uncertainties regarding alternative fuels are affecting investment decision making (Fricaudet, et al., 2023). More specifically, this restrains investors and banks from pursuing investments in alternative fuel operated vessels (Metzger, 2022) (Sun, et al., 2023). From the perspective of the bank, research assumed that vessels are traditionally considered appropriate collaterals to loans (Albertijn, et al., 2011). However, given the uncertainties on technological development, the appropriateness of alternative fuel operated vessels, in case of unproven technologies, as collateral to bank loans could diminish. On top of that, infrastructure availability was shown to be a key consideration to advance such investments (Glavinovic, et al., 2023). Based on this, one could argue that unavailability of required infrastructure may impact operational flexibility and therefore operating cash flows. Although, the significance of the specific impact on cash flows would be subject to further analysis. Considering these implications, the risk of default on a loan increases because of potentially stranded assets (Haider, et al., 2019). In view of this section, the technology related investment risks can be summarised in the figure below.

Figure 1 Technology related risks



Thus, the sustainability transition in maritime shipping faces challenges from a technology perspective. The literature showed that currently vessels operating alternative fuels are only ordered to a limited extent (Fricaudet, et al., 2023). Nonetheless, it was noted in one study that the pace of ordering such newbuilding vessels could be increasing alongside technology developments. In this case, herding behaviour in maritime shipping could influence the direction of the sustainability transition (Papapostolou, et al., 2017). Based on our findings, **we propose that technology risk is the primary factor limiting investments in alternative fuel operated vessels**. Due to uncertainties regarding the

pace of technological development, the risk is difficult to mitigate. Within the literature, technology related risk mitigation strategies were not discussed.

4.4. Uptake of sustainable- and green financing

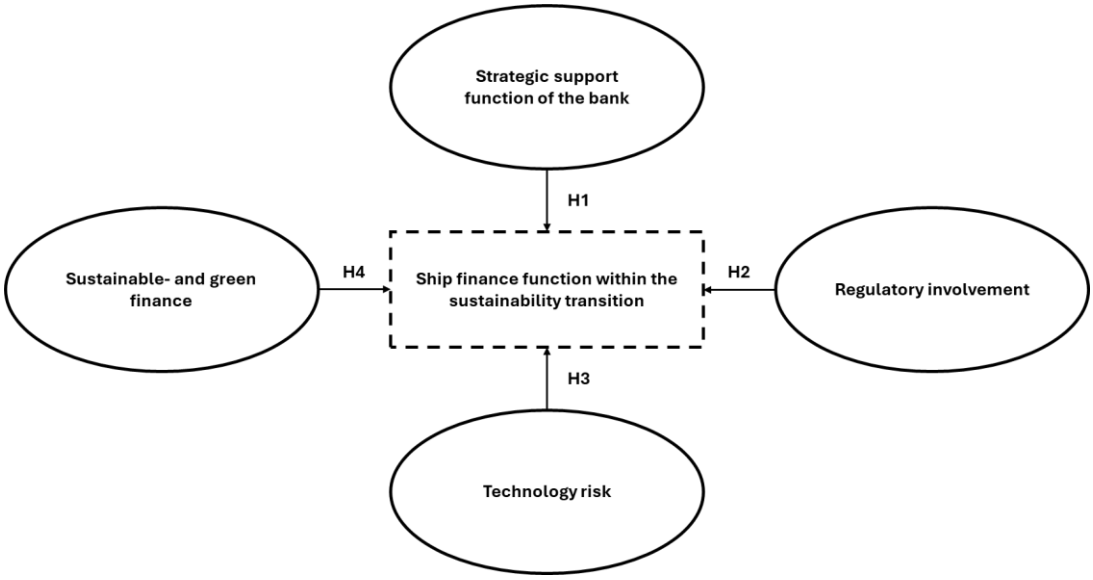
One study mentioned that green financing in maritime shipping is not a logical choice because of its relatedness to fossil fuel activities (Torvanger, et al., 2021). Nevertheless, it was indicated that the uptake of sustainable- and green finance in maritime shipping is emerging (Morchio, et al., 2024). Based on this, one could conclude that a wider scope of green projects are being identified within maritime shipping. Therefore, green financing solutions become increasingly feasible. This development was confirmed within the literature, since it showed that responsible shipping is gaining attention from various stakeholders in the industry (Xue & Lai, 2023).

Morchio, et al. (2024) indicated that opportunities exist for the financial sector within the maritime shipping sustainability transition. However, research indicated that limited financial product innovation takes place within banks, regardless of the traditionally important role within the maritime industry (Yu, 2020). Based on our findings from the literature, **we hypothesise that increasing sustainable- and green finance product offerings by banks is an important condition to accelerate the sustainability transition in maritime shipping.**

4.5. Summary

The hypotheses developed pertain to factors which could affect the sustainability transition in maritime shipping and are important to understand in view of our overall research question. The figure below graphically summarises the hypothesised factors. While reviewing the literature, interactions between factors, or between certain elements of factors, were touched upon. However, existing relationships were not specifically discussed and would be subject to future research.

Figure 2 Graphical representation of hypothesised factors



5. Empirical findings

In this section, we present our findings from the interviews with industry professionals, adhering to the structure outlined in the methodological approach. The interviewees represent two EU banks with an active shipping portfolio and a major global container liner company. The questions and statements which were applied during the interviews have been formulated following an initial assessment of the selected literature and the conceptual framework. The conceptual framework allowed us to connect the reviewed literature and develop hypotheses which were deemed relevant to consider in light of the overall research aim. The remainder of this section is organised according to the statements and questions discussed during the interviewees, which have been allocated to the hypotheses developed within the previous section.

5.1. Empirical findings: the role of the bank

Policy versus practice. Current sustainability commitments from banks and ship owners are workable in practice.

It was found that for both banks sustainability is a core part of the corporate strategy. One interviewee explained that sustainability commitments are aligned with net zero by 2050 ambitions by the Net Zero Banking Alliance (NZBA). This is a United Nations led finance initiative. One important implication of the outspoken commitments from banks is that maritime shipping companies will be actively questioned on their net zero ambitions. In addition, it was mentioned that financiers' commitments are aligned with the Poseidon Principles. The implications pertain to strict reporting, but the resulting transparency was found to be an effective tool to achieve environmental targets.

In practice, one bank's intentions can be demonstrated by the omitted support for oil exploration companies. The global trend is decarbonising and oil exploration activities do not fit within the bank's strategy anymore. However, oil storage companies are still supported. The interviewee mentioned that these type of activities could end soon because of two reasons. First, it is expected that in the medium- to long term no viable investment cases can be developed. Second, the reputational risk becomes too significant. Nevertheless, in maritime shipping, banks have yet to develop strategies to move away from fossil fuel related activities. Both interviewees indicated that the maritime industry will remain an important sector within their portfolios, despite its pollutive nature.

The early stages of sustainability strategy formulation by banks was illustrated with an example, outlining the complexity of some investment cases. In practice, the investment cases are often not as straightforward as reflected through general strategy outings. The acquisition of a newbuilding oil tanker can be more energy efficient than acquiring a car carrier which is transporting electric cars from China to Europe. That is, the design of the oil tanker is much more energy efficient and therefore the vessel is burning less fuels, regardless of its useful purpose.

It was mentioned by one interviewee that sustainability ambitions from banks and ship owners are not necessarily aligned. However, a difference was identified between larger and smaller maritime shipping companies. The interviewee mentioned that this could be explained by shareholder pressure, since it affects the need to decarbonise for larger (publicly listed) companies to a greater extent. Nonetheless, it was recognised that maritime shipping companies do not always directly control the energy intensity of their operations. That is, realising GHG emission reduction targets also have to do with how the ship is operated. This is depending on certain factors, such as the weather, berth availability at port and contractual arrangements. On top of that, due to the relatively long useful lifetime of vessels, decarbonising maritime shipping takes time. As such, the interviewee mentioned that maritime shipping is not an ideal sector to decarbonise quickly and could stay behind compared to other industries.

From the perspective of the ship owner, it was found that their sustainability policies are mainly aligned with the IMO guidance. Due to ship yard availability and construction time for newbuilding vessels, short term IMO targets will most likely not be achieved by the overall maritime shipping community. Instead, the long term targets, net zero by 2050, seem more likely to be achieved by the industry. Although in practice many questions on alternative fuels remain. On the other hand, the company is subject to EU regulations, such as EU ETS. The EU regulations have a significant impact on its operations.

Portfolio impact. How does the current client portfolio affect sustainability goals and ambitions?

In principle, it was indicated that banks do not straightforwardly finance vessels, mainly because of traditional maritime features such as cyclicality and high risk. The bank's capacity to anticipate this cyclicality was viewed as an important condition to remain active in the maritime shipping sector over a longer period. As a result, longstanding relationships with clients have developed. The bank values these relationships and does not exclude maritime shipping companies only because the sector is relatively polluting. Although, the bank recognises that other financiers may pursue a different strategy.

One interviewee mentioned potential pressure from shareholders to reform the portfolio. However, pressure from shareholders was mainly directed at enhancing profitability and not necessarily decarbonising. Although, the bank acknowledges that decarbonising is a prerequisite to remain profitable in the long run. Therefore, sustainability is already core to the bank's strategy. In the short run, the bank is aware that other parties will generate significant revenues with fossil related activities such as oil exploration projects.

Turning the question around, to demonstrate the impact of sustainability commitments on the bank's current portfolio, one interviewee presented an example from their short-sea portfolio. This separate division of the bank mainly focuses on the top-five Dutch coastal maritime shipping companies.

These companies generate revenues between 200-300 million euros per year. The clients' sustainability commitments align well with those of the bank. That is, this set of companies have the (financial) capacity to bear additional administrative burdens and to eventually reform their fleets. The problem arises for smaller maritime companies, around the 30-40 million euro yearly revenue. The bank foresees struggles for these companies to comply with future regulations. As a consequence, these companies are at risk within the bank's portfolio on the long term.

From the perspective of the ship owner, it was agreed upon that transitioning will be hard for smaller companies. Therefore, the implication of them phasing out from the bank's portfolios could be imagined. Overall, the sustainability transition in maritime shipping was perceived as a lucrative opportunities for banks. Much capital will be required to renew the global fleet. It was mentioned that ultimately, both banks and ship owners have similar goals. Therefore, the ship owner is not necessarily fearing for its position within the bank's lending portfolio.

5.2. Empirical findings: regulatory involvement

Regulatory involvement. Increasing regulatory complexity limits financiers to play a role in maritime shipping.

From a policy perspective, it was mentioned by one bank representative that regulatory involvement is important to create awareness and to progress the sustainability transition. For example, the NZBA and the Poseidon Principles offer important support and tools for banks to effectuate climate ambitions in maritime shipping.

From a regulatory perspective, both banks indicated that the legal environment they must navigate has indeed become more complex. However, it was expressed that the lack of a central regulator in maritime shipping is hampering progress. If the IMO would be considered that central regulator, legislative development from the IMO advances very slow. On the contrary, regulatory development for the financial sector progresses swiftly. For instance, the European Central Bank (ECB) has been taking the lead in decarbonising operations for the EU financial sector. As such, the maritime shipping companies will notice the implications of these developments.

In addition, it was considered that at the end of the value chain, consumers are price driven. Hence, maritime shipping companies seek to offer the lowest prices. Therefore, the bank stresses the need for financial incentives to make sustainable investments more attractive. On the contrary, the ship owner's representative mentioned that customers are increasingly willing to pay a sustainability premium. Still, it was agreed upon that generally price stimulation would boost the industry transition.

Regulatory risk as such, is only assumed to a limited extent by both banks and the ship owner. While the ship owner anticipates new regulations by being far ahead of existing regulations, the banks are closely connected to the Poseidon Principles, reflecting IMO guidance. It was indicated by one

interviewee that enhanced regulations by the IMO will most likely not result in unrealistic targets. The bank is aware that major shipping companies have the ability to influence IMO decision making. This awareness is the main reason for limited assumption of regulatory risk from IMO imposed regulations.

5.3. Empirical findings: technology risk considerations

Technology risk. Diverse company strategies for alternative fuel selection poses significant investment risk.

It was mentioned that currently many uncertainties exist regarding technological development. Therefore, the bank observes limited investments by maritime shipping companies into alternative fuel operated newbuilding vessels. Moreover, it was indicated that the current level of investment is perceived limited in general compared to historical benchmarks. This was mainly explained by current uncertainties due to technological and regulatory developments. The ship owner aligns with this view, mentioning technology risk as the most important restraining factor for current investments.

Even though technology risk was considered significant, one bank representative explained that the risk can be mitigated to a large extent. The bank typically does not provide funds for individual assets, but rather applies a fleet perspective. This way, the investment case is diversified among several technologies and as a whole carries a lower risk profile. Moreover, differing strategies relating to different fuel types by shipping companies is not negative for the bank. This results in a diversified loan portfolio, mitigating risk to a certain degree.

Residual asset value. The uncertainties related to future dominant fuel types in maritime shipping significantly impacts the risk of stranded assets.

In line with the previous statement, one interviewee indicated that the risk related to residual value of assets is indeed perceived significant. It was mentioned that this is a key consideration for the decision to provide a loan or not. The interviewee mentioned the complexity related to LNG powered vessels. Going forward, the Poseidon Principles consider the GHG emissions “from well to wake”, rather than “from tank to wake”. In other words, the environmental impact will be counted considering the energy intensity related to the complete lifecycle of the fuel. Hence, the interviewee anticipates a possibly changing approach from banks towards LNG operated vessels. At the same time, it was mentioned that financing of LNG operated vessels is expected to continue as part of the bank’s current strategy, seeing LNG as a transitional fuel.

The ship owner representative indicated that despite significant technology risk, the urge to act upon a concrete newbuilding strategy is existing. The company is considering its options, taking into consideration required port infrastructure plans. In order to be agile, it was expressed that the current newbuilding strategy focuses on dual fuel operated vessels. At this point there is no specific preference for a certain fuel type. LNG, methanol and ammonia are considered. However, the company

acknowledges that within the current state of technological development and considering existing infrastructure availability, LNG is more suited as a transitional fuel. Ultimately, ammonia was considered the ideal future option. In line with the company's strategy, also from an industry perspective it was perceived that dual fuel operated vessels are currently considered essential to mitigate the risk of stranded assets.

Portfolio diversification. Aiming for a diversified portfolio opens the doors for riskier investments in new technologies.

As indicated prior, the bank encourages a diversified portfolio since it contributes to risk mitigation. Moreover, the interviewee mentioned the importance of sharing best practices among its clients. In this regard, an example was shared related to one of the bank's projects in the Port of Rotterdam area. Within the Dutch short sea trade, the possibility to experiment with alternative propulsion technologies exists due to relatively short distances between ports. The bank recently supported a project related to battery powered vessels. Within the coastal trade, the opportunity to recharge batteries allows for electrification of operations. However, the interviewee indicated that within the deep sea trade this technology is not viable.

As mentioned, the ship owner pursues a diversified newbuilding strategy, while keeping in mind infrastructure availability and the state of technological development.

Loan terms. Shorter loans are better suited for investments in new technologies.

One interviewee mentioned that maritime shipping companies have generated significant revenues in the past years. Therefore, lower leverage ratios seem acceptable. Disregarding the potentially diminished need for leverage, riskier investments do typically require tighter loan terms and conditions. However, this is a trend which is visible in shipping for longer. Whereas in the past a lifetime of 25 years per vessel was considered within the investment case, this has nowadays been reduced to 10 to 15 years. Shorter loan terms are mainly driven by the increased pace of technological development.

Furthermore, regarding potentially stricter loan terms and conditions, the fleet perspective was mentioned to mitigate risk. For instance, consider the bank's policy which include loan-to-value ratios of 70 percent. When a syndicate of banks invest in a fleet of 100 vessels, an average lifetime of 15 years can be assumed. To develop an attractive investment case for vessels operating new technologies as part of this fleet, the lifetime to recover the investment can be set at 20 years, while conventional fuel operated vessels which are part of the fleet are accounted for against 14 years.

As mentioned earlier, from a ship owner perspective it was confirmed that currently lower levels of leverage are required to reform the fleet. Nevertheless, leverage remains an important part of financing strategies. From the bank's perspective, lower leverage at maritime shipping companies allows for a slightly higher risk profile while investing. At the same time, the bank would incur higher

risk for larger clients. As such, the interviewee indicated that the sustainability transition in maritime shipping could lead to higher market concentration of larger firms.

New versus existing clients. New technology investments are rather explored with existing clients than new clients.

Firstly, one interviewee emphasised the important role of the bank in the maritime shipping industry. The bank is often an important long term advisor to its maritime clients. This was demonstrated by the ability of the bank to look through cycles. Therefore, it is important to continue having discussions on challenging topics like sustainability. As such, longstanding relationships with existing clients are greatly valued. Nevertheless, it was mentioned that the preference for existing clients over new ones differs per bank. A key element in the relationship pertains to trust. One bank indicated to aspire a strategy of inclusivity related to sustainability advances, pursuing synergies between both parties' environmental strategies.

Despite the longstanding relationships, the interviewee acknowledged that there are leaders and laggards within the sustainability transition. In addition, as described earlier, the bank assumes a higher market concentration of larger firms due to the sustainability transition. It will be harder for smaller maritime companies to keep up with regulations and capital requirements to transform the fleet. The ship owner representative acknowledged this development.

5.4. Empirical findings: sustainable- and green financing

Alternative- and green financing. The need for capital in maritime shipping will open doors for alternative capital sources, while especially green financing structures will gain popularity.

Firstly, the bank's representative was not able to provide most recent insights on competitive impact from alternative financing structures. Nevertheless, it was indicated that bank financing is expected to remain very competitive due to stability and cost. In addition, the attractiveness of bank loans was explained by the various strategic services banks can offer clients due to their industry experience. However, European banks do observe increasing market shares by Chinese banks to (mainly) domestic maritime shipping companies. Moreover, the global nature of the maritime industry also encouraged export agencies in for example Korea to provide funding. Besides bank financing, the interviewee mentioned that there could be dedicated private equity houses which offer similar expertise as banks. While financing alternatives from capital markets or bond financing, are not seen as typical attractive capital sources for maritime companies.

In terms of green financing, the green loan principles from the LMA are typically followed. Green investments were confirmed to be in high demand. However, the optionality to apply green loans is often limited. For example, LNG is a currently popular alternative fuel but related activities may not

fall within the LMA scope of green projects. Besides green loans, other sustainable- or green finance products were not mentioned.

From the ship owner perspective, it was indicated that alternative green financing solutions are actively pursued. Currently, the company has published their green financing framework and issued a sustainability linked bond. These developments in the green financing space are aimed towards financing energy efficiency projects, including newbuilding vessels.

6. Discussion

The purpose of this section is to validate our findings from the literature review with the collected insights from practice. As such, we reflect upon the hypothesised factors affecting the capacity of banks to accelerate the sustainability transition in maritime shipping. The remainder of this section is structured as follows. Section 6.1 analyses the role of the bank as strategic partner for maritime shipping companies. Next, section 6.2 considers the need for enhanced regulatory involvement to advance a sustainability transition. Subsequently, section 6.3 examines the impact of technology risk on the sustainability transition. Lastly, section 6.4 discusses the potential impact of developments in sustainable and green finance on the role of the bank.

6.1. A future proof strategic role of banks in maritime shipping

It was established that dedicated ship finance banks fulfil an important role as strategic business partners of maritime shipping companies. Primarily, the bank has traditionally been the most important capital provider. Moreover, the bank's expertise, ability to navigate cycles and longstanding relationships are key features of the important- and strategic position within the maritime industry. However, challenges exist. It was verified during the interviews that the ship finance sector can be considered rather conservative. The relationship driven nature of the industry could obstruct or delay innovation involving new technologies. The conservative nature of the ship finance market could be explained by the bank's risk averseness and vulnerability to extreme volatility and crisis risk. At the same time, one bank representative indicated the importance of having a profitability focus. It is important for banks to balance profitability and sustainability focuses in the short to medium term. Although, it was established within the interviews that sustainability is considered a condition for long term profitability. Besides, one could argue that the profitability focus of banks may lead to a cautious financing approach towards unproven technologies.

Despite various challenges, the bank aims to leverage its traditional role in maritime shipping. It was indicated that banks foresee to fulfil an enabling role regarding a sustainability transition. However, capital structure decision making by shipping companies is depending on the stage of the shipping cycle. As such, the short term need for leverage was perceived relatively low. One could argue that this comes with advantages. That is, lower leverage ratios allow banks to assume higher risk profiles regarding investments. This could benefit investments in unproven sustainable technologies. Moreover, since the transition may lead to consolidation within the maritime shipping industry, risks can be reduced and profitability improved.

Overall, by anticipating and aligning with evolving regulations banks can further exploit the growing demand for sustainable solutions. In light of the overall research aim of this paper, the future position of the bank is important to consider at first. The current paper hypothesised that going forward banks remain well positioned to maintain their strategic support function in maritime shipping, despite

high market volatility and industry cyclicality. Based on our findings and the analysis in this section, it could be argued in favour of the hypothesis.

6.2. Regulatory support or increased complexity?

A global web of regulations without one central regulator, creates regulatory challenges for maritime shipping companies and ship finance banks. It was found that maritime shipping companies are viewing the IMO as leading regulator, but regulatory development advances slowly. Banks mainly consider financial sector regulators and initiatives, such as the ECB and Poseidon Principles. It was found that financial sector regulations develop faster compared to legislation imposed by the IMO. Moreover, delegated policy making responsibility by nation states to the IMO still requires improvement for effective adoption of IMO legislation into national laws.

Traditionally, the role of the financier within maritime shipping was found facilitative. Whereas developments regarding responsible shipping could affect the attitude of the financier. In practice, the requested need for ESG performance reporting could increase investment complexity and affect the willingness of banks to provide capital to maritime shipping companies. Although, it was found from the interviews that market based measures which incentivise sustainability investments, are increasingly called upon by both shipping companies and banks. In this regard, one could argue that banks and shipping companies mainly refer to price incentives for customers, to boost sustainable shipping. Currently, the absence of concrete measures may lead to a cautious financing approach, which slows down a sustainability transition.

Nevertheless, it was found that financial sector initiatives impact maritime shipping considerably. That is, shipping companies are extensively asked by banks about sustainability aspects underlying their loan requests. Therefore, regulatory developments in supporting industries, such as the Poseidon Principles within the financial sector, drive sustainability advances within maritime shipping. Supporting sectors seem to move faster than maritime shipping in the regulatory environment. Based on this, one could question the need for additional regulations and market based measures imposed by the IMO, supposedly viewed as the central regulator in maritime shipping. Many so called regulatory uncertainties can largely be allocated to technology risk rather than regulatory risk. For instance, research has shown that sustainability related investment cases depend on investment case assumptions related to future fuels and carbon pricing. Future fuel prices directly relate to technological development and therefore the direction of the industry transition. Whereas carbon pricing can be regulated, it appeared that regional frameworks, such as by the EU with the EU ETS, could show greater significance due to the complexity to regulate the globally oriented maritime industry.

Overall, regulatory uncertainties were only assumed to a limited extent by banks and shipping companies. While stricter regulations could increase the administrative burden and lead to additional costs for shipping companies and financiers. On the one hand, banks follow specific financial sector

legislation strictly. As said, these regulations were assumed to develop faster than the general maritime industry's regulatory framework. On the other hand, shipping companies aim to be ahead of future IMO regulations, while being impacted by supporting sectors' regulatory developments. The willingness to provide capital to maritime shipping companies by banks would not be affected due to the level of regulatory uncertainty which was established in this paper. Although, un-orchestrated legislation could lead to hesitance by banks to provide capital due to additional scrutiny. Nevertheless, all interviewees acknowledged the anticipated consolidation within maritime shipping, driven by increasing and stricter regulations.

To conclude, the current paper hypothesised that enhanced regulations in maritime shipping are not required to advance a sustainability transition, as strict financial sector regulations put pressure on the sector to reform. Based on the findings from the literature review and insights from practice, one could argue in favour of the hypothesis following the analysis in this section.

6.3. Technological development, the main driver of a sustainability transition

Technology risk has been identified as the key factor affecting the pace of the sustainability transition. Consequently, the bank's lending policies are also tied to the stage of technological development and the assumption of corresponding risks. Although, the business risk arising from the state of sustainability technologies in maritime shipping was not widely discussed within the selected literature. Partly, this can be explained by the only recent uptake of alternative fuel technologies in maritime shipping. Nonetheless, all interviewees recognised the essence of considering technology risk in more detail.

It was found that banks observe cautious investment strategies by maritime shipping companies due to the uncertainties on future dominant technologies. From the literature review, it was conceptualised that core technology related investment risks pertain to financial performance impact, re-finance and second hand value of assets, and available port infrastructure. From the interviews, it can be concluded that these elements are indeed key considerations of overall technology risk. Moreover, the magnitude of the risk was found to be mainly impacted by the pace of technological development.

From a risk mitigation point of view, banks and ship owners seem to follow a similar approach. The investment risk is diversified through applying a fleet perspective. This way, the impact of a stranded investment due to technological obsolescence will be largely mitigated. Moreover, the ship owner's focus on dual fuel operated vessels provides another layer of risk mitigation. Considering that the traditional lifetime of a vessel is around 25 years, currently ordered newbuildings could have the opportunity to retrofit and operate other fuel types.

The current paper hypothesised that technology risk is the primary factor limiting investments in alternative fuel operated vessels. Based on the findings from the reviewed literature and insights from

practice, one could argue in favour of the hypothesis. Important to note, while technology risk can be considered the primary factor limiting investments, it can also be considered the main factor accelerating sustainability investments.

6.4. Growing presence of sustainable- and green finance

Few developments have been identified. Firstly, within the literature it was established that market based measures relating to carbon finance have a significant impact on maritime shipping markets. Secondly, the shipping community stresses the need for market based measures to increase project economics for sustainability related investment cases. Thirdly, increasing awareness on responsible shipping and the according role of the financier could provide opportunities for the financial sector to increase green financing product offerings. Based on these findings, one could argue that banks are well positioned to take a leading role as part of the sustainability transition by supporting the development of innovative green technologies.

However, it was indicated that the maritime shipping industry is not a straightforward economic sector to advance sustainable and green finance solutions, due to its sticky behaviour to fossil related activities. This could explain our observation during the interviews that both banks were not much expressive about green finance solutions, despite the bank's current actitives in the green financing space. It was mentioned that ultimately, banks could influence the type of vessels which enter the world fleet, they have limited control over how the vessels are operated, which can affect the overall sustainability impact.

From the ship owner perspective, it was mentioned that the uptake of sustainable- and green financing is considered an important element to accelerate the sustainability transition. The company is actively engaged in the green financing space and expressed the success of its sustainability linked shipping bond. Nonetheless, based on our findings from the literature and interviews, one cannot conclude whether the developments in the green financing space are a critical condition to accelerate the sustainability transition in maritime shipping. From what it seems, traditional lending products from banks are well capable to fund sustainable projects, without a green label attached. Possibly, regulatory involvement could affect this perception.

To conclude, the current paper hypothesised that increasing sustainable- and green finance product offerings by banks is an important condition to accelerate the sustainability transition in maritime shipping. Based on the analysis in this section, one could doubt the criticality of the role of sustainable and green finance solutions to accelerate a sustainability transition. However, the potential upside may not be ignored.

7. Conclusion

This research investigated the role of the financier as part of a sustainability transition in maritime shipping. It was aimed to introduce several factors affecting the capacity of banks to accelerate the sustainability transition within the maritime shipping industry. As such four factors were identified.

- Principally, the current paper showed that banks fulfil an important strategic support function for maritime shipping companies, which follows from developed expertise and longstanding client relationships. It was found that based on such strong foundations, banks are likely to remain their important position in maritime shipping amid a sustainability transition, despite industry cyclicality and market-related challenges.
- Secondly, this paper indicated that banks and ship owners foresee an important role for the regulator to advance a sustainability transition in maritime shipping. Nevertheless, it appeared challenging to identify a central industry regulator. Currently, the role of the IMO was perceived leading. However, a corresponding regulatory risk regarding uncertainties on enhancing future environmental regulations, is assumed only to a limited extent by banks and ship owners. Although, it is likely that increasing regulations will further shape the industry, for instance through consolidation. Importantly, financial sector regulations, such as the Poseidon Principles, were anticipated to put pressure on the maritime industry to reform. As a whole, maritime shipping is significantly affected by regulations from supporting sectors. In addition, it was mentioned that maritime shipping companies aim to be ahead of the IMO, a slowly moving regulator. Therefore, it could be concluded that the outspoken need for increased regulatory involvement by a central regulator to incentivise sustainability investments is not necessarily a requirement for the industry to transition.
- Third, the impact of technological development on the pace of a sustainability transition in maritime shipping was established to be significant. In this regard, key technology related risks include potential impact on financial performance, re-finance and second hand value of assets, and infrastructure availability. Although, banks and ship owners apply a fleet approach to mitigate technology risk, uncertainties on technological development remain a primary restraining investment factor.
- Fourth, it was found that the emergence of sustainable- and green finance solutions provide opportunities for banks to enhance their product offerings and drive decarbonisation in maritime shipping. Nevertheless, it was found that banks are not proactively pursuing green financing structures to drive a sustainability transition in maritime shipping. On the contrary, the issuance of sustainability linked bonds was actively marketed by the ship owner. Therefore, one could argue that opportunities in the green financing space are yet to be further exploited.

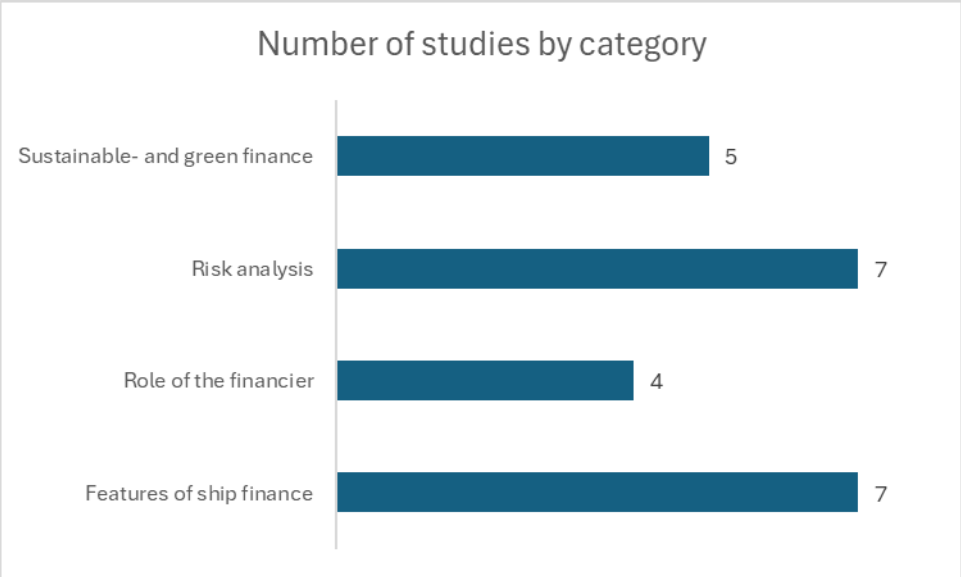
As such, the current paper established that the capacity of banks to accelerate a sustainability transition in maritime shipping was found to depend mainly on the pace of technological development.

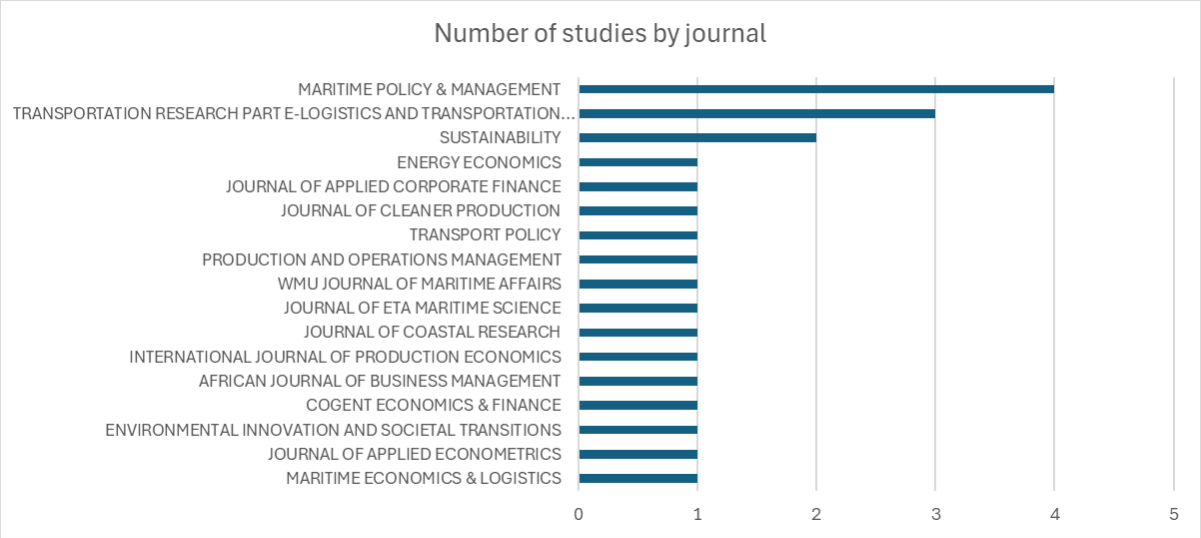
While the regulatory landscape and green finance environment have the potential to affect the position of banks, technological uncertainties limit the pace of sustainability investments.

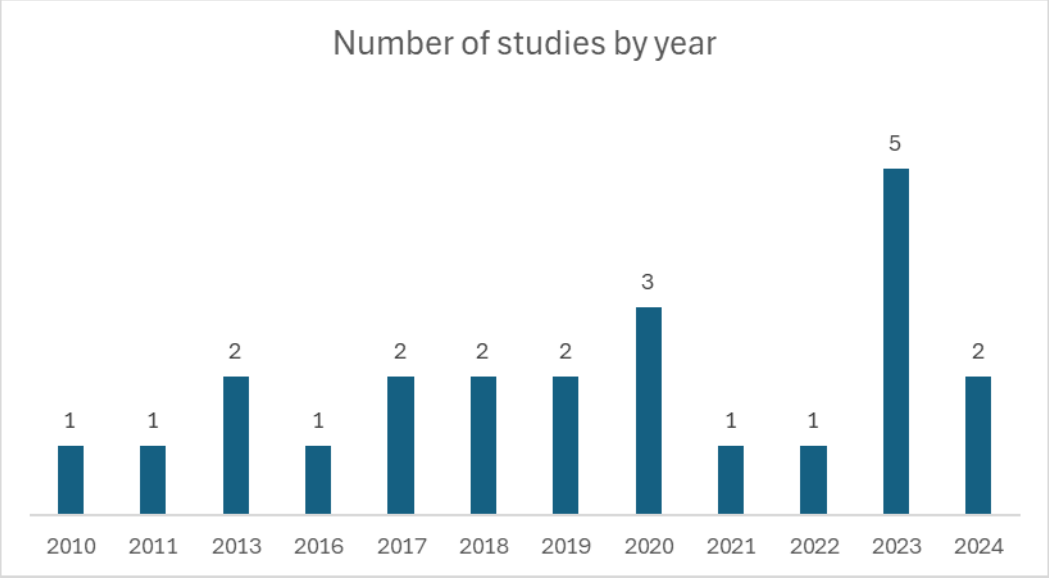
Important to note is that the findings in this paper are subject to limitations. The scope of the empirical study consists of a limited number of participants. Two EU based banks and one major global container carrier were represented. The ship owner was represented by the global asset management team, without direct corporate finance responsibility. To generate a complete view of the company's perspective on the issues discussed, it is important to gather insights from various teams, including corporate finance. Moreover, insights from ship owners operating in other maritime shipping segments would be valuable to consider. From the financier perspective, it is critical to consider additional input from non-EU banks due to the global nature of the maritime industry. Furthermore, the role of the financier within the maritime shipping sustainability transition was investigated by addressing the perspective of the financiers themselves. It is important to validate industry findings involving additional stakeholders to consider the position of the financier. For instance, the views of regulatory bodies. Lastly, from a methodology point of view, the literature review included articles focused on ship finance. A broader search focus, including regulatory and environmentally focused articles could offer different perspectives. Moreover, the interview notes were collected manually and have not been subject to thematic coding given the limited number of participants.

Following a review of the selected literature, a systematic debate among scholars on a collective set of factors influencing ship finance from the perspective of the bank was not identified. Although this research contributes to such systematic discussion, further empirical research is required to validate the robustness of these findings. In addition, future research could investigate the impact of ESG performance reporting and transparency following recent enhancements of the Poseidon Principles. Moreover, additional understanding is required on the role of sustainable- and green finance strategies within the sustainability transition. For instance, the resilience of green financing strategies to market volatility in maritime shipping remains underexplored.

Appendix A. Initial observations from the selected literature







Appendix B. One-pager with questions and statements

Theoretical Case & Statements

		Alternative scenario/considerations
Vessel	Financing an LNG-powered container vessel	Other fuels (e.g. hydrogen, biofuel)
Company XYZ profile	Globally operating container carrier, HQ in Europe	Different market segments (e.g. tanker, bulk)
Strategic goal company XYZ	Replace 30% of current fleet with LNG-powered vessels	Strong versus weak commitment
Company debt to equity ratio	Company XYZ is substantially leveraged at 1,75	Role of leverage for conventional and alternative fuels
LTV projection	The loan to value ratio will exceed 65% for several years	Various KPI requirements for such loans
Operations	No charter contract concluded yet, re-sale intention in 9 years	Market willing to pay premium? Re-sale value risk

Strategy

Policy versus practice

Current sustainability commitments from banks and ship owners are workable in practice

Client impact

How does the bank's client portfolio affect its sustainability goals and ambitions?

Portfolio diversification

Aiming for a diversified loan portfolio opens doors for "riskier" alternative fuel investments

Alternative financing

Regulatory complexity limits alternative financiers to compete, favouring banks

Loan profile and risks

Technology risk

Diverse company strategies for alternative fuel selection poses significant investment risk

Residual & re-sale value

The uncertainty on future dominant fuel types in shipping significantly impacts re-sale values

Loan term

Shorter loan terms are better suited for investments in ships operating alternative fuels

New and existing clients

Rather investing with existing clients in these new vessel types versus new clients

LNG and green finance

Price risk

Even though LNG plays an important role in the (short-term) sustainability transition, the associated price risk remains obstructive

Green financing

LNG is rightfully considered as a "green" fuel

Appendix C. Interview notes

Interview 1

Interviewee: bank representative

Background: Head of Sustainability Expertise Corporate Bank. About 30 years of experience in banking from which more than 10 years dedicated to transportation.

Notes:

Policy versus practice

- Firstly, banks do not straightforwardly finance vessels. This is because the maritime industry is extremely cyclical, besides regulatory development and lending policies regarding decarbonisation. The cyclicality arises from ship yard capacity and the construction time of vessels. When the market is booming, many vessels are ordered and delivery takes time. There is a lag in supply and therefore the charter rates increase further. When vessels are delivered by ship yards, supply increases and charter rates decrease again.
- There are a few Dutch banks which finance vessels. The one more than the other. This shows that expertise is limited. While expertise can be considered a condition to serve the maritime industry considering strong cyclicality. Some banks are 'tourists', these come and leave with the cycles but do not necessarily have a long term vision regarding maritime shipping.
- The bank is not planning to exclude certain industries only because they are relatively pollutive. An example of such is maritime shipping. Although, it could be a strategy from other banks to only provide capital to sustainable economic sectors. The bank realises the positive impact to society from maritime shipping and the sector will be supported. It was assumed that other similar banks follow an alike approach.
- The sustainability ambitions from banks and shipping companies do not necessarily align. It was argued that from the perspective of the bank, shipping companies pursue sustainability strategies because of various reasons, ranging from intrinsic motivation to customer pressure. On top, investors put pressure on shipping companies (and banks) to reform.
- Many banks have to report their individual environmental policies, with an institution called the NZBA. Over 100 banks have committed to increasingly align their activities to a net zero ambition. By 2050, everything that is being financed by the banks has to be net zero. As such, maritime shipping companies will be actively questioned by banks regarding their sustainability ambitions to see fit with the bank's commitments.
- The Poseidon Principles are a major game changer for financiers. This allowed banks to map better the carbon intensity of their portfolio and it is expect to significantly impact lending policies going forward. Which vessels do we want to finance and which not.

Portfolio impact

- A sustainability transition in maritime shipping is an opportunity for the banks to decarbonise their shipping portfolios. At first, the bank urges its clients to assess operations and see whether speed optimisation or bunker strategies can result in energy efficiency gains. At the same time, external forces such as a Suez canal blocking impact sustainability performance by shipping companies. Therefore, the bank's clients do not always have full control on pollution.
- The impact on the portfolio is difficult to grasp. There are still too many questions on future fuels and technological development. Therefore, in the short term, the bank's shipping portfolio will not be impacted drastically. This is noteworthy because shipping was one of the bank's first segments which received sustainability target setting. Nevertheless, it shows that decarbonising the shipping portfolio takes time.

Regulatory involvement

- Increasing and stricter regulations following the 2008 financial crisis resulted that many banks left the maritime shipping industry. This was not per se a one of a kind event. As mentioned regarding cyclicality, these periods of market entrants and leavers are considered typical.
- The existence of an EU carbon tax system is expected to develop globally. The shipping companies with energy efficient vessels will benefit, while relatively pollutive companies will be disadvantaged. This emphasises that it is commercially smart to prioritise sustainability.
- Increasing regulations has resulted in investment delays by shipping companies. However, the major reason for investment delays has not been regulatory uncertainty but rather technological development. Shipping companies are waiting to invest, to understand the direction of the transition.
- The challenge in maritime shipping is to determine a relevant regulator due to the global nature of the sector. The IMO is the main international regulator, but it remains very challenging to regulate maritime shipping. Therefore, it is difficult to talk about a leading regulator in the maritime transition. If the IMO is considered, regulations develop very slowly. On the contrary, regulatory development for banks progress very swiftly. The ECB implemented many sustainability regulations for European banks. So from a financial sector perspective, the regulator has a steering role. This will be faced by maritime shipping companies.
- For European shipping companies, CSRW regulations will be important. Consequently, the maritime shipping companies have to report on sustainability within their yearly reports going forward. This obligation counts from 2026.

Technology risk

- Technology risk is a critical consideration as part of the bank's investment decision making.

Residual asset value

- The bank assumes the risk of stranded assets due to technological development. The useful lifetime for vessels within investment cases has been shortened from 25 to 15 years, to account for technology risk.
- This is particularly interesting regarding investments into LNG operated vessels. Even though this might be seen as a transitional fuel, the emission count from tank to wake will be adjusted into well to wake. Therefore investments into LNG operated vessels may be viewed differently going forward. That is, the entire value chain of LNG as a fuel is energy intense.

Portfolio diversification

- Keeping in mind earlier comments, it is not against the bank policies to finance LNG operated vessels. On the contrary, it is important to maintain a diversified portfolio. Nevertheless, LNG is not a green fuel, this has to be realised.
- Maritime shipping will experience difficulties in the coming five to ten years to advance reductions of GHG emissions. For this reason, it is difficult for the bank to diversify its portfolio since alternative fuel investments are limited and the industry is anticipated to stick longer to fossil related activities. The bank will also need to explain this to its shareholders.

Loan terms

- Currently, shipping companies are earning good money. Therefore, we will see lower leverage in the market.
- In principle shorter loan periods reduce risk. The loan periods have nowadays been shortened. Technological progress has increased, so the terms and conditions to the loans have to be tighter. The latest developments are not entirely clear to the interviewee, because of a primary sustainability job focus.

New versus existing clients

- Sustainability targets do not shy banks away from longstanding clients, but this differs per bank. Such important relationships are highly valued and the bank intends to continue these. The bank has a so-called inclusive strategy, which aims to move her clients along the bank's individual strategy. The bank's current strategy includes sustainability, therefore it is important for the bank that its clients follow a similar strategy. The bank aims to make a difference with their available tools. Important tools are for instance its advisory ability and product offerings.
- It is important for the bank to continue conversations with its clients about sustainability topics. In practice, the bank's portfolio exists of leaders and laggards in terms of a sustainability transition. The bank aims to share knowledge and best practices through client engagement. At the same time, the bank foresees a role to educate its clients on sustainability practices.

Alternative and green financing

- Maritime shipping is not a quick mover in terms of a sustainability transition compared to other industries. The coming decade, it is likely to see maritime shipping being far behind in decarbonising.
- The question on alternative financing is difficult to answer. The latest insights regarding private equity is not known to the interviewee. But in general, bank financing can be considered relatively cheap and stable. On top, the bank has expertise which is important to ship owners. Nevertheless, private equity houses can also specialise.
- On the other hand, the bond market was not assumed very attractive to maritime shipping companies. Same holds for export agencies from for example Korea or China.
- As such, alternative financing sources exist, but are not necessarily very competitive to traditional bank financing.
- The bank pursues green financing practices. As said, LNG investments are not considered green. The bank follows the green loan principles from the LMA. It is considered very difficult to apply green loan structures to vessels investments. Therefore, the area remains quite untouched within maritime shipping.

Interview 2

Interviewee: bank representative

Background: Senior Relationship Manager for Shipping, Transport and Logistics. Over 30 years of banking experience.

Notes:

Policy versus practice

- Sustainability is a core element of the bank's corporate strategy. The bank is one of the greenest banks in the EU and can be considered an innovator regarding sustainability practices. As such, it was one of the first banks to issue green bonds.
- The bank does not assume significant pressure from its shareholders on sustainability progress. This may be different to other banks. Instead, the bank's shareholders have a significant profitability focus. Hence, this is not necessarily sustainability focused, but may be related.
- Considering the bank's overall lending policies, companies involved with oil exploration activities are not longer supported. Although, other financiers will earn significant revenues in the coming decades supporting these activities. This was a big step for the bank, which traditionally financed many oil exploration related activities through a reserve based lending approach. Fossil fuel storage activities remain being financed.
- In contrast, within maritime shipping such dynamic is not yet visible. The fact that shipping is very much tied to fossil related activities does not mean that the bank excludes the sector.
- The current fossil related activities which are still supported can be excluded two ways. First, in the future no economically viable business cases can be prepared anymore. Second, reputation risk becomes to significant.
- The bank is one of the founding members of the Poseidon Principles. As such, the bank's commitments are closely related. Collectively, banks promised society to reduce GHG emissions. The bank is proud to be considered best in class regarding the Poseidon Principles reporting requirements.
- In practice, the bank's sustainability commitments resulted in the installation of several committees evaluating investment proposals. One of the evaluation criteria refers to whether the investment is sufficiently green. This may result in interesting dynamics. For example, an efficiently designed oil tanker may be financed while a car carrier transporting electrical cars from China to Europe may not be financed because of its inefficient design.

Portfolio impact

- The bank's commitments to the Poseidon Principles have a few implications to its portfolio. Mainly, older and pollutive assets are aimed to be excluded from this shipping portfolio, to make room for new green investments.

- Within the Dutch short-sea practice (focus area of interviewee), the bank focuses on the top-five companies by capacity. These are not small companies with revenues between 200-300 million Euros. The problem regarding a sustainability transition is situated with the companies smaller than that. With revenues between 30-40 million euros. The bank anticipates that it will be difficult for these companies to comply with regulations.
- The bank actively requests sustainability related information form its clients. This is adding an additional burden. However, the information is not specifically for the bank, since the IMO is requesting similar information.
- Overall, the banks need to decarbonise their lending portfolios. Shipping provides an opportunity to do so.

Regulatory involvement

- A parallel to 2008, with increasing and stricter regulations, is interesting to consider, but is not identified. The current regulatory driver for maritime shipping companies is the IMO, this is very different to 2008. The financial crisis was subject to a liquidity issue, currently decarbonisation is the main underlying driver of increasing regulations.
- The bank understands the challenges with identifying a central regulator in maritime shipping. Due to various flag states, it is hard to implement coordinated legislation.
- Overall, regulatory risk is considered minimal by the bank. Decision making within the IMO is influenced by maritime shipping companies and these will not commit to unrealistic target setting. In addition, the IMO's targets are supported by CAPEX planes from shipping companies, technological development and the general state of the economy. The bank as such does not assume entrepreneurial risk.
- From an EU perspective, the story is slightly different. Considering the EU ETS, maritime shipping companies are forced to comply.
- A comparison with the wind energy sector can be imagined. At the start, technological developments steer the practical implementation. However, initially investments in wind turbines were not economically viable. This changed when the regulator imposed price incentives. Because of this technological development was able to progress and this changed the whole industry. As similar situation could be anticipated for maritime shipping. Because in the end, customers are price driven.
- For the bank, the role of the regulator is considered important, although the Poseidon Principles have significant impact already. In maritime shipping it is not only important to replace the fleet, but also to renew the fleet. A system which provides cheaper lending to support energy efficiency investments for existing vessels would be very beneficial. This is one concrete example where the regulator could play a role.

Technology risk

- Technology risk is in principle considered a key decision making factor. However, the bank does not shy away from unproven technologies. As such, the risk is largely mitigated from a fleet perspective. The bank does not prefer to invest an individual vessel operating alternative fuels. It needs a corporate guarantee. Therefore, as part of a broader fleet investment, some vessels may pertain to alternative fuel operated vessels. This is common practice within the bank, diversifying risk.

Residual asset value

- Technology risk can largely be aligned with the possibility of stranded assets.

Portfolio diversification

- In due time, the bank would like to have a larger share of green technologies in its portfolio. However, this is anticipated to last another 10 to 20 years. Although, the Poseidon Principles have the potential to boost this development.
- The bank views LNG operated vessels important during a transitional phase from fossil to green. Even though it is still a fossil fuel, the environmental impact is less compared to conventional fossil fuels.
- The bank has a special role within the Port of Rotterdam area from a financing point of view. Portfolio diversification is considered important to mitigate technology risk. In this regard, the Dutch coastal trade is a good segment to experiment with alternative fuels. These smaller companies could electrify their operations and utilise batteries that can be recharged during port calls. For example, hybrid vessels could transport goods from the UK through the Netherlands inland to Germany. The first part of the journey may be completed using conventional fuels, but the second part can be completed on the battery. As of now, the technology does not work for sea going vessels since the distances are too vast.

Loan terms

- Risk mitigation through lending policies is effective and obvious. For instance, a reduced LTV could be possible. However, this is paradoxically considering investments into new technologies. Providing less debt automatically reduces loan periods. More importantly, because the technologies are unproven, the bank is careful to invest and applies a fleet approach to spread risks.
- For example, to better evaluate the phase-in of new technologies, the average loan period for the fleet may be set at a certain number of years. Vessels operating conventional fuels could be accounted for slightly below that threshold, whereas vessels operating alternative fuels could be accounted for above that threshold. This way, business cases from clients can be tailored by the bank.
- In addition, lower leveraged companies can be considered with higher risk profiles. At the same time, larger companies can also be considered with higher risk profiles. As such, the

sustainability transition in maritime shipping can indeed lead to consolidation within the industry. That is, smaller companies are not able to collect the required capital to reform.

New versus existing clients

- Principally, ship finance is relationship driven. The bank highly values its longstanding client relationships. As such, the sustainability trajectory is a joint effort in which the bank aims to facilitate the maritime shipping company in order to transition.

Alternative and green financing

- Green financing structures are actively pursued by the bank. These are important to its strategy. As such, the green financing definitions from the green loan association are followed.
- The impact of green financing to the sustainability transition in maritime shipping can be considered limited thus far. Although, green finance solutions show considerable potential in other sectors than shipping.

Interview 3

Interviewee: ship owner representative

Background: interviewee representing the Global Asset Management Team. Over 12 years of experience in chartering and purchasing departments.

Notes:

Policy versus practice

- Instead of closely following the IMO guidance, the company set its own sustainability targets. These are related to the IMO trajectories, but reduced with 10 years. That is, the company aims to be ahead of IMO regulations. At the same time, this is a major risk mitigation strategy.
- In practice, the company acknowledges that competition behaviour is taken into account. The company's main competitors are based in Europe and these are also subject to for example the EU ETS. Therefore, the company aims to be best in class.
- At this point, charter rates are pretty high because of geopolitical conflicts and low water levels in the Panama Canal. The company observers that customers are willing to pay an extra fee if it can be assured that the GHG footprint is lower versus competitors' offerings. The company calls such initiatives "ship green". A mass balance approach is utilised to provide green journeys on a per customer basis.
- Whether the financial sector could accelerate the sustainability transition in maritime shipping is perceived pessimistic. Partly, this has to do with the current stage of the cycle. From the company's perspective, there is definitely a role for the bank, but it should be a healthy mix between equity and bank financing. Without the ship owner's intent, the bank has little ability to influence the direction of investments.
- The company's sustainability commitments are definitely workable in practice. As said, on the long term these are more ambitious compared to the IMO guidance. Focusing on the big liner companies, the IMO 2050 targets will be achieved. The short term targets will most likely not be achieved. The current fleet is old and ship yard availability is low. Moreover, questions about future fuels are hindering investments. Will it be ammonia in the end?
- Compared to Asia, it is evident that the European liners will lead the process. The rest will come from the IMO, which will enforce transition upon other global companies.

Portfolio impact

- The urge to renew and replace the company's fleet is present. Therefore, the company has a dominant newbuilding strategy. This pertains to dual fuel operated vessels. However, the company is still very open to a mix of fuels and technologies. Many questions regarding technological development remain.

Regulatory involvement

- Principally, the company is always considered to be guided by regulations. The existing regulations on GHG emissions from the IMO are very high level. On the contrary, the EU ETS is very concrete. Together, the company considers these policies as its main regulatory framework regarding sustainability.
- The company anticipates that the IMO may implement a similar system to the EU ETS. This has already been incorporated within the company's strategies.

Technology risk

- Technology risk is major, although assumed to a limited extent. Nevertheless, technological development is a key driver for sustainability investments. The company is cautiously ordering newbuilding vessels. Technology risk is largely mitigated through its dual fuel strategy.

Residual asset value

- Currently, many companies have newbuildings being delivered years ago. Due to limited ship yard capacity, deliveries have been delayed. Often these newbuildings are conventional fuel operated. This puts pressure on business cases for sustainable fuel operated vessels considering uncertainties on future fuel prices and technologies. As such, betting on the wrong fuel could significantly affect the portfolio value.
- Methanol and LNG operated vessels have the main focus in the short term. The design of a vessel is extremely important. A portfolio mix of dual fuel operated vessels including these two alternative fuel types provides for a robust portfolio mix. In practice, it is foreseen that such dual fuel vessel enters the dry dock for refit in about 10 years. Competitors are clearly also taking risks in this space.

Portfolio diversification

- As said, the company remains open to a mix of technologies. The current focus is on newbuilding vessels that can run on conventional and LNG/methanol/ammonia. A hybrid strategy. At the moment there is no preferred fuel, since the company assumes a mix of fuels and uncertainties related to future prices and regulations.
- The company is convinced that dual fuel operated vessels will be the most efficient type of vessels in the world fleet during the coming 10-20 years.
- Portfolio diversification is also relying on port infrastructure availability. Currently, LNG is available to bunker many global ports, other alternative fuels not so much.

Loan terms

- Currently, the company assumes a lifetime of 25 years per vessel. The company understands that banks work with reduced loan periods due to technological development. The capacity at shipyards is booked out, so the earliest possibility for green fuel vessels to be delivered is 2027-2028. What will the level of technology be at that time?

- Since the industry as a whole generated significant revenues since Covid-19, the need for bank financing is not as high. There is sufficient capital available to fund the company's newbuilding strategy on the short term. However, the market may adjust and demand for bank financing increase.

New versus existing clients

- Looking at the industry as a whole, it is perceived difficult for smaller companies to transition given the high amount of capital that is required. As such, the company anticipates that market concentration will increase. A recent example is the Gemini partnership between two major container liners. Consequently, the shipping portfolios at banks will also change. Smaller companies will have a tough time to survive in the long run.

Alternative and green financing

- The company actively engages in green financing structures. As such, a sustainability linked bond was issued. These types of bonds are linked to the emission levels of the vessels. The sustainable financing structures are a clear part of the company's strategy.
- LNG is considered within the green space by the company. The emission factor might be high, but the density is much lower and therefore less fossil oil would be required.

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