A new age in seafaring?

Analysing the Dutch approach to incentivise a zero carbon fleet

Suzanne Oostdam

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Supervisor: Henner Busch, LUCSUS, Lund University

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Abstract:

Contributing 3% of global annual carbon emissions, the shipping sector has to do its part to keep the global temperature under the maximum increase of 2°C. To fulfil this target, the Netherlands conceived the 'Green Deal on Maritime and Inland Shipping and Ports' in 2019. This thesis aims to make a preliminary assessment on the policy's effectiveness by applying Weber et al.'s environmental policy effectiveness framework. The policy will be examined according to four steps; these will aid in assessing the policy's expected ability to reach the policy goals.

It was found that the Green Deal heavily relies on an ecological modernisation vision and market-based mechanisms to reach policy goals, resulting in moderately low chances of potential success. Based on existing evidence, this thesis suggests that the Netherlands could achieve more environmental successes if their sustainable shipping policies would gravitate more towards command-and-control policies.

Keywords: environmental policy, policy effectiveness, sustainable shipping, low-carbon shipping, ecological modernisation theory, the Netherlands

Word count: 11,520

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1 Introduction

In the fast-paced globalised world we know today, transporting goods by ship is unmatched in efficiency, cost, and speed. When at the end of March 2021 the Suez Canal was blocked for days by ship Ever Given, it was undoubtedly an economic disaster (Baker et al., 2021). The economy and the current food system heavily rely on shipping and this shows: 90% of global trade as measured by weight is transported by ship, moving billions of dollars worth of goods each day (Walker et al., 2019). In 2016, some 1.8 million marine vessels were registered for a broad range of uses; from bulk carriers to cruise and passenger ships and container ships to fishing vessels (Smith et al., 2015). Shipping accessibility is essential to the development and maintaining a healthy economy of island states and countries with sea access (Sciberra & Silva, 2018, p. 448). The Netherlands is one of such countries which relies heavily on shipping; the Port of Rotterdam is by far the largest harbour in Europe and is an important player in the global trade (Havenbedrijf Rotterdam, 2021).

For decades, the focus of ports around the world has been on developing the economy as fast and effectively as possible and to gather as many shipping and trade deals. However, the climate crisis is demanding attention and since the Paris Agreement, the new focus is slowly but surely shifting towards limiting climate change to "well below 2 °C – and preferably to 1.5 °C" (Williamson, 2016, p. 153). This means that some sectors are expected to switch completely to zero emissions to be able to keep to the above promise (Williamson, 2016).

So too does the shipping sector need to change their way of operation. Research suggests that if the shipping industry would contribute to keep global warming under 2°C, then "deep emissions reduction should take place soon" in the form of, amongst others, constructive regional actions and national involvement (Wan et al., 2018, p. 429). The decarbonisation of the shipping sector requires massive collaborative efforts between governments, industry leaders, knowledge and financial institutions, and civil society (Lloyd's Register, 2020; Bouman et al., 2017). Currently, it is estimated the global marine shipping trade represents nearly 3% of CO_2 emissions annually; some 885 million tonnes of CO_2 (Smith et al., 2015). Although the reduction of carbon emissions in shipping presents significant political and legal challenges (Han, 2010), there is potential: it was suggested in 2017 that with current technologies, a more than 75% reduction of CO_2 emissions is possible (Bouman et al., 2017). Currently, it is estimated the global marine shipping trade

Following the new climate demands and an approaching climate deal as set out by the International Maritime Organisation (IMO), The Netherlands has picked up its responsibility in the shipping sector

by formulating the “Green Deal on Maritime and Inland Shipping and Ports” (hereafter: GD) in June 2019. The creation and consecutive signing of this GD comes at a political time when the government is increasingly under pressure in court to either reach climate goals (ECLI:NL:HR:2019:2007) or asked to conceptualise concrete climate actions (Rutte, van Haersma Buma, Pechtold & Segers, 2017; Schonis, 2018). The GD is a voluntary opt-in non-binding legal document that outlines the sustainability goals and development in the Dutch shipping sector – both maritime and inland – and further extends into desirable outcomes such as more research and development and more engagement from shipowners in promoting sustainability with their clients. In 2022, the document will be up for review and assessment with the potential of extension.

Currently, there is no research that aims to critically assess the maritime shipping implications this GD may have as of date. The GD is the first of its kind in the shipping sector in the Netherlands and thus research is needed to uncover and tackle potential challenges and successes that the implementation of this document might encounter.

1.1 Problem definition and research aim

Essentially, the GD is a market- and finance-based policy that aims to implement new technologies successfully through market mechanisms (Mallaburn & Eyre, 2014). In the Dutch economic landscape, radical low-carbon innovations such as electric, hydrogen, or methanol shipping are not appealing to shipowners as they are expensive and risky (Meijerhof, 2020). The GD aims to change this by supporting further knowledge development and certification of technologies so these can enter the market as a viable commercial option (Meijerhof, 2020). This will partly happen through the attractive business case developments and the launching customership role the government will pick up. This role entails that the Government Shipping Company will support innovative shipping projects or technologies. Oftentimes this relation between government and market aims to stimulate the adoption of the innovation by “enhancing network externalities, creating critical mass, setting a de facto standard and/or lowering price per unit” (Arendsen & van de Wijngaert, 2011, p. 123). Radical innovations, defined as “improvement within a given frame of solutions” Norman & Verganti, 2014, p. 82) are not the only focus of the GD; incremental innovations such as gas-based fuels like LNG, chimney scrubbers, and fuel mixing are covered as well. It must be noted that these innovations are transitional in nature and in no scenario sufficient to keep global warming to 2 degrees Celsius (Meijerhof, 2020). Here the use of radical versus incremental innovations refers to a difference in respectively a “change of frame” versus “improvements within a given frame of solutions” (Norman & Verganti, 2014, p. 82).

As the time to mitigate climate change keeps ticking on, it is important that policies adequately address decarbonisation issues. As such, the focus of this research will be on the effectiveness of the GD to do exactly that. This thesis will be using an environmental policy effectiveness framework and some concepts from Hajer's ecological modernisation theory to consider the expected effectiveness of the GD. The overarching research question of this thesis is the following: can the Netherlands achieve environmental successes in the maritime shipping sector by implementing the Green Deal (RQ)?

The answer to the above question will be found in a stepwise manner. By utilising Weber et al.'s (2014) environmental policy effectiveness framework, I will consider the theory behind the policy and its instruments by policy content analysis. The expected effectiveness of the policy will then be considered through a literature review which will culminate in a critical assessment of the entire policy. The research aim is to meaningfully contribute to the body of research on environmental policies by examining the Dutch case. While shipping is a global practice and the Netherlands is its own unique case study, analysis of its GD can be valuable information to effective environmental policy. Conclusions that are drawn in this thesis can serve as a learning example for other effective environmental policy implementations, specific to the shipping sector.

1.2 Relevance to sustainability science

Bakker and Bridge (2008) adopted the term environmental governance to conceptualise the actions by the administrative state to address environmental management issues. This concept was initially used in the neoliberalisation and management of resources: a topic that is typical to political ecology. Himley (2008) suggests that environmental governance is often rooted in ecological modernisation and political economy. The privatisation of commons, the incapacitation of the state, and voluntary regimes are typical concerns of political ecology and will be shown to be applicable in the case of the GD. The scope of this thesis is not to determine the answers to classic political ecological questions of how, by whom, for who, and in which power relations the GD is created (Himley, 2008). However, these concerns initially gave rise to questioning if the GD can deliver the successes it promises. Inspired by political ecology to criticise the GD in a more constructive way, the framework and theories that will be used throughout this thesis critically question the nuance between terminology such as low-carbon and sustainable and the influence of political and market-based decisions.

Furthermore, this thesis contributes to sustainability science by examining a sector that has been described as "lethargic" (Wan et al., 2018, p. 430) and "a late comer to some of the most pressing sustainability challenges of our time" (Papandreou et al., 2021, p. 153). While the IMO has a strategy to address carbon and other greenhouse gas (GHG) emissions, as well as countries targeting shipping

on a national or regional level, there is still a great body of literature that is critical of the developments as of present (Papanderou et al., 2021; Sciberras & Silva, 2018; Sciberras, 2020; Wan et al., 2018). Part of this problem has been hypothesised as a lack of literature on the importance of sustainable development for the international marine transport sectors (Sciberras & Silva, 2018). Therefore this thesis aims to incorporate some sustainable development concepts into its assessment.

Lastly, the problem of decarbonising a sector is one that covers multiple fields. As strategy and governance can "play a critical role in facilitating and putting in place a sustainable development program", it is important to critically review and assess the efforts that are being taken currently (Sciberras & Silva, 2018, p. 437). This makes the topic of decarbonisation in the shipping sector an interesting perspective for the field of sustainability studies. The interdisciplinary character, need for facilitation, and desire to understand what it means to develop something sustainably seems a textbook example of the sustainability challenges of the 21st century.

2 Background

2.1 Shipping in the environmental landscape

While shipping is considered the most energy-efficient method of transporting goods and cargo all over the world when taken as ton-miles (weight per distance travelled), it is also one of the least regulated sources of anthropogenic carbon emissions (Russo et al., 2018; Wan et al., 2018). The most pressing environmental and ecological consequences of shipping can be divided up into three main sections; 1) air emissions, 2) water discharges, and 3) physical impacts (see Figure 1) (Jägerbrand et al., 2019). Air emissions are concerned with GHGs, most commonly sulphur oxides, nitrogen oxides, and carbon oxides; as well as particle matter and volatile organic compounds such as methane (Walker et al., 2019; Wuisan et al., 2012). Water discharges mostly concern the discarding or leaking of materials from ships; marine litter and oil can threaten wildlife populations and damage DNA (Jägerbrand et al., 2019). Physical impacts are mostly concerned with artificial light, collisions with wildlife, and noise (Jägerbrand et al., 2019). These impacts negatively impact the longevity of individuals and populations, as well as migration patterns, communication between individuals, and prey detection (Jägerbrand et al., 2019).

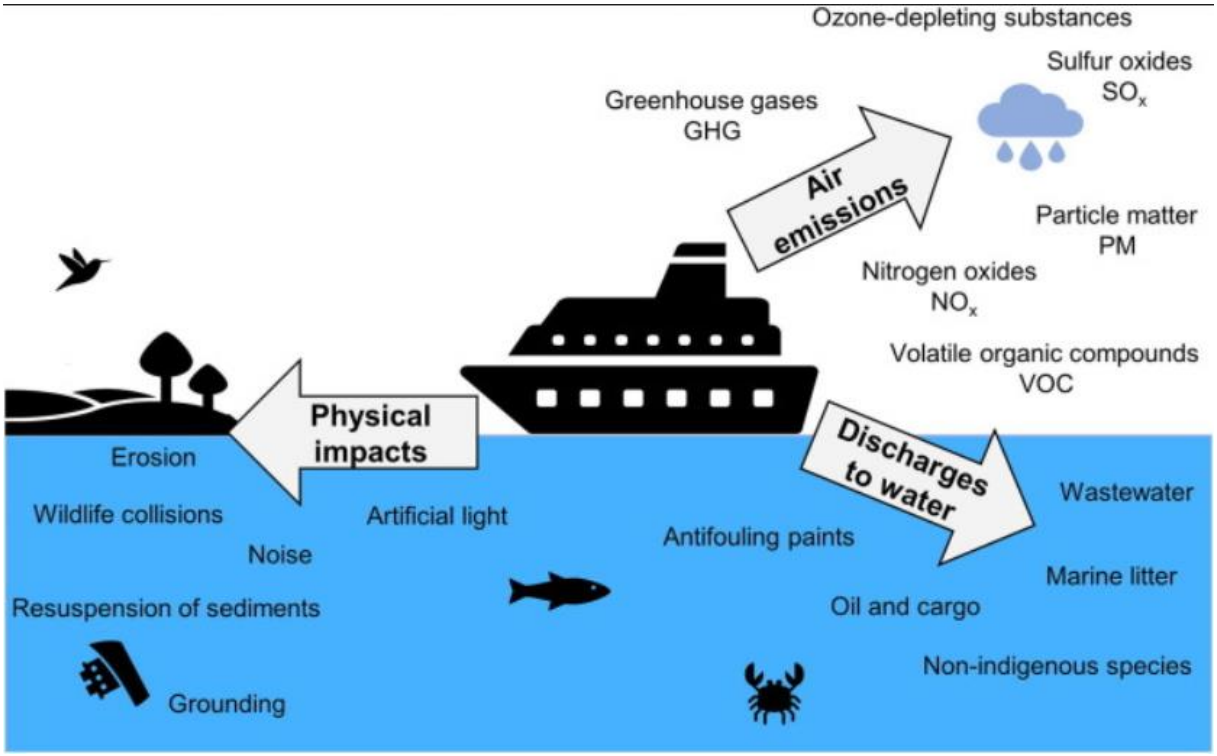

Figure 1. Classification of ecological and environmental impacts of shipping (Jägerbrand, Brutemark, Svedén & Gren, 2019).

The aforementioned type of pollutions have major negative effects on the physical, chemical, and biological balance of aquatic environments, affecting aquatic life on an incredibly broad scale (Wuisan et al., 2012). Besides the impacts on marine wildlife, air pollution and GHG emissions decrease air quality. Port workers and residents in close proximity to port areas are therefore negatively affected in their health. Communities near port areas see an increase in morbidity and mortality and a higher incidence of (lung) cancer and heart and respiratory diseases (Contini & Merico, 2021; Han, 2010). Shipping was found by the World Health Organisation to be the third most polluting after road transport and heating or cooling systems (Héroux et al., 2015).

2.2 Shipping in the societal landscape

Shipping plays and has played an essential role in the economy and history of the Netherlands. In the early 17th century, Dutch jurist Hugo de Groot (or more commonly: Hugo Grotius) introduced the principle of 'mare liberum'; meaning each person has the right to access the sea and its resources (Kronfeld-Goharani, 2015). It was then no surprise that through seafaring the Netherlands further developed their economy and grew what is called 'the Golden Age' in the 17th century (Ebben et al., 2010). Even centuries later, most of the sea is no-man's land (Kronfeld-Goharani, 2015) and the Netherlands still plays a significant role as a transport hub.

The Netherlands' tactical geographic location makes it a valid option for both maritime as well as inland shipping (Havenbedrijf Rotterdam, 2021). The waterway connections with inland locations and train lines allow its transport network to spread far into Europe and thus the Netherlands has positioned itself as an important global transport facilitator. The Port of Rotterdam in particular is a good example of this elaborate transport network and therefore is also the largest harbour in the Netherlands and in Europe. The Port of Rotterdam employs some 385,000 people in the Netherlands and is valued at 6.2% of the gross domestic product (Kuipers, 2018). In total, the Port of Rotterdam was responsible for 18% of CO_2 emissions in the country in 2019; around 28 Mton of CO_2 emissions (Havenbedrijf Rotterdam, 2021). It must be noted that these emissions include all processes the harbour takes up; thus it is not only shipping emissions. However, it is useful to illustrate that despite focussing on propulsion in this thesis, there is another mammoth task associated with making the shipping sector more sustainable in its infrastructure and harbours. Other ports can be found in the Netherlands in Moerdijk, Delfzijl, Amsterdam, and Terneuzen.

The GD is part of a broader coalition agreement from 2017 (Rutte et al., 2017). The then newly-elected government released their agreement 'Confidence in the Future' to outline the collective actions they were intending to take up during their four year ruling. In the section sustainability, the maritime shipping sector is said to be able to make substantial environmental gains – which are meant to be outlined in a then, yet-to-come GD. The clause promises a GD which considers the 'sustainability of maritime shipping, inland shipping, and harbours'. The final GD explicitly does not consider harbours (Green Deal, 2019, p. 3) and there seems to be no separate policy addressing the sustainability of harbours. The first article of the GD considers the following as its problem definition: "[t]o preserve our prosperity for future generations, we must enhance the competitiveness of our economy while at the same time reducing the burden we put on our environment and our dependence on fossil fuels and scarce resources" (2019, p. 2). Other goals set out in the GD follow the general IMO ambitions such as a 70% reduction in carbon emissions (baseline: 2008) by 2050, and completely carbon neutral shipping by the end of the century (IMO MEPC, 2018). Within the timeframe of the GD (until 2024), the focus of the maritime sector is to reduce the average carbon emissions per tonne-kilometre by at least 20% (baseline: 2008), to reduce air pollutants as set out by international demands, and to develop five business cases for shore power for maritime shipping.

Actors involved in signing the GD were Dutch Ministry representatives; governmental administrative authorities; trade associations; harbour representatives; banks; shipowners; knowledge institutions; and a collection of private and public associations concerned with a broad topic of issues (more detailed summary can be found in Appendix 1).

2.3 Sustainable development in shipping

Various sustainable development theories, not specific to the shipping industry, can be valuable in understanding what it means to sustain something. Originally, sustainable development, first used in the Brundtland Report in 1987, is a concept that aims to balance ecosystem health, to develop the economy, and to improve human welfare (Meadowcroft, 2007). As an all-encompassing concept, sustainable development has become incredibly present across various sectors. Despite its widespread use, it is thought that often the specificity of these concepts differ majorly across these sectors (Parris & Kates, 2003). This was predicted by Hajer as well; policymakers and stakeholders are ordered to incorporate sustainability, but the interpretation is entirely theirs (1996). It cannot be assumed that sustainable development is understood in the same way across various fields of study, neither how it is measured (Parris & Kates, 2003), and between stakeholders as well as over time (Maas, Kruitwagen & van Gerwen, 2012). Understanding the differences between 'sustainability', 'low carbon', and 'decarbonisation' has been found to be an underdeveloped research area before (Wu, Zhang & Luo, 2020). Therefore, the importance of properly defining these terms can contribute to successfully implementing the actions associated with them.

To bring this back to the Dutch shipping sector, it is important to understand how the GD aims "to indicate progress toward or away from some common goals of sustainable development" and what concepts are being relied on (Parris & Kates, 2003, p. 571). The topics that return in the GD will be the ones that policymakers and stakeholders deem important and somehow connect with sustainable development. These topics influence the way politicians and the economy will respond to and prioritise regarding the climate crisis and importantly, how the efficacy of responses are evaluated (Parris & Kates, 2003). The desirable outcomes as laid out in the GD, are representative of the values that are prioritised in the Dutch case (Kates, Parris & Leiserowitz, 2005). Taking note of these topics and understanding which ones are left outside of the scope can tell us a lot about the potential effectiveness to reach environmental successes. For the case of this thesis, the concepts elaborated on in Figure 2 below are the basis of important sustainable development concepts.

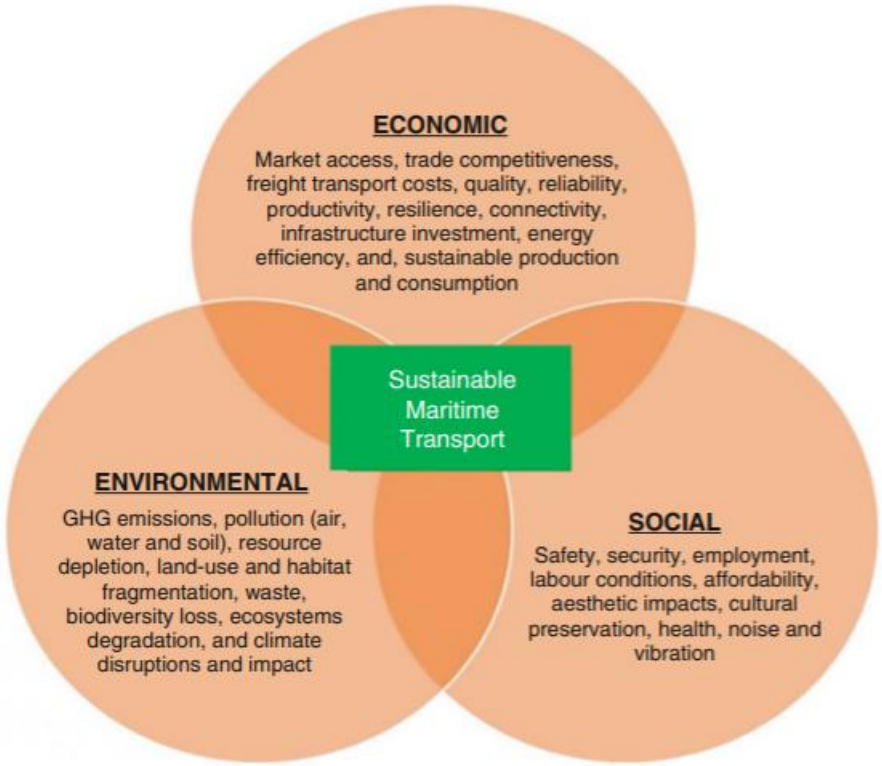

Figure 2. Sustainable maritime transport: spheres and issues (Papandreou et al., 2020).

It must be noted there is a pronounced difference between low carbon, sustainable, and decarbonised sectors. Decarbonisation is the act of phasing out the reliance on carbon-emitting forms of energy; therefore a decarbonised sector is one that is decoupled from carbon (Wimbadi & Djalante, 2020). Low carbon is the terminology that is used to refer to development that aims to emit the least amount of carbon possible; possibly in the long term contributing to a (more) decarbonised sector (Wimbadi & Djalante, 2020). With the aid of carbon capture and storage or sequestration, low carbon sectors can be net zero carbon (Sepulveda et al., 2018). Both these terms are solely focussed on the GHG emission points of the environmental sphere as seen in the figure above.

Sustainability, in turn, encompasses the above three spheres of environmental, social, and economic issues. There remains disagreement regarding the specified goals, targets, and indicators of sustainable development (Parris & Kates, 2003; Cotton et al., 2007). As such, using sustainable as a term without proper indicators of what is understood to be sustainable can logically result in problems with evaluation. As is most commonly accepted though, the trinity of society, economy, and the environment should be, in some way, sustained or developed (Parris & Kates, 2003). Therefore, one could argue that depending on which indicators are used, a low carbon or decarbonised sector can still be unsustainable. It might be neglecting further areas of environmental problems such as biodiversity

loss or ecosystem degradation, and risks overlooking additional problems in the economic and social spheres.

3 Theory and Framework

3.1 Environmental policy effectiveness evaluation framework

With the emergence of sustainability as a concept in shipping, new frameworks that aim to bridge various disciplines are needed to improve the integration of different priorities (Weber & Driessen, 2010). At times, these priorities seem to be stark opposites, such as decreasing fuel consumption and increasing economic productivity. The 'new' discourse of sustainable shipping can therefore benefit from a foundational framework or methodology to adequately test and evaluate all indicators addressed in a policy that are described in Figure 2 above. Such is the aim of this thesis: to perform an assessment to judge the effectiveness of the GD.

An unmissable component of these environmental policies are the policy instruments. These instruments are mechanisms that promote or guide stakeholders into the desired directions. How these instruments are used and if they are successful, can have major effects on the way that society responds to changes (Weber, Driessen & Runhaar, 2014). Weber and colleagues recognised three areas of influence; command-and-control, economic, and communicative. The efficiency of these policy processes can be measured by examining the outcomes, the impacts, and the outputs of the various policy instruments. Outputs are defined as "tangible results of a policy, often in the form of programmes or plans" (Weber, Driessen & Runhaar, 2014, p. 1383). The outcome corresponds to what extent the policy objectives are fulfilled (Gysen, Bruyninckx & Bachus, 2006). Lastly, impacts are the actual measurable state of the environment; thus seeing a reduction in pollution, carbon, and other GHGs.

As such, the framework that is most useful to this end, is the methodological framework as set out by Weber, Driessen, and Runhaar (2014). Consisting of four steps, it aims to describe policy theory (1), policy instrumentation (2), analyse goal attainment (3), and evaluate its effectiveness (4).

The way in which this framework will be utilised is by firstly determining some underlying assumptions by analysing the policy content with the help of the ecological modernisation theory by Hajer (1), followed by identifying the policy instruments used and describing these (2). Consecutively, current achieved effects will be discussed and compared to the policy objectives (3). Following this, the framework will conclude by using perceived and expected measures of effectiveness (4) – meaning

current insights into the process of the GD. The data that will be used at each step will be elaborated upon in section 4.

3.2 Ecological modernisation theory

The theory of ecological modernisation made an appearance in the mid-1990s and has since gained some traction for various reasons. Hajer, who was one of the first to identify the issue of ecological modernisation as a socio-political theory, argues that the discussion is no longer about whether an environmental crisis is happening, rather it is about how one interprets this crisis (Hajer, 1995). Essentially this has given rise to the broadening of finding solutions to the ecological crisis. No longer are the solution oriented parties only 'radical environmentalists', they now consist of politicians who have to balance and address multiple interests. Hajer defines ecological modernisation as a theory which "suggests that environmental problems can be solved in accordance with the working of the main institutional arrangements of society" (Hajer, 1995, p. 8). Essentially, this means that under ecological modernisation, a win-win situation is possible: economical and institutional workings can create beneficial outcomes for the environment. Therefore, ecological modernisation presented as a good fit for the socio-political landscape. Some papers have argued that ecological modernisation is a necessary condition for sustainable development (Langhelle, 2000), while others have argued against it and instead suggest ecological modernisation may inhibit the development of more efficient or appropriate alternatives (York & Rosa, 2003) and plead to focus on "sustainability beyond emission control" (Yliskylä-Peuralahti, 2017, p. 43). This dynamic and complex rhetoric of ecological modernisation can be argued to be a "first step on a bridge that leads towards a new sort of sustainable modern society" or simply "another example of inefficiency and market failure" (Hajer, 1995, p. 19).

Understanding the role of ecological modernisation theory in policy-making is of importance to this thesis. Ecological modernisation can be used as a political discourse of environmental policy-making (Yliskylä-Peuralahti, 2017). Hajer argues that policy-making means more than simply "finding acceptable solutions for preconceived problems" (Hajer, 1995, p. 6). Rather, the drafting and implementation of policy is built on the way a social phenomenon is defined, understood, and regulated. How environmental politics develops is dependent on how the environmental problem is framed in the institutional context (Hajer, 1995). This becomes relevant to this thesis when one considers the following questions; what commitments are being respected, which conditions are fixed, and which conditions are malleable (Hajer, 1995)? Are these commitments being utilised in the form of strong or weak forms of ecological modernisation – meaning that respectively identifying the need to restructure societal institutions or the focus on technological solutions (Goods, Rainnie & Fitzgerald,

2015; Yliskylä-Peuralahti, 2017). In the GD we will dissect which commitments are deemed fixed and which are malleable. From this, we can deduce what this says about the understanding of the issue of sustainable maritime shipping.

4 Methodology

The environmental policy effectiveness framework is the key method to answer the RQ of this thesis. This framework asks to elaborate on policy theory and instrumentation with the aim to analyse and evaluate its attained goals and effectiveness. With these goals in mind, policy content analysis is most useful to the former objective to lay out a comprehensive review of policy theory and instrumentation. For the latter objective, a concrete literature review and further review of openly accessible documentation by stakeholders and various governmental scales are most insightful for the final evaluation.

4.1 Policy content analysis

Analysing the content of the policy has two benefits relevant to this thesis. Firstly, while the GD is not actually a legally binding policy, the drafting and finalising process and action points can reveal a lot about the underlying assumptions it was based on (Tight, 2019). What is considered *successful* or *optimal* environmental policy is a political issue (Bouma et al., 2019). These underlying assumptions are important for step one and two of Weber et al.'s framework. Therefore, a thematic analysis of the policy was deemed most appropriate to unveil these underlying assumptions, as well as the extent to which the thematic analysis can aid in further steps of the framework. Identifying the themes makes it possible to unveil what the implicit key priorities are when the policy was drafted. Appendix 2 elaborates on the Articles mentioned throughout the text.

The policy that was analysed is the "Green Deal on Maritime and Inland Shipping and Ports", signed on June 11, 2019. The thematic analysis was performed according to the outline of the work of Ryan and Bernard (2003); "(1) discovering themes and subthemes, (2) winnowing themes to a manageable few (i.e., deciding which themes are important in any project), (3) building hierarchies of themes or code books, and (4) linking themes into theoretical models" (p. 85). In the case of this thesis, the latter step consisted of linking themes to the environmental policy effectiveness framework and Hajer's ecological modernisation theory.

For the first step, themes and subthemes were found by virtue of repetition of concepts or ideas (Ryan & Bernard, 2003). Mainly, these concepts would relate to what the desirable area of effect was. For

instance, the Government Shipping Company took up various responsibilities to promote the usage of alternatively powered vessels by means of demonstration. These articles were themed under 'demonstration' as these sort of pilot projects can gather a lot of practical information relevant for stakeholders. Another method of analysis that was deemed important for this thesis was the concept of 'missing data' (Ryan & Bernard, 2003). Missing data is quite abstract; naturally not every single topic can be included and worked out in detail. However, it is thought to carry the most weight as policy can be understood as "any course of action (or *inaction*) relating to the selection of goals, the definition of values, or the allocation of resources" (Codd, 1988, p. 235: italicisation not in original). Focussing especially on the potential 'inaction', the missing data can reveal a lot of information on what shipping stakeholders do not consider part of their responsibility or part of sustainable maritime shipping. While the missing data are part of the results, these can be found in the discussion section.

Following Ryan and Bernard's outline, step two consisted of organising and pruning identified themes. This was done over the course of multiple days to ensure well-thought out themes. Typically, in step two and three, certain themes may be left out according to relevancy, time limits, workability, or research boundaries (Ryan & Bernard, 2003). While the typical recategorizing was applied to step two, it was deemed unnecessary to leave certain themes outside of the thesis scope. As there were only 11 identified themes across a single section of the policy, allowing all these themes to return for the analysis, was thought to improve the quality of results as well as cater best to the overarching research aim. These results are linked back to theory, according to step four of the method by Ryan and Bernard (2003). All textual data analysis was done in NVivo 12 with Lund University access.

4.2 Literature review

Step three and four of Weber et al.'s framework will be addressed through extensive literature review and combining the data and results collected in the policy content analysis. The literature review was conducted by selecting papers that researched environmental policy types effectiveness. Common keyword searches utilised in the results and discussion section were 'sustainable shipping', 'environmental policy', 'decarbonisation shipping', 'low carbon shipping', and 'market-based policy'. Variations and combinations of these keywords were used for more specified results, such as 'sustainable shipping policy' or 'decarbonisation market-based policy shipping'. Furthermore, a snowballing method was used to select papers accordingly. Where appropriate, keywords were accompanied by 'Netherlands' to gather data specific to the Dutch case. Additional attention was paid to case studies on market-based policies and command-and-control based policies in the shipping

sector. These papers were relevant to generate a better understanding of policy effects in the shipping sector: this is thought to improve the final assessment.

Besides searching specifically for Dutch cases, in the general keyword searches no spatial boundary was utilised due to the global but recently emerging nature of sustainable shipping. All information regardless of location was deemed useful for the Dutch context. A cut-off year was not found to be beneficial with the common keyword searches as these were already biased towards recent research due to its new emergence (Papandreou et al., 2021).

Additional searches for information were conducted through common search engines and websites of stakeholders to gain an understanding of what actions were currently being undertaken – this was especially relevant for the goal attainment section. Stakeholder websites were visited in the period March and April in 2021 and were searched for 'Green Deal' to ensure linkage to the GD. Some examples of stakeholder websites that were searched were bln.nl, maritimetechnology.nl, rijksoverheid.nl and waterbouwers.nl (respectively stakeholders 10, 12, 1, and 14 in Appendix 1).

4.3 Limitations

In step four in the original framework by Weber et al., experts are engaged in interviews to share their judgement on the expected perceived effectiveness of the GD. Weber et al. shared their key findings with these experts in interviews and requested their confirmation or rejection. As a result, the original framework distinguishes between expected effectiveness and perceived effectiveness. The latter is thus a reflection of expert judgement, whereas the former is "based upon academic and empirical literature" (Weber et al., 2017, p. 1386). This design choice was made to validate results and avoid conclusion bias. While undoubtedly the perceived effectiveness could have been beneficial in this research, it was decided not to include it. This was related to difficulty selecting experts in sustainable shipping policies and time issues resulting thereof. Therefore, interviews with experts were left out in the research design of this thesis. To compensate, extensive searches of stakeholder websites were conducted as well as reviewing openly accessible minutes of Dutch and European level meetings related to shipping; these offered similar insight into currently active processes that expert interviews would have given.

Perceived effectiveness was the only point in the original framework that engaged interviewees. Reflecting back on the research conducted for this thesis, interviews would have been beneficial in step 3 (goal attainment) already. As will come forward in section 5.3, goal attainment was difficult to gauge. In this situation, interviews with stakeholders could have been conducted to gain a thorough

understanding of what actions were being undertaken and which ones had been neglected. While in this case stakeholder selection was easier, efforts to come into contact were not fruitful and time issues resulting thereof restricted further pursuing. As a result, we can conclude that future research would benefit greatly from including experts in the framework earlier than step 4 (evaluation of effectiveness).

Other limitations that should be discussed, is the national scope of the GD. While the GD is the first Dutch policy that tries to link sustainability, decarbonisation, and the shipping sector together, it surely is not the first one regionally and globally. The European Union and the IMO are working on the decarbonisation of shipping as well (Sciberras, 2020). As shall be seen throughout this thesis, the global sphere of marine shipping is pronounced at various points throughout the GD. Due to its national scope, it is not possible to address the global issues, potentially leading to the GD contributing to fragmented sustainability efforts (Wu, Zhang & Luo, 2020).

While first and foremost this thesis was focussed on determining the effectiveness of the GD alone, we should not forget to consider the global character of shipping and how a single national policy is just a drop of water in the ocean. Regional and global policies should be considered and used as comparisons to avoid creating a policy 'mess' (Bouma et al., 2019). However, the boundaries of this thesis would not allow for a regional or global policy comparison. Future research with improved tools and a greater timespan should consider the European and global multitude of policies regarding sustainable shipping.

5 Analysis

5.1 Policy theory and underlying assumptions

5.1.1 Frequency of text units

Using the stemmed analysis function in NVivo 12, a frequency of text units analysis was conducted. This flagged the words 'greening', 'shipping', 'maritime', 'inland', and 'deal'. These units, except for 'greening', were decided to be left out after being read in its context – mainly as these were the topic of the GD and did not particularly signal information relevant to policy theory. These word units are the topic of the policy and are bound to be repeated often. Instead, the focus was put on 'greening' and other less common text units that signal interesting assumptions. The words 'green' and 'greening' are exclusively used to refer to the concept of green growth and the 'greening' of a sector or industry (e.g.: greening the petrochemical industry, greening the fleet, etc.). In other words, the use of green

growth and greening sectors as a concept signals the desire to grow the economy in a sustainable manner. The economy as it functions now is a fixed concept, but the way in which actors use materials and energy can become more sustainable without compromising economic growth (Hickel & Kallis, 2020). The concept of green growth is often used in combination with managed transition theories (Wells et al., 2020), incremental changes (Norman & Verganti, 2014), and is synonymous with ecological modernisation (Hickel & Kallis, 2020).

The next frequently used text unit is 'emissions', mostly used in combination with some variation of 'reduction' in the same sentence. Only a handful of times was it used in the context of measuring emissions. In the remaining cases of occurrence, it was used in the text unit 'zero-emission'. These would refer to zero-emission vessels and fuels. Related to that was the occurrence of 'development'. Most often used in the context of 'research & development' or as a clause with 'development of new technologies/projects/strategies', this high use signals where the focus of the GD lies. 'Fuel' as a text unit was mainly used to refer to 'renewable fuels', which in most cases did not refer to a specific renewable fuel – simply 'renewable fuels' in general. To a lesser extent fuels were mentioned regarding fuel efficiency. While it is thought that operational changes can further increase fuel efficiency (Cariou, 2011), the GD was not concerned with making any agreements on operational changes.

As to be expected, 'sustainable' was common as well in the entirety of the GD. Often used in the context as a stand-alone word with an idea attached to it that is assumed the reader is familiar with, the concept itself is actually never elaborated on. Phrases such as "enhance the sustainability […] of transport" and "strengthen the competitive and sustainability" (Green Deal, 2019, p. 3) of shipping and ports signal there somehow is a common understanding of sustainability. However, it is not discussed at any point throughout the GD what 'sustainability' as a concept means beyond carbon emission reduction. This was found to be an area of concern for some stakeholders; a lack of specificity regarding what is expected of stakeholders can be traced back to a misunderstanding about what sustainability is and what it should be (Meijerhof, 2020). Linking back to Figure 2, the GD is most concerned with the 'economy' branch and 'GHG emissions' in the environmental branch.

What can be concluded from this section is that purely by virtue of repetition, green growth (ecological modernisation) as a concept and developing the technisation of the shipping sector are the focus of the GD. Sustainability as a concept was found to be solely about carbon emission and other features of sustainable development were neglected. The GD is built on the assumption that stakeholders are familiar with sustainability and it is implied that everyone agrees on its meaning.

5.1.2 Common themes

While word frequency has told us about some of the assumptions underlying the policy drafting, identifying common themes can further aid in understanding what mechanisms are at hand to produce the desired effects under every relevant article point related to maritime shipping in the GD. The final themes that were used are demonstration; economic nudging; experience & improvement; funding support; information campaign; information sharing; infrastructure; knowledge acquisition; lobbying & level playing field; marketing; and measuring emissions.

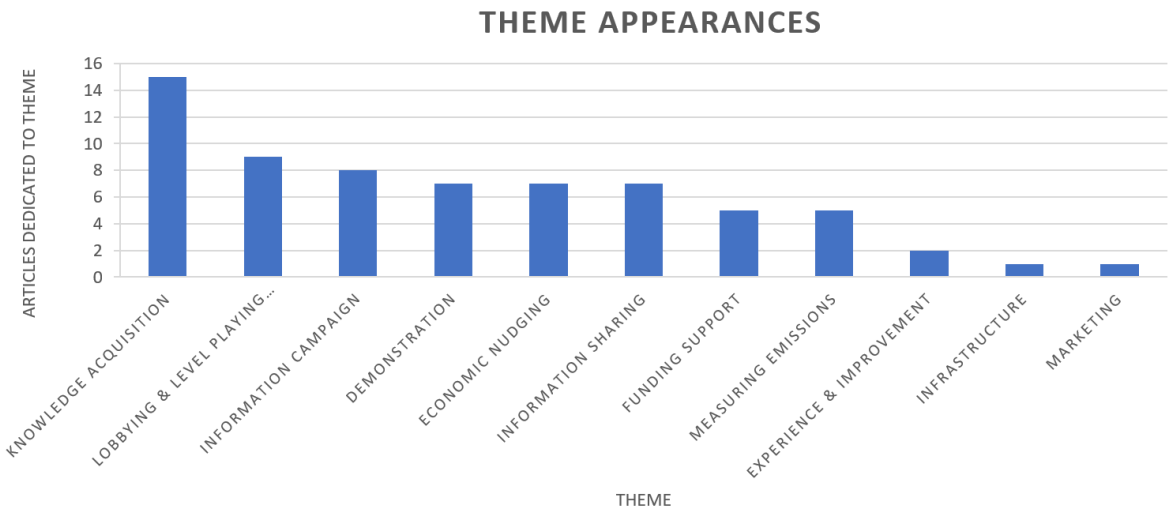

Figure 3. Theme appearances according to the amount of articles touching upon themes.

The most relevant themes were knowledge acquisition, lobbying & level playing field, and information campaign. Other themes followed closely as can be seen in Figure 3. The ones that were discussed only once were marketing and infrastructure. While these were not exactly 'missing data', a case will be made for these actions in section 5.1.3.

As was briefly mentioned in section 3.1, a lot can be learned from how a policy was drafted when considering which commitments are being respected and which conditions are fixed or malleable (Hajer, 1995). Analysing the themes as found in the GD, it seems a weak form of ecological modernisation is at hand. Rather than redefining the boundaries of the system, the solution to ecological degradation must be found within the already defined boundaries. Ergo, the desire to create a competitive economic landscape to maintain growth, generate profits, *and* make the climate ambitions has to coexist, which as of now, is thought to be possible through the adequate implementation of novel technology. This idea is not definitively wrong or right. Transformation of

systems may indeed happen through the development of niche practises (Smith & Kern, 2007), which this GD tries to make room for by investing in the further development of novel technologies and bringing these to the foreground. However, a better understanding of the way these themes are employed as well as their instrumentation (section 5.2) can tell us a lot about the policy theory.

Drawing comparisons between the themes introduced above and the ecological modernisation theory by Hajer, it becomes apparent that the focus on knowledge acquisition signals an interest in developing low-emission technology. Knowledge acquisition themes were almost exclusively connected to the development and implementation of novel clean technology. Some examples are hydrogen fuel, batteries, or (mixing) biofuel. A good part of this meant creating convincing business cases for shippers to start investing in technology and to familiarise them with the sustainable concepts (identified as 'information sharing' theme). A business case shows the individual opportunity for a vessel and sustainable technology, whereas the lobbying and level-playing-field theme is meant to make these decisions competitive on a larger scale.

Funding support and economic nudging are similar issues; increasing the cost of high-emission vessels and simultaneously offering options to decrease investment costs should incentivise the change to sustainable options. Some demonstration and pilot projects are introduced in the GD to satisfy some gaps in terms of the implementation of new technologies.

In earlier research it was found that environmental gains often are of lesser importance compared to the economic gains, regardless of commitments that have been made to sustainability (Yliskylä-Peuralahti, 2017). Logically, ecological modernisation is a conditional implementation tool – during difficult times environmental considerations are often left out. Importantly, social investments such as safety are also typically dropped first (Yliskylä-Peuralahti, 2017). As the GD relies on voluntary initiatives, it is vulnerable to unstable times.

In sum, the GD is strongly reliant on the theory of ecological modernisation and thus follows a pattern of relying on economic nudging, moderate lobbying, investing in desirable outcomes, and actively taking on the role of launching customership. These sort of transitions can be defined as a managed transition (Figure 4 below); in which a stringent-acting state and market is present. Both parties aim to play an active role in developing and employing new technologies. Managed transition is often led by green growth strategies that can be enabled by fuel efficiency measures and encouraging emergent technologies (Wells et al., 2020). These aspects are found to be present in the GD and thus the GD is categorised as a managed transition approach.

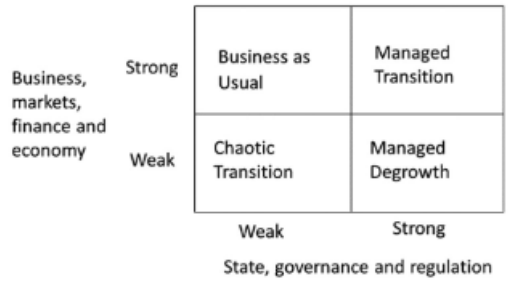

Figure 4. Potential futures (Wells et al., 2020).

5.1.3 Policy goals

It is important to define what is considered the policy goal throughout this thesis. The goals relating to the year 2024 are the explicit goal of this policy and should thus be the subject of this thesis. However, as climate change is a long term issue, it is considered in this context too short-sighted to focus on the year 2024 alone. The goals beyond 2024 are to eventually create a sustainable climate-neutral shipping sector. Considering this is likely a long-term task, and an intensive one, it was considered reasonable to see the GD as the start of a greater effort to decarbonise the shipping sector. Therefore this thesis will make a two-fold assessment. In the results section Weber et al.'s framework helps focus on the initial expected effectiveness of the GD within its set out timeframe. In the discussion section some caveats will be made beyond the scope of the GD, with the GD as initial starting point.

In Article 1, the GD sets out its main goals for, amongst others, the maritime sector. By 2024, which is the end of the initial GD, the stakeholders aim to have a 20% carbon reduction per tonne-kilometre (compared to 2008 emissions); a further reduction of air pollutants such as SOx, NOx, and particulate matter (PM); and importantly, five new business cases for shore power for maritime shipping. By 2030, the stakeholders have agreed to at least one zero-emission seagoing vessel. By 2050, the aim is to have achieved a 70% absolute reduction in emissions from maritime shipping (compared to 2008 emissions as set out by the IMO). After 2050 but before the end of the century, the intention is to create a climate-neutral maritime shipping sector as soon as possible. What a climate-neutral shipping sector will look like and what technologies – if any – will be relied on is not yet clarified. The goals relating to the year 2024 are specifically the point of vision for this GD. This means that while carbon emissions are meant to decrease somewhat – a 20% reduction per tonne-kilometre; the focus is mainly on developing technologies and business cases to make low-carbon shipping more attractive. So too will the results section mainly consider these developments as important.

5.2 Describing policy instrumentation

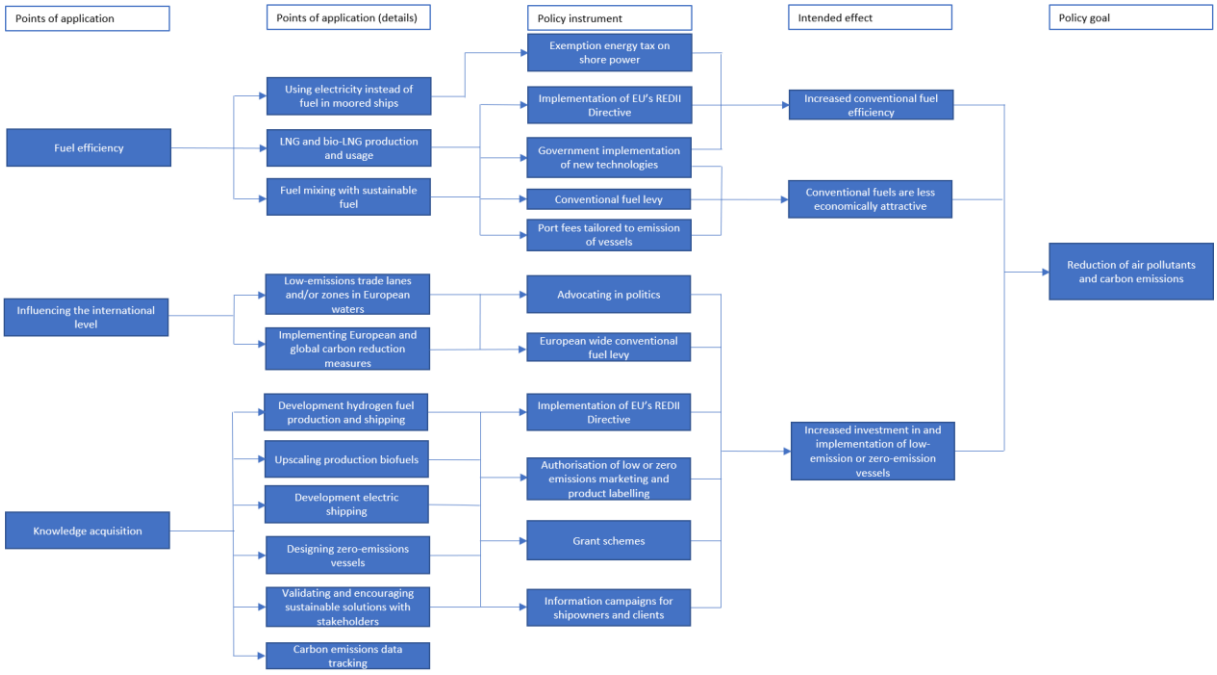

Figure 5. GD policy and its points of application and policy instruments used. Concept taken and adapted from Weber, Driessen & Runhaar, 2014. Analysis and content is the author's own work and analysis.

The GD is primarily focussed on creating an attractive economic incentive for stakeholders to invest in low or zero-emission fuels or vessels or "the scope for financing green investments must be improved" (Green Deal, 2019, p. 6). Thus, the policy is relying on market mechanisms to bring about incremental innovation with an eventual transition towards sustainability. Therefore the instrumentation as seen in Figure 5 are generally typical economic or financial nudges.

The first set of instruments that should be shortly highlighted are financing mechanisms. Some funding options are of both European and national nature. The Dutch ministries of Infrastructure & Water Affairs and Economic Affairs both offer grant support for sustainable projects in the maritime sectors (Article 12.5) as well as consider funding the validation of technologies (Article 19.8), and considering options for future funding instruments based on the existing funding structure (Article 19.6). Similarly, the government promises to abolish the energy tax on shore power, which should promote ships to have their engines run on electricity after mooring in the ports (Article 12.4). This should save CO_2 emissions as electricity is used rather than the usual polluting heavy fuel oil (Schroten et al., 2020). These mechanisms are meant to create a more attractive situation for stakeholders to invest in or make a switch to sustainable options. Other financing mechanisms may rely on making conventional fuels less attractive. Some of those options are implementing increasing port fees according to how emission-heavy a vessel is (Article 15.2, 18.5, and 21.2) and the government implementing a sustainable criterion in the selection process for shipping channel maintenance (Article 24.2).

Stakeholders who can prove they reduce their emissions are therefore entitled to benefits. The addressees for these policy instruments are mainly harbour representatives, trade and public associations, shipowners, knowledge institutions, and private companies.

Regarding influencing the international level, the aim mainly seems to be on creating a 'level playing field' and investment security on a European and global level. Shipping is a massive global operation and so realistically, actions taken or situation changes in one country can promote or decrease economic competition as was seen by the Suez Canal blockage (Baker et al., 2021). Some suggestions include low emission zones or trade lanes (Article 12.8, 13.7, and 18.3), globally adopted carbon reduction measures and fuel levies (Article 13.3), and further funding and investment in research and rollout schemes (Article 19.4). These actions are covered by 'advocating in politics' and 'information campaign' in the policy instrument branch. The addressees in these articles are mainly public associations, shipowners, trade associations, and to a limited extent, the banks (Appendix 1).

Lastly, knowledge acquisition is most pronounced and most present. Efforts are made to design zero-emission vessels (Article 12.5), improve and upscale the biofuel production chain through innovation (Article 18.8), and investigate the potential of hydrogen fuel (Article 18.9 and 24.4). The addressed stakeholders in these articles are mainly knowledge institutions, private companies, and public associations.

To conclude, most policy instruments are focussed on either make conventional fuels not economically attractive or make the alternatives accessible and cheaper. To a lesser extent, command-and-control and communication tools are used.

5.3 Goal attainment

Goal attainment will be analysed according to the output, impact, and outcome as outlined earlier. Firstly, the 'impact' shows to what extent measurable states have changed. The main goal of the GD is to see a reduction in emissions and air pollution. As elaborated in the GD, carbon measuring and report-keeping would be a source of information and could therefore benefit the understanding of the problem of sustainability in shipping (Article 12.1). A report outlining the aggregated carbon emissions over 2019 of the bigger ports of the Netherlands and shipowners should have been published on the 1st of July, 2020. As can be seen in Figure 5, there was no instrument identified that was meant to enforce or promote the measuring of carbon emissions. Due to this, it may have become increasingly difficult to keep track of said carbon emissions. This may explain why as of March 2021, these reports have not been published as well as no indication that carbon data has been collected in the first place.

Therefore the main goal of carbon emission decrease in the GD cannot adequately be subjected to an evaluation. However, other implied goals in the GD can still be discussed and evaluated.

Moving on, the 'output' is measured by identifying any programmes or plans that have been initiated as a result of the GD. The GD includes an article on the cooperation within the boundaries of the policy. The cooperation consists of a 'Taskforce' of relevant stakeholders, which at the latest would be introduced by the 11th of November, 2019. The Taskforce is meant to meet twice a year and on the 1st of January, 2022, the GD will be evaluated by them. An evaluation report will be written out on whether the goals will be reached. On the basis of the report, the GD can be amended or prolonged. No documentation or news can be found on the GD Taskforce. Meijerhof found similar results in 2020; a significant amount of interviewees indicated they had not heard anything regarding a Taskforce linked to the GD (p. 37). As the Government Shipping Company and the Ministry of Defence were meant to take up their role as launching customership, it was anticipated to see some actions regarding implementing new innovations. However, no reports could be found regarding their involvement in the implementation of new technologies. On the international level, no evidence was found that indicated the Netherlands was active to promote low-emission zones or carbon reduction measures.

Another goal that can be considered under the output label is the Netherlands Maritime Technology website (Article 12.2) which aims to keep up a national 'maritime technology solution' website to promote the accessibility of information and allow for better decision-making. The website is online and for the most part accessible. However, the most recent articles on their services, products, and implementation of Corporate Social Responsibility all stem from 2016 – before the GD was signed into motion. On a similar website, also directly linked to the Netherlands Maritime Technology group, more useful information can be found. For instance, in 2020 a report studied stakeholder's current interest in potential 'sustainable maritime solutions', with the aim to suggest a solution that should be researched (de Bruijn, 2020). The results suggest further researching biofuels and energy and fuel efficiency measures for the short term; for the long term, carbon capture and hydrogen fuel needs to be further researched although costs are expected to run up (de Bruijn, 2020).

As a direct result of the Green Deal, Maritime by Holland generated a 'Maritime Masterplan' in 2020, which in light of the COVID-19 pandemic aims to make big changes over the long term. Their goal is to create thirty emissionless ships and five retrofits (new technology applied to old ships) in 2030 (Nederland Maritiem Land, 2020). Their investment of 250 million Euros is split between generating knowledge on methanol, hydrogen, and electrical shipping and application of new technologies to, amongst others, fishing vessels, ships for the Ministry of Defence and Government Shipping Company, and energy efficiency measures (Nederland Maritiem Land, 2020).

Lastly, the outcome should indicate to what extent the policy goals have been fulfilled. The overall goal of carbon reduction is difficult to address as there is no carbon emission data. While it is currently not possible to comment on the emission and pollution reduction goals, other objectives can still be considered. One example is the promised abolishment of the energy tax on shore power (Article 12.4). For the year 2020, the taxation plan was meant to exempt tax over shore power with the aim to promote energy use for maritime shipping but this was deemed unattainable (Schroten et al., 2020). Instead, the exemption was introduced for the taxation plan of 2021 (Wet opslag duurzame energie- en klimaattransitie, 2021, art. 3.1 lid E). It is unclear yet if this change has brought about significant carbon saving changes. Furthermore, the initiatives by Netherlands Maritime Technology and Maritime by Holland suggest a move towards desirable behaviour as set out in the GD. However, linking these actions to concrete outcome and impact goals should be done as the GD comes to an end.

5.4 Evaluation of effectiveness

The environmental policy evaluation framework considers three topics to evaluate the successfulness of the policy. These three areas are the coverage of theoretical points of application, the steering power of policy instruments, and compensation of (negative) side effects (Weber, Driessen & Runhaar, 2014).

5.4.1 Coverage of points of application

The points of application are all covered by policy instruments but one: the carbon emissions tracking (see Figure 6). As was found in section 5.3, this has led to a lack of knowledge on carbon emissions data and thus inhibits the likelihood of accurately measuring any impacts or outcomes. This is severely decreasing the potential effectiveness of the policy as there is no evaluation possible. As for the remaining policy instruments used, most tend to address the remaining points of application. The Dutch position on an international level is not strongly solidified and as discussed previously, there was little evidence that suggests the representatives addressed these points of application. Similarly, the upscaling of biofuel production was not covered. This is due to the findings by Meijerhof (2020) that the GD neglects to address or help in the commercialisation of solutions, of which amongst others, upscaling biofuel production.

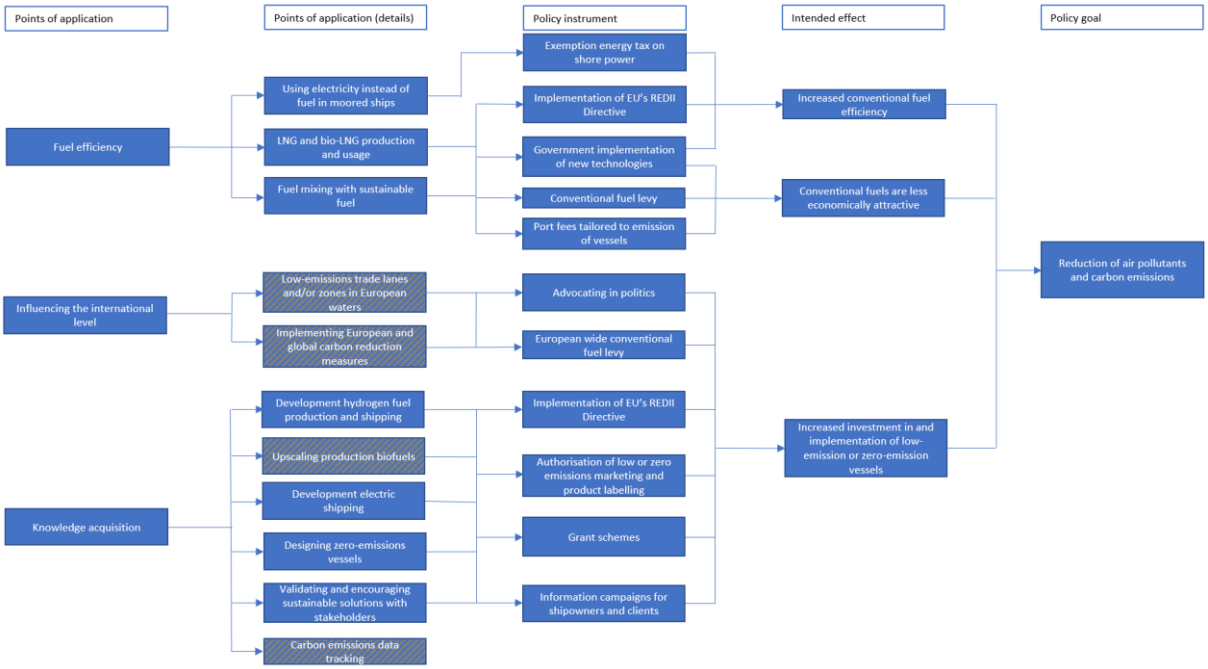

Figure 6. GD policy; Greyed out points of application signify a lack of action. Concept taken and adapted from Weber, Driessen & Runhaar, 2014. Analysis and content is the author's own work.

5.4.2 Steering power

The steering power of a policy refers to the extent that addressees are encouraged or discouraged from partaking in certain actions. While the GD stakeholders (Appendix 1) are relatively well-represented and diverse, the GD is considered limited in effectiveness as there is no incentive to avoid undesirable behaviour. There is no corrective clause for undesirable behaviour and neither is the GD legally binding. As for the actions by the Government Shipping Company and the Ministry of Defence, the expected effectiveness is relatively high. The co-operation between the Ministry of Economic Affairs, Ministry of Finance, and Ministry of Defence with clear and concrete goals suggests that these articles can be reached. In part, the contribution of Maritime by Holland's masterplan increases the likelihood of success. The efforts by the Government Shipping Company and the Ministry of Defence are a push in the direction towards sector-wide sustainable implementations, but it is unsure yet if this will be the push the private actors in the shipping sector need.

5.4.3 Compensation of side effects

As has been mentioned throughout the previous sections, uncertainty is a massive problem for appropriate changes to what technology is being used. While the pilot project efforts are a step in the right direction, the remaining content of the GD is not thought to actually aid in the implementation of these pilot technologies. This is partly due to that uncertainty, as concluded by Meijerhof in 2020; one of the interviewees in the research was quoted as saying: "if someone says; we ensure that

hydrogen infrastructure is created, many more shipping companies are willing to switch to hydrogen" (Meijerhof, 2020, p. 32). This problem signals a lack of compensation for (negative) side effects. While actions may be desired by actors, the minimal (financial) support is lacking. Even with the cooperation of the banks in the GD, stakeholders find themselves unable to find attractive business cases. Evidence suggests that "there is knowledge about what is technically possible", what is lacking is the "further development and commercialisation of solutions" (Meijerhof, 2020, p. 33). This is relatively common in market-based mechanisms; stakeholders are left to carry the risks and costs of new technologies which makes the investment less desirable (Yliskylä-Peuralahti, 2017).

This same issue is seen in the GD; the policy instruments are mainly financial- and market-based mechanisms. These are suggested to be less effective than command-and-control type of regulation (Weber, Driessen & Runhaar, 2014; York & Rosa, 2003; Yliskylä-Peuralahti, 2017). For example, in the Finnish and Danish shipping context it was found that it is "the only effective way to ensure minimum safety and environmental standards" (Yliskylä-Peuralahti, 2017, p. 52). Therefore it can be concluded that direct implementation of regulations regarding environmental targets or implementation of radical innovation can effectively ensure standards as set out by the GD. However, this requires a strong political presence. Conversely, the Netherlands' is strongly in favour of a "technology neutral approach", which brings "a lot of uncertainty to the market" (Meijerhof, 2020, p. 33). The uncertainty of the GD negatively affects the expected effectiveness.

6 Discussion

6.1 Beyond the Green Deal

As alluded to earlier in section 5, there are two outstanding perspectives when assessing the GD. While the GD's main goals are short-term in scope, the eventual global change the shipping sector needs to see is climate neutrality by the turn of the century – preferably much earlier (Williamson, 2016). Will the 2024 goals exclusively be considered for the effectiveness assessment in this thesis, or should the scope be extended to look beyond this timeframe, to the eventual sustainable shipping sector?

Throughout the results section we have considered the 2024 goals. In the discussion section, the GD beyond its 2024 goals will be specifically taken into account. For additional support, the 'missing data' as mentioned in section 4 will be scrutinized along with the environmental policy theory of the GD.

6.2 Missing data and suggestions to account for them

Both in the scope of the GD and beyond, the lack of consideration for operational changes is negatively impacting the ability to make climate mitigation goals. While arguably operational changes are most effective when implemented on a global level and consumer and demand expectation is managed, the GD is lacking as it does not even consider operational changes and communication as an option. Furthermore, the fact that carbon emissions are not immediately curbed, makes the challenge of eventually going carbon-zero *and* keeping climate change to under 2 degrees Celsius all the more difficult.

Social factors are found to have a major effect on the effectiveness of policies, these social factors cannot simply be addressed by exclusively using standard market-based instruments (Bouma et al., 2019). Addressing the consumers of the chain can be incredibly valuable in giving additional economic incentive. If the GD aims to rely on market mechanisms, then changing the demand side is just as valuable as trying to nudge the inner workings of the market. The fact the GD does not address the consumers, is considered a weak point in this case. To manage the consumer and demand side, communication techniques could have been used for consumers to desire sustainable shipping, address overconsumption and cheap frivolous goods, and to manage delivery time expectations to open the door to slow steaming – which significantly lowers GHG emissions (Lack et al., 2011); some studies estimate a decrease of around 11% in CO_2 emissions (baseline: 2008) (Cariou, 2011). For some goods, such as fresh foods, slow steaming is not an option. Rather, managing the demand for all-year-round in season fresh fruits and vegetables may aid in decreasing the demand and thus need for shipping, as well as investing in and implementing zero-carbon fuels so the shipping of these goods can happen carbon-neutral as soon as possible. While addressing the consumer side of shipping can be beneficial, it is only effective for consumer goods. For oil tankers and cargo-owners, sustainability is not at all a concern as their decision-making is based on speed and cost; slow steaming would increase delivery times and labour costs (Wan et al., 2018). Therefore, slow steaming is often not feasible in these sectors (Wiesman, 2010). In these situations, strict policy and command-and-control regulation is the only approach in which one can ensure sustainability is taken into account (Mander, 2017; Yliskylä-Peuralahti, 2017).

Additional operational changes besides slow steaming that can significantly improve efficiency in using conventional fuels are shore power usage by moored ships. Ships in ports usually keep their engines on for maintenance and heating, causing air pollution and human health problems (Contini & Merico, 2021; Cullinane & Cullinane, 2013; Han, 2010). Although not particularly addressing the human health

problem, the GD opted and succeeded to remove shore power tax to avoid ships leaving their engines running on heavy fuel oil. The next step would be to ensure the already existing shore power infrastructure is actually being utilised by ships *and* is created by renewable energy. Currently there are no reports of either issue being tackled.

Going back to Hajer's theory (1995), ecological modernisation considers environmental degradation an external problem that can be solved by internalising it into existing institutions and global management (p. 251). Throughout the text, it has been shown to be a supporting theory for the set-up of the GD. From that understanding, the GD is lacking in adequately implementing external issues into the sustainable shipping sector. As has often been concluded, the GD is centred around lowering air pollution and GHG emissions through addressing these issues from an economic standpoint. Like Hajer's theory of ecological modernisation, this approach is based on the idea that the market can and will address and eventually solve environmental and social issues if these are internalised into the market and the institution.

In the scope of this GD, the focus is entirely on substituting conventional fuels with a zero-carbon alternative. The GD neglects to address the social or environmental aspects of the shipping sector – which as was discussed in section 2 are and should be included in sustainable development. Some pressing environmental examples are marine ecosystem destruction, plastic waste or leakages from ships (Jägerbrand et al., 2019; Wuisan et al., 2012); some social issues are the continued use of cheap (overseas) labour and human rights and safety violations that tend to disproportionately affect minority groups (Alimahomed-Wilson, 2019; Mazhari, 2018; Ranasinghe, 2020). Again, here the global character of the shipping sector makes these problems difficult to tackle. Regardless of the location of a company's headquarter or where a ship is built, the flag a ship sails under is determined by which country best represents the ships' purpose (Yliskylä-Peuralahti, 2017). This would mean that although the Netherlands implement rules (command-and-control) or companies decide to do business fairly (Corporate Social Responsibility), the effect in the worst case could be minimal as ships revisit which flag they sail under. Therefore, fair treatment of workers is a global political issue to address.

Understandably, the most pressing issue right now is to address the excess of GHG in the atmosphere and so the focus on substituting conventional fuel for zero-carbon fuel is understandable. The need for zero-carbon fuels is there, but what will be created with zero-carbon fuels will not be a sustainable shipping sector. It should be questioned why the GD and other environmental policies are set on "manag[ing] to sustain what is known to be unsustainable" (Blühdorn and Welsh, 2007, p. 185).

6.3 Questioning assumptions of sustainability

In the ideal situation, the Dutch government including its Ministries would pick up a guiding role and actively choose and promote a method of zero-emission shipping. The GD would present as an initial strategic roadmap, with additional approaches to address the complete breadth of the shipping sector – both inland and maritime and supply and demand. In previous sections it was noticed that a lack of addressing consumers, considering additional social and environmental issues, utilising communication and applying operational changes in the shipping sector significantly inhibits the short term successes and achievements the GD could have picked up.

As a textbook example of ecological modernisation, the GD is mainly concerned with technological advancement supported by economic development or 'green growth'. As opposed to command-and-control regulation or communication, this approach brings more freedom for stakeholders to make decisions. The ecological modernisation theory and voluntary opt-in initiatives are thought to be vulnerable to economically unstable times, such as pandemics, stock market crises, or even as small as a change in management. In changing circumstances, the drive to be sustainable is weak as there is no funding to invest in innovation (Yliskylä-Peuralahti, 2017). When these economically unstable times arise, companies generally try to lower their operating costs, which often causes these companies "to postpone or abandon investments in sustainability" (Yliskylä-Peuralahti, 2017, p. 54).

A similar issue is found in the 'intended effects' branch in Figure 5 (recopied below). The first two effects are actively counteracting one another. Increased conventional fuel efficiency is a double edged sword: firstly it means that per tonne-kilometre, the air pollutants and carbon emitted goes down; this is the desired effect. Secondly, the implications of the improved efficiency usually brings about a relative decrease in costs for conventional fuels (Wiesmann, 2010). This can be summarised as the rebound effect; as fuel becomes more efficient, it also tends to become cheaper and will therefore be used more often (Andersson et al., 2016; Tanaka & Okada, 2019). This tends to lead to an increase in emissions, even despite fuel efficiency measures (Andersson et al., 2016).

Figure 7. Reprint of Figure 5; GD policy and its points of application and policy instruments used. Red square added to highlight the 'intended effects' branch as discussed in the paragraph above.

Furthermore, the implicit assumption of 'green growth' can logically be debunked; York and Rosa argued that economic growth will always outpace sustainable progress achieved in the reduction of emissions (2003). Ergo, where on paper economic growth should promote the investment in zero-carbon technology, the continued reliance on growth as a profit mechanism will always overshoot the carbon and GHG reductions that happen through the aforementioned technologies. Therefore, various researchers have concluded that exclusive reliance on (voluntary-based) ecological modernisation within the existing economy, will most likely fail to create a low-carbon sector (Yliskylä-Peuralahti, 2017). Once again it should be highlighted that the current GD is not able to adequately promote the desired behaviour that is desperately needed to reach sustainability goals.

6.4 Final policy recommendations

The final policy recommendations are twofold. Firstly, future shipping policy has to address the identified missing data in section 6.2. Sustainability is more than making a sector low-carbon and a shipping policy should reflect this concern. Environmental issues beyond carbon and other GHG emissions such as but not limited to: ecosystem health, habitat loss and fragmentation, biodiversity loss, and waste from shipping, needs to be observed and managed accordingly. Just as important is the attention that should be paid to the social sphere of shipping. The safety and rights of employees on and relating to ships need to be harboured; especially minorities and people in the global South who tend to be exploited by a profit-driven system (Alimahomed-Wilson, 2019; Mazhari, 2018;

Ranasinghe, 2020). This last point is not completely unrelated to the second division of policy recommendations.

While the GD moderately relies on ecological modernisation and green growth vision, this thesis has shown that there are issues with these approaches. Future policy-makers should consider approaching future shipping policy from an entirely different perspective. Preferably one that considers a strong-acting government that can guide the shipping sector into a more well-managed or degrowth transition.

7 Conclusion

With the aid of Weber et al.'s framework, the GD was analysed and evaluated. First and foremost it should be considered that at the time of writing, the GD is only halfway through its implementation period and so conclusions that will be drawn can still change as time goes on. That being said, even at this stage, initiatives should have been initiated and therefore changes should be noticeable in one way or another. Stepwise, this thesis has shown that the GD relies on technological development, following the theory of Hajer's ecological modernisation, to reinstitute a new sustainable regime. The GD focusses mainly on finding low-carbon ways to propel marine vessels, while other environmental or social concerns are not being addressed. This led to the conclusion that while the GD is focussed on climate mitigation, it is lacking on the sustainable development front as outlined in section 2.2. Policy instruments that were used to address the changes needed in propulsion techniques were mainly market and finance-based. While research and development was relatively well-covered in the GD (Meijerhof, 2020), it has been shown that stakeholders feel like they need more national, regional, and global support to implement these new developments. As a result, goal attainment showed a fraction of the desired behaviour and a lack of action on the behalf of most stakeholders. Failure to publish carbon data and form the GD Taskforce weighed heavily in the final evaluation.

Finally, the expected effectiveness of the GD is considered to be low due to the inability to discourage undesirable behaviour, lack of steering power, and failure to acknowledge and address further environmental and social issues. Nonetheless, as the GD is the first of its kind in the Dutch shipping context, it can benefit over time by the implementation of other, more detailed and stringent complementary policies. As such, the pressing advice for the future is to expand shipping legislation to cover more sustainable development targets with concrete actions and to introduce complementary specialised policy to introduce new developments. While this seems like a mammoth task, with a stronger government presence in the shipping sector, the Netherlands will have the tools to safeguard

the climate for future generations while simultaneously protecting the shipping sector's best interests, both nationally and globally.

7.1 Further research

As for the long term vision as discussed in section 6, we should question if the ambitions as laid out in the GD will be able to fulfil the long term ambitions. A voluntary-based policy is heavily discouraged as more concrete actions are needed to bring about changes. Furthermore, the concept of ecological modernisation and green growth in shipping should be questioned and researched in more detail. Research suggests these concepts do not hold up in the long term and thus more careful consideration is needed to evaluate their effectiveness. A concept such as managed degrowth could be of relevance here. Similarly, comparative studies that contrast the Dutch case with other relevant sustainable case studies can be valuable to reflect on the various possible approaches to environmental policy. Ideally, future research should proactively steer towards the action-research direction and find constructive ways to implement the much needed radical changes in the shipping sector.

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9 Appendix

Table 1: Stakeholders as identified by the Green Deal

NR	ACTOR	DUTCH NAME	SHORT DESCRIPTION	CATEGORY
1	Minister of Infrastructure and Water Management	Minister van Infrastructuur en Waterstaat	Dutch ministry responsible for infrastructure and affairs concerning water	Government
2	Minister of Economic Affairs and Climate Policy	Minister van Economische Zaken en Klimaat	Dutch ministry responsible for economic affairs and climate affairs	Government
3	State Secretary for Defence	Staatssecretaris van Defensie	Secretary for the Dutch Ministry of Defence	Government
4	Gelderland provincial executive	Gedeputeerde Staten van provincie Gelderland	Administrative authority of the province of Gelderland	Government
5	North Brabant provincial executive	Gedeputeerde Staten van provincie Noord-Brabant	Administrative authority of the province of Noord-Brabant	Government
6	Overijssel provincial executive	Gedeputeerde Staten van provincie Overijssel	Administrative authority of the province of Overijssel	Government
7	Utrecht provincial executive	Gedeputeerde Staten van provincie Utrecht	Administrative authority of the province of Utrecht	Government
8	Nijmegen municipal executive	College van burgemeester en wethouders van gemeente Nijmegen	Administrative authority of the city of Nijmegen	Government
9	Central Bureau for Rhine- and inland shipping	Centraal Bureau voor de Rijn- en Binnenvaart	Represents employers in the Dutch inland shipping sector	Trade association
10	Royal BLN-Schuttevaer	Koninklijke BLN-Schuttevaer	Represents entrepreneurs and the collective good of the Dutch inland shipping sector	Trade associations
11	Royal Association of Netherlands Shipowners	Koninklijke Vereniging van Nederlandse Reders	Represents the Dutch maritime shipping sector	Trade associations
12	Maritime by Holland	Nederland Maritiem Land	Connects and represents the Dutch maritime shipping sector	Trade associations
13	Netherlands Maritime Technology	Netherlands Maritime Technology	Trade association and representative for the Dutch maritime technology sector	Trade associations
14	Association of Waterbuilders	Vereniging van Waterbouwers	Association for ship construction parties	Trade associations
15	Groningen Seaports NV	Groningen Seaports NV	Representing Groningen Seaports in Delfzijl	Harbour representative
16	Port of Amsterdam NV	Havenbedrijf Amsterdam NV	Representing Port of Amsterdam	Harbour representative
17	Port of Rotterdam NV	Havenbedrijf Rotterdam NV	Representing Port of Rotterdam	Harbour representative
18	North Sea Port	North Sea Port	Representing North Sea Port in Terneuzen	Harbour representative
19	Port of Moerdijk NV	Havenbedrijf Moerdijk NV	Representing Port of Moerdijk	Harbour representative
20	Dutch Association of Inland Harbours	Nederlandse Vereniging van Binnenhavens	National association of inland harbour representatives	Inland harbour representative
21	Boosting Initiatives for Collaborative Emissions-reduction with the Power of Shippers Network	Boosting Initiatives for Collaborative Emissions-reduction with the Power of Shippers Network	Network of shippers, aiming to accelerate sustainable transition	Shipowner

22	Evofenedex	Vereninging evofenedex	Association of entrepreneurs and shipowners	Shipowner
23	ABN Amro Bank NV	ABN Amro Bank NV	Dutch owned bank, investment banking	Bank
24	ING Group NV	ING Groep NV	Dutch owned bank, investment banking	Bank
25	NIBC Bank	NIBC Bank	Dutch owned bank, offers corporate services	Bank
26	Cooperative Rabobank U.A.	Coöperative Rabobank U.A.	Dutch owned bank, investment banking	Bank
27	The Netherlands Organisation for Applied Scientific Research TNO	Nederlandse Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek	Independent research organisation	Knowledge institution
28	Maritime Research Institute Netherlands	Stichting Maritiem Research Instituut Nederland	Independent research organisation to the maritime industry	Knowledge institution
29	Delft University of Technology	Technische Universiteit Delft	Public research university	Knowledge institution
30	Akzo Nobel Industrial Chemicals BV	Akzo Nobel Industrial Chemicals BV	Dutch-owned multinational manufacturer of industrial chemicals, located in Amsterdam	Private company
31	Binnenlandse Container Terminals Nederland BV	Binnenlandse Container Terminals Nederland BV	Association inland terminal group in the Netherlands and Belgium	Private company
32	Deltalinqs	Deltalinqs	Networks and promotes common interests of actors in the Port of Rotterdam	Private company
33	Netherlands Association Forwarding and Logistics	Federatie van Nederlandse Expediteursorganisaties	Federation of Dutch shipping agents and logistics, offers logistic services	Public association
34	GoodShipping BV	GoodShipping BV	Company specialisiing in reducing CO_2 emissions for shipping clients	Private company
35	Nederlandse Hydrogen Fuel and Fuel Cell Association	Nederlandse Waterstof en Brandstofcelassociatie	Association for implementation and utilization of hydrogen fuel and fuel cell technology in the Netherlands	Public association
36	Platform Sustainable Biofuels	Platform Duurzame Biobrandstoffen	Supporting association that helps implement and upscale the use of sustainable biofuels	Public association
37	Shell Nederland BV	Shell Nederland BV	Dutch-owned multinational oil and gas company	Private company
38	Foundation Green Award	Stichting Green Award	Foundation that aims to certify sustainable shipping, with the aim to incentivize sustainable options	Public foundation
39	Foundation for Inland Shipping Projects	Stichting Projecten Binnenvaart	Rotterdam-based foundation focussing on innovative projects in the inland waterway transport sector	Public foundation
40	ProSea Marine Education	Stichting Prosea	Foundation focussed on educating marine professionals on the environmental consequences of the decisions they make	Public foundation
41	Dutch Association for Transport and Logistics	Transport en Logistiek Nederland	Dutch association for entrepreneurs and companies involved in road transport and logistics	Public association
42	Verening van Nederland Inland Terminal Operators	Vereniging van Nederlandse Inland Terminal Operators	Dutch association of organising and developing inland container terminals	Public association

Table 2: Analysed articles mentioned in the main text.

ARTICLE	TEXT ENG	CATEGORY
12.1	With due regard for article 28, KVNR and VVW will annually provide information on the aggregated carbon emissions of their affiliated fleet. The first report, on 2019, will be published on 1 July 2020.	Measuring emissions
12.2	NMT will provide clarity on available sustainable maritime solutions by 1 January 2020. These solutions will be published on: www.sustainable-maritime-solutions.nl. NMT will keep this website up-to-date.	Information sharing
12.4	I&W has agreed with the Ministry of Finance that the latter's proposed Taxation Plan for 2020 will abolish the energy tax on shore power used by shipping. I&W and the Ministry of Finance will also jointly investigate the effects of changing the fiscal regime for electric shipping.	Economic nudging
12.5a	Knowledge institutions and industry partners will jointly design a zero-emission maritime vessel, including a convincing business case, by 2024.	Knowledge acquisition
12.5b	Ongoing and new research and development projects financed from national and European resources will contribute to this effort. In addition, every effort will be made to use existing I&W and EZK grant schemes for sustainable projects in the maritime sector.	Funding
12.8	KVNR, Evofenedex and BOZ will investigate scope for zero-emission trade lanes before 1 January 2022 and to this end conclude long-term agreements between specific producers, shippers, shipowners and ports.	Level playing field
13.3	At international level I&W will call for the adoption of carbon reduction measures. In connection with this, I&W will within the framework of the IMO pursue the introduction of a global carbon emissions tax, i.e. a fuel levy. I&W will also call for the revenues from this levy to be used for an international fund or other incentive scheme to promote and accelerate research, rollout and installation of innovative sustainable maritime solutions.	Level playing field
13.7	I&W will strive for the establishment of low-emissions zones in all European waters, in the interests of a level playing field.	Level playing field
15.2	BOZ will seek to optimise the Environmental Ship Index (ESI) and Green Award, to better align the discounts awarded on port charges with the objectives of this Green Deal.	Economic nudging
18.3	BOZ, in collaboration with I&W and EZK, will pursue international agreements on incentive programmes for carbon reduction, the establishment of low-emissions zones at ports in Northwest Europe and promotion of climate-friendly trade lanes between the Netherlands and the Baltic.	Level playing field
18.5	The Green Award Foundation and KVNR will investigate whether smaller dry cargo vessels can be included in the Green Award programme.	Economic nudging
18.8	Shell will, in collaboration with the Ports and other stakeholders, explore the extent to which the production of biofuels (including bio-LNG) can be accelerated in order to make maritime shipping more sustainable.	Knowledge acquisition
18.9	As the owner of offshore wind farms and as a producer and supplier of marine fuels, Shell will take the initiative to explore, along with other market parties, the extent to which offshore wind energy can be converted into hydrogen and the extent to which this hydrogen can subsequently be supplied to shipping as part of the energy transition process.	Knowledge acquisition
19.4	I&W will work at international level (IMO, CCR and the EU) to secure ambitious agreements on increasing the sustainability of maritime and inland shipping, with the goal of promoting investment security and preserving the global level playing field.	Level playing field
19.6	EZK will have the Netherlands Enterprise Agency (RVO) survey which financing schemes and resources are currently available to maritime and inland shipping enterprises, and will also explore options for future funding instruments. Should the envisaged funding instruments not become available, I&W will enter into talks with the Parties about carrying out the actions they have undertaken in this Green Deal.	Funding
19.8	I&W is prepared to make a fund available of up to €1 million a year for the assessment and validation of technologies referred to in article 23, paragraph 4, for the duration of the Green Deal and within the relevant legal frameworks and competition rules.	Funding
21.2a	BICEPS Network, Evofenedex, TLN and FENEX will make every effort to ensure that their affiliated shippers and logistics service providers use sustainability as a selection criterion contracting shippers and shipowners.	Information campaign

21.2b	With regard to tendering procedures, they will facilitate the removal of obstacles to the greening of ships and shipping routes and encourage the inclusion of incentives, such as premiums for the use of clean ships or for the realisation of a clean and energy-efficient freight transport route.	Economic nudging
24.2	I&W's Rijkswaterstaat will include an award criterion of 30% carbon emission reductions relative to the current emissions of conventional methods in the most economically advantageous tender system for public procurement of maintenance contracts for six sea access channels.	Economic nudging
24.4	As a producer of green hydrogen in ports and a buyer of inland shipping logistics services, Nouryon will explore, with other market parties, the scope for storing and supplying green hydrogen for use by maritime and inland vessels and ports. This will be included in its plans for scaling up water electrolysis for industry.	Knowledge acquisition