

Article

Incorporated Maritime Policy Concept: Adopting ESRS Principles to Support Maritime Sector's Sustainable Growth

Kaidi Nõmmela *  and Kati Kõrbe Kaare

Department of Mechanical and Industrial Engineering, Tallinn University of Technology (TalTech), Ehitajate tee 5, 19086 Tallinn, Estonia

* Correspondence: kaidi.nommela@gmail.com

Abstract: The international maritime sector plays an important part in contributing to the global sustainable economy and plays a significant role in achieving sustainable development goals. A variety of regulations and standards power the sustainability management of the global maritime sector, including the United Nations' Sustainable Development Goals and the European Union's new draft European Sustainability Reporting Standard. Limited research on the potential contribution of maritime policy-making to support sustainable development has led the sector to face multiple challenges. In this study, we analyzed how local policy-making can impact international goals and global sustainable development based on comprehensive datasets of 143 maritime companies. The study recommends the incorporation of sustainability dimensions of the maritime sector into all levels of policy-making and supporting the policy implementation with the local maritime governance structure. A maritime country should have strategic planning objectives that embrace maritime affairs and use the interactions identified between local development and the maritime sector. We propose a framework for maritime policy-making that supports sustainable development. A maturity model for sustainable development in the maritime sector was developed. The results can be used as guidelines for policymakers in planning sustainable development in a maritime country.



Citation: Nõmmela, K.; Kõrbe Kaare, K. Incorporated Maritime Policy Concept: Adopting ESRS Principles to Support Maritime Sector's Sustainable Growth. *Sustainability* **2022**, *14*, 13593. <https://doi.org/10.3390/su142013593>

Academic Editor: Alessandro Farina

Received: 20 September 2022

Accepted: 19 October 2022

Published: 20 October 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords: maritime sector; sustainable development; policy framework; European Sustainability Reporting Standard; SDGs; ESG; maturity model

1. Introduction

In today's world, sustainability is one of the main competitive drivers [1] for economic, environmental, and social welfare. As one of the major contributors to world trade [2–4] and employment [5], the international maritime sector plays a significant role in facilitating sustainable development [3,4,6,7]. Integration of the sustainable development concept into corporate strategies has been inevitable, as the urgent pressure from the environment and growing attention from the social sphere are significant. Sustainable development includes decision making that takes into account the current situation as well as a long-term focus and ensures a fair distribution of the costs and benefits of the development [8]. In the maritime sector, more flexibility is required in managing processes and balancing strategic development and operations with changing demands and increasing expectations.

The maritime sector is unique, differing from other economic sectors due to its specificities [9,10] and special sectoral issues and priorities [5]. Compared to other sectors, the maritime sector stands out primarily for its [5,9–11]:

- Interdisciplinarity.
- Multiplicity of interests.
- International dimensions.
- Volatility due to global demand and supply.
- Strict regulations.
- Strong relations with environmental and social impacts.

- Use of limited and public marine resources.
- Huge and long-term capital investments.
- Management by national and international institutions.
- Dynamism due to complementarity between different transportation modes.

Although the increase in seaborne trade has a positive effect on local economic growth, it also significantly impacts environmental and social aspects [3,4,11,12]. At the same time, there has been limited research on the potential contribution of local maritime policy-making to support sustainable development [9].

The maritime sector has critical value in people's lives and the economy, and it is a major component of the local and regional logistics and transportation system [3,11]. In 2019, blue economy activities (marine living and non-living resources, marine renewable energy, ports, shipbuilding and repair, maritime transport, and coastal tourism) contributed 1.5% in terms of gross value added and 2.3% in terms of employment to the European Union's (EU) economy [13]. Maritime countries are highly dependent on the development of the maritime sector, as it provides resources, offers transportation opportunities, promotes tourism, generates the use of renewable energy, etc. [3]. The main social impacts of the sector are employment and people's material wellbeing, communities' self-identification, and changes in the natural environment that impact local participants [14]. In this research, 'a maritime country' is defined as a country bordering the sea whose economic and social welfare is dependent on the use of the sea, including transport, tourism, food, national security, and other maritime-related activities. In the study, 'the maritime sector' includes maritime-related activities: Shipping, ports, the maritime industry (including shipbuilding and repair), maritime services, and fishing.

The authors of this study recommend incorporating the sustainability dimension of the maritime sector into all levels of policy-making, and supporting the policy implementation through the multi-level structure of the local maritime governance based on a business management style. A maritime country should embrace maritime affairs by identifying the connections and effects between local development and the maritime sector and incorporating them into strategic planning. The framework proposed in this study relies on the concept of a maturity model, which is a management assessment tool with guidance on how to improve the current status. With appropriate approaches and tools, policymakers have the opportunity to lead the sustainable development of a maritime country with successful maritime policy-making.

A much better understanding of maritime impacts on local sustainable development and other sectoral activities is needed for environmental preservation, social satisfaction, and economic prosperity. This approach can unlock new opportunities for sustainable growth by changing the previous ways of sectoral policy-making and dilemmas and aligning national policies with international goals. Currently, the maritime sector is often treated in policy-making as any other economic sector is, which has significant importance in the economic development of the country. However, in a maritime country, the maritime sector extends beyond sectoral boundaries and should be included in all national strategic interests.

The aim of this study is to propose a framework for maritime policy-making to support sustainable development. The study focuses on the most relevant guidelines regulating sustainability development, which are the United Nations' (UN) Sustainable Development Goals (SDGs) and the EU's new draft European Sustainability Reporting Standard (ESRS). In order to achieve the aim, the current status of sustainability reporting of Estonian maritime sector companies was analyzed based on the detailed datasets of 143 maritime companies. We used content analysis and text classification techniques together with a scientific literature review. As a result, a maturity model for sustainable development in the maritime sector and a framework for policy-making to support sustainable development were developed. The key beneficiaries of the proposed framework are policymakers, including government officials and politicians, maritime interest groups, and researchers.

The results can be used as guidelines for policymakers in planning sustainable development and as a basis for further research in maritime sustainability-related studies.

The article is organized as follows: Section 2 presents the general background of sustainability expectations on an international level, focusing on the UN's SDGs and the EU proposals, and highlighting the multiplicity of guidelines. Section 3 provides a literature review of sustainability maturity models and how to incorporate the sustainability concept into strategies. Section 4 describes the methods used in this study. Section 5 presents the findings, i.e., the current status of sustainability reporting in the Estonian maritime sector, the maritime sustainability maturity model, and the framework for maritime policy-making. The findings are discussed and summarized in Section 6.

2. Background

To enhance sustainable development, a variety of international sustainable strategies, goals, and standards have been agreed upon at all levels of governance. Local stakeholders and businesses are required to report their sustainability progress in order to evaluate the achievements of these agreements. Businesses that operate globally, including the maritime sector, often face difficulties in choosing and implementing appropriate sustainable management protocols and reporting standards. To achieve the agreed-upon international goals and gain economic growth while maintaining ecosystem services and a healthy environment and society, strong cooperation between all major stakeholders and support from local governmental institutions are required [15–17].

Members of the UN have committed to pursuing coherent policies for sustainable development with the aim to achieve the SDGs, which are the focus of realizing Agenda 2030 [15,18]. The 17 SDGs, with 169 associated targets, set high expectations for all business sectors, including the maritime sector. The responsibility of the maritime sector is primarily seen in SDG 14 “Life below water”, but the development of the maritime sector is highly relevant to all other SDGs, for example [19]:

- Contributing to the reduction of maritime-related pollution (SDG 3 “Good health and well-being”).
- Minimizing dumping and waste disposal at sea (SDG 6 “Clean water and sanitation”).
- Guaranteeing supportive and healthy work environments for seafarers and other workers (SDG 8 “Decent work and economic growth”).
- Controlling emissions from the shipping sector and the maritime industry (SDG 13 “Climate action”).
- Ensuring safe, secure, and environmentally protective maritime businesses (SDG 16 “Peace, justice and strong institutions”).

To perceive the status of sustainable development progress, a variety of sustainability reporting standards, frameworks, and guidelines are in use. According to the European Financial Reporting Advisory Group [20], the most used are different national standards, the Global Reporting Initiative Standards, the United Nations' SDGs and guidelines, the Task Force on Climate-related Financial Disclosures recommendations, the International Labour Organization guidelines, the Organization for Economic Cooperation and Development (OECD) guidelines, etc. In the EU, sustainability-related non-financial statement reporting has received considerable attention since the adoption of Agenda 2030. To increase transparency and improve the quality of the environmental, social, and governmental (ESG) information provided by companies of all sectors, the European Commission (EC) set detailed requirements for non-financial reporting. Large companies and large groups of companies (reporting on a consolidated basis) representing public-interest entities with an average of 500 employees during the financial year were obligated to include a non-financial statement in their annual management report. This statement included minimum information about the company's development, performance, and position, and the impact of its activity related to environmental, social, and employee matters and respect for human rights, anti-corruption, and bribery matters [21]. The EC recommended that companies may

rely on different frameworks when reporting data—national, Union-based, or international frameworks [21].

In 2021, the EU adopted a new proposal regarding corporate sustainability reporting [22]. According to the EC, the current legal framework did not ensure the required information for users, as the reported information was often insufficiently reliable and incomparable between companies, or not provided at all by companies. The primary users of sustainability information (investors, non-governmental organizations, social partners, and other stakeholders) did not receive enough necessary information for decision-making. Furthermore, companies that had to report found it difficult to decide what information to provide because of a lack of precision in the requirements and differences between international and private standards. The proposal recommended extending the scope of the reporting requirements to additional companies, including all large companies and listed companies (except listed micro-companies) [21].

In 2022, the EU proposed a draft for mandatory ESRS. The architecture of the draft ESRS has three layers (sector agnostic, sector specific, and entity specific), three reporting areas (strategy, implementation, and performance measurement), and three topics (environmental, social, and governance). All companies under the scope of the proposal would have to report in compliance with the ESRS. At the time of preparation of this paper, the draft ESRS was in public consultation [23]. The first report complying with the standard by the companies is expected to be issued in 2024 with reference to the reporting year of 2023 [21].

The OECD has developed guidelines for creating coherent policies for sustainable development in order to help to achieve the SDGs globally [15]. As stated in the guide, the main mechanisms for coherent policy development are (1) political commitment, including whole government and foreign affairs; (2) policy coordination and interactions between sectoral policies; (3) a systematic approach to policy effects; (4) involvement of major stakeholders; and (5) monitoring and reporting systems. The OECD's proposed framework is designed for country-specific policies to avoid or minimize the negative spillover effects of various policies between countries [15]. The proposed framework consists of an analytical framework for analyzing coherent issues and identifying interactions among the SDGs and targets, an institutional framework for aligning mechanisms for policy coherence to the 2030 Agenda, and a monitoring framework for tracking the progress of the policy.

As the maritime sector is regulated both on international and local levels, it is obligated to follow cross-sectoral agreements and legislations [9]. In order to manage the expected sustainable development, support from local policy-making is needed. Designing a policy by linking the ESG objectives of the maritime sector in a balanced way plays an important role in supporting sustainable development [15,24]. The absence of such a supportive and incorporative maritime policy will transform the expected sustainable development into separate local and international legal provisions without real results [8].

3. Literature Review

3.1. Sustainability Maturity Models

Sustainability requires both internal and external self-evaluation and systematic management from both the private and public sectors [1]. To evaluate the current sustainable status of the maritime sector, which is necessary for policy-making, a structured process and a matrix of practices can be used to define the as-is state and offer guidelines for decision making [25,26]. In business performance management, the maturity model concept has been widely adopted [25], but there are gaps in the literature in terms of maturity model use in maritime policy-making in relation to sustainability.

As the maritime sector's unique aspects have to be taken into account when developing a maturity model, previous studies provide useful insight into the model components in a different context. There are mainly two types of model levels found in the literature. Firstly, there are levels that combine research content and activities to achieve goals. Housni et al. [27] developed an environmental sustainability maturity system for maritime port

managers with five levels: (1) Initial; (2) framework; (3) monitoring and stakeholders; (4) review; and (5) environmental sustainability. Boullauazan et al. [28] introduced a maturity model for smart ports including five levels: (1) Silo (port being fragmented); (2) integration (smart port enabled); (3) supply-chain (digitized); (4) port (intra-connected); and (5) inter-port (inter-connected system). Lütkemeyer et al. [1] developed a maturity model for sustainability in product development. This model includes five levels based on the awareness and use of the sustainability concept: (1) The organization does not know and does not use the concept; (2) the organization knows but does not use the concept; (3) the organization has initial projects or a pilot project that includes this concept; (4) the organization implemented this concept partially or in some areas; and (5) the organization implemented this concept fully or completely in all areas.

Secondly, the literature review reveals model levels that are based on the stages of sustainable development progress. Santos et al. [29] proposed a maturity model for sustainability in the supply chain with five levels: (1) Nonexistent; (2) conscious or aware; (3) intermediate; (4) advanced; and (5) sustainable. Vasquez et al. [30] proposed a sustainability maturity model for micro, small, and medium-sized enterprises with four levels: (1) Insufficient; (2) basic; (3) developing; and (4) consolidated. These levels are more generally used in different contexts and easily adaptable due to changing conditions (e.g., changes in regulations, changing social pressures, emerging new challenges and crises).

The second main component of the maturity models is the dimensions that describe different aspects of the maturity assessment. The most common feature in the dimensions of previously developed sustainability maturity models is an environment-related aspect, e.g., energy and environment, environmental sustainability goals, environmental knowledge management, etc. [1,27–30]. Other dimensions are mostly based on factors focused on in previous research. A few studies have also included the design of policies and strategies among the dimensions of the models [1,27,30]. The results of the literature review supported the development of the maturity model as part of the maritime policy-making framework by demonstrating how a maturity model could provide guidance to successfully achieve sustainability goals, generate a more comprehensive vision, and help address sustainability efforts and actions [1,27–30].

3.2. Incorporating Sustainability into Strategies

The integration of the sustainability concept and the reporting system into maritime policy-making and corporate strategies has been time-consuming [5,16]. While a number of international regulations and guidelines for marine protection have been adopted [7,16], there is still a lack of governance structures for achieving the SDGs [16]. Wang et al. [19] identified two main challenges that are associated with the SDGs implementation into the private sector's actions. Firstly, the SDGs consist of various goals with different relevance in business contexts, and secondly, SDGs are mutually dependent, which makes it difficult to incorporate them into specific business plans and strategies [19]. Consequently, it is important to provide support to the maritime sector through the policy-making framework of government institutions.

The literature review showed that most of the research is focused on sustainable development actions in the private sector and few studies pay attention to policy-making in the maritime sector regarding sustainability matters [6,7]. Nömmela and Kõrbe Kaare [9] studied how to design a maritime policy with the ESG approach and proposed a framework for policy design that is the first step of the policy-making cycle. They also exemplified the evaluation of policy compliance to the ESG criteria using the ESG indicators proposed in the same research [9] and proposed an index for the maritime cluster impact assessment as input for policy-making. This index included three indicators: Economic impact, socio-cultural impact, and environmental impact [31]. The literature review also highlighted the importance of integrating multiple intervention levels and dimensions into sustainable development strategies. Different dimensions have a distinct influence on the ability to integrate sustainability into the maritime sector [6], and a multiplicity of levels could

be considered important in order to develop more efficient policies supporting a more sustainable maritime sector.

The results of the literature review revealed that the international maritime sector has an important contribution to each SDG [19]. Wang et al. [19] analyzed how the maritime industry can meet the SDGs, and as a result, proposed a framework for the assessment of the SDG implementation status in the maritime industry. Neumann et al. [32] focused on SDG 14 “Life below water”, and the results showed that it is necessary to develop various underlying normative approaches, principles, and objectives [32].

4. Methods

This study was divided into two main stages: (1) Developing the sustainability maturity model for the maritime sector and testing it on the reporting results of the Estonian maritime sector and (2) developing the framework for maritime policy-making to support sustainable development (Figure 1). The stages were carried out sequentially as the sustainability maturity model was an important input in the policy-making framework.

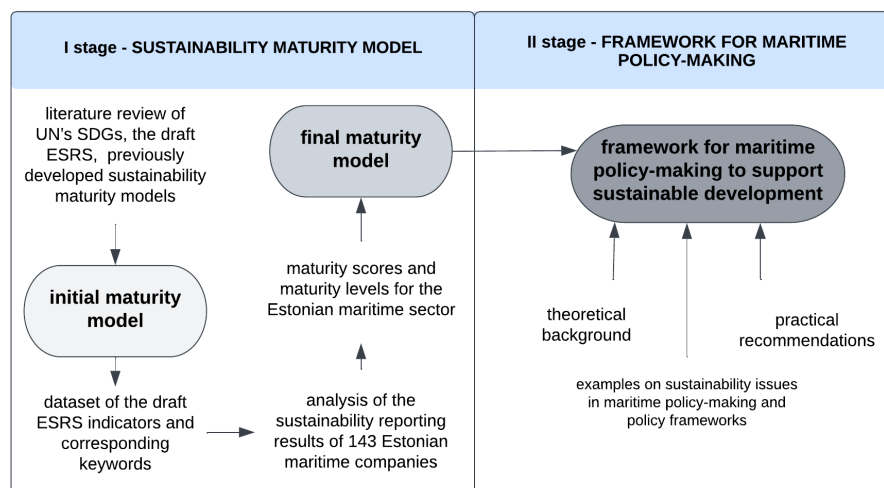


Figure 1. The development process of the research.

In the first stage, we focused on the literature review of sustainable development in the maritime sector, including the UN's SDGs and the draft ESRS and examples of previously developed sustainability maturity models. Based on the findings, an initial maturity model was developed. The initial model was tested on the sustainability reporting results of Estonian maritime companies, which were analyzed based on their annual reports. We chose Estonian maritime companies whose main or secondary activity was related to maritime activities in 2021 or 2020 (depending on the submission of the annual report by the company) according to the Estonian Business Register [33]. In cases of secondary activity, at least 20% of the sales revenue of the reporting year had to be from maritime activity in order to be included in the study. The Estonian maritime sector was divided into five sub-sectors based on the Estonian Classification of Economic Activities, which is the national version of the international NACE classification:

- Shipping.
- Ports.
- Marine industry.
- Maritime business services.
- Fishing.

A sample from the maritime companies was selected that proportionally included large (2.8% of the total sample), medium (16% of the total sample), small (43.4% of the total sample), and micro (37.8% of the total sample) size companies using the number of employees as the criterion (based on the EC recommendation concerning the definition

of micro, small, and medium-sized enterprises [34]). The total number of employees of the sampled companies was 5903, of which 23.4% were employees of large companies, 46.8% were employees of medium companies, 24.9% were employees of small companies, and 4.9% were employees of micro-companies. A total of 143 companies from maritime sub-sectors were included in the study (Table 1).

Table 1. Characteristics of the sample by sub-sector.

Maritime Sub-Sectors	No. of Companies Included	Total No. of Employees
shipping	6	739
ports	32	2286
marine industry	63	1980
maritime business services	34	767
fishing	8	131

The annual reports of all 143 maritime companies were analyzed using content analysis and manual text classification techniques. The results were entered into a dataset of draft ESRS indicators and corresponding keywords. Each main indicator of the draft ESRS (a total of 13 main indicators) was associated with keywords, thereby creating a system of ESRS indicators (Table 2).

Table 2. The draft ESRS categories and main indicators with associated keywords [23], authors' additions.

ESRS Category		Main Indicators	Associated Keywords
general	ESRS 1	general principles	sustainability policy/actions/plans/target, environmental policy/action/plans/targets, etc.
	ESRS 2	general, strategy, governance and materiality assessment	activities, value chain, business model, clients, investors, government, politicians, management, management structure, sustainability impacts/risks/opportunities, etc.
environment-related matters	ESRS E1	climate change	climate change, climate, energy, fuels, energy consumption and intensity, GHG, emissions, etc.
	ESRS E2	pollution	pollution, pollution incident/risks, etc.
	ESRS E3	water and marine resources	water resources, marine resources, water intensity performance, etc.
	ESRS E4	biodiversity and ecosystems	biodiversity, ecosystems, biodiversity-friendly consumption and production, etc.
	ESRS E5	resource use and circular economy	resources, circular economy, waste management, etc.
social-related matters	ESRS S1	own workforce	workforce policy, employees, employment, training, skills, health, safety, etc.
	ESRS S2	workforce in the value chain	value chain workforce/employees, etc.
	ESRS S3	affected communities	communities, surroundings, interest groups, locals, etc.
	ESRS S4	consumers and end-users	consumers, users, clients, etc.
governance—related matters	ESRS G1	governance, risk management and internal control	governance, nomination process, risk management, control system, etc.
	ESRS G2	business conduct	business conduct/behavior, corruption, competitive, ownership, payments, etc.

After filling the dataset with our analysis results, the maturity scores were calculated using the following equation:

$$Average_{I,II,III} = \sum_{i=1}^n A_{I,II,III} / n_{I,II,III} \quad (1)$$

where *I* is the entire maritime sector, *II* is each main indicator of the draft ESRS, *III* is each maritime sub-sector, *A* is the total score of *I*, *II* and *III*, and *n* is the maximum score of *I*, *II* and *III*. The levels of the maturity model were based on the literature review of previous research on sustainability maturity models and the analysis results of the Estonian maritime companies' annual reports (Table 3).

Table 3. Explanations of the scores in the sustainability maturity model.

Model Level	Min Score	Max
0—undefined	0.00	0.00
1—beginner	0.01	25.00
2—developing	26.00	50.00
3—progressive	51.00	75.00
4—matured	76.00	100.00

After calculating the maturity scores and finding the maturity levels of the Estonian maritime sector, the final maturity model was proposed with guidelines on how to increase the maturity score with support of policy-making and increase the level while taking into account the peculiarities of the maritime sector.

The second stage of the study included collecting and systemizing information on previous studies of sustainability matters in maritime policy-making. In this stage, the theoretical background from the literature review and practical recommendations from the international organizations' reports were compiled on the policy-making role in sustainable development. By combining the knowledge from previous studies, theoretical and practical background, and the results of the proposed maturity model, a framework for policymakers to support the maritime sector was developed.

This study directly contributes to the literature on sustainability matters in the maritime sector and maritime policy-making. First, the study contributes to the literature by proposing a maturity model for sustainable development in the maritime sector. The model can be used to calculate the maturity levels of the maritime sector in different countries, or as a basis for further research on maritime sustainability maturity models. Secondly, the study contributes to the literature on policy-making by proposing a framework on how to support the maritime sector in sustainable development. This framework can be used as a guide for policy-making in the maritime sector and for further research on the role of policy-making in achieving international and national sustainability goals.

5. Results

5.1. Current Status of Sustainability Reporting in the Estonian Maritime Sector

The overall score of sustainability reporting in the Estonian maritime sector based on the analysis was 12.37. With this score, the maritime sector qualifies for the first level of the proposed sustainability model. This was an expected result as the companies with under 500 employees and no public interest are not obligated to report ESG-related indicators or information in Estonia. For each of the main categories of the ESRS (general ESRS, environmental ESRS E, social ESRS S, governance ESRS G), the Estonian maritime sector had a score of 52.40 in general ESRS and the rest of the scores were below 25.00 (Figure 2). The score of 52.40 places the Estonian maritime sector at level 3 with a general overview of maritime companies' activities. This is due to the obligation from the Estonian jurisdiction according to which, in the annual management report, all companies must disclose their main areas of activity, most significant investments, significant projects and events, etc. [35].



Figure 2. The sustainability maturity levels of the entire Estonian maritime sector and sub-sectors of shipping and ports in the distribution of the draft ESRS categories.

Among the maritime sub-sectors, only shipping had a score above the first level—32.05. The scores of the other sub-sectors (ports, marine industry, maritime business service, and fishing) corresponded to the first level. Both the shipping and ports sub-sectors have one company with public interest, which means they have the obligation to report significantly more information on ESG-related matters.

5.2. Maritime Sustainability Maturity Model

Based on the results shown in the previous section (Section 5.1) and the literature review, a sustainability maturity model for the maritime sector was developed (Figure 3). The model has five levels: (0) Undefined; (1) beginner; (2) developing; (3) progressive; and (4) matured. It also has three dimensions: (1) Environmental; (2) social; and (3) governance. In the following, each maturity level of the maritime sector is described, and guidelines for how to increase the maturity score and maturity level are provided.

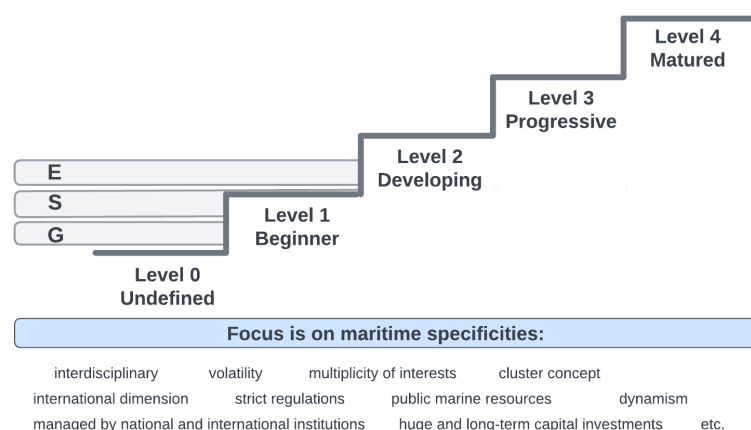


Figure 3. The proposed sustainability maturity model for the maritime sector.

The sustainability maturity model is part of the policy-making framework for the maritime sector (Section 5.3). The main steps in increasing the maturity score include (1) explaining the gaps in current policies and action plans; (2) defining the sustainability goals of the maritime sector; (3) designing new or enhancing existing policies; (4) creating commitment by all stakeholders; and (5) reporting and analyzing the progress. As the maritime sector differs from other economic sectors [9], it is important to take into account the specificities of the sector when choosing the steps to increase the maturity level.

In the 'Undefined' level, the maritime sector has not defined sustainability-related goals and measurable targets or there is a missing reporting system. The sector consists mainly of companies that have not set development plans for sustainable development nor contribute to local and international goals. The reporting results show no progress in the development. In order to increase the maturity score and start contributing to sustainable development, there is a need to identify all international and regional regulations that guide sustainability activities in the maritime sector. As the sector is strictly regulated, both nationally and internationally, and operates in the global market, the rules and standards strongly impact the possible development directions. It is important to use a cluster approach when analyzing the effects of the sector's development as this enables the identification of all possible impacts on the related economic sectors and the surrounding area. Involving all major stakeholders to create a mutual understanding of the actions, needs of the parties, and goals of the sector and the maritime country is the most time- and resource-consuming aspect. The stakeholders should increase the funding of scientific research on sustainability matters in the maritime sector as this creates a basis for development plans and strategic decisions. The next step is designing new and enhancing existing policies with maritime sustainability goals and actions and enacting a reporting system that would help to understand the progress. The final step at this level should be

implementing renewed policies and related legal regulations, which change the sectors' obligations related to sustainable development and reporting requirements.

At the 'Beginner' level, the maritime sector has started to take steps toward contributing to sustainable development, and the reporting results show minimum actions. At this level, public institutions have the possibility to support maritime companies by offering training programs in order to raise the awareness of companies' teams and other major stakeholders of sustainability procedures, management's options, impacts, strategic planning, reporting advantages, etc. The public sector should make an effort to involve the highest management teams of the companies in training programs as well as in all main discussions and actions related to sustainable development. As the maritime sector is interdisciplinary, covering a wide range of sectors [9], the companies should be fully aware of the possible interactions and effects of development decisions. When setting strategic plans (e.g., the use of new solutions or technology), the companies as well as supporting public institutions should take into consideration the international dimensions of the maritime sector that sometimes conflict with national interests [9]. It is important that the government funds the construction of sustainable infrastructure as this supports companies to implement the development plans. Therefore, it is possible to direct the companies through changes in the tax structure; however, this requires further research.

In the 'Developing' level, the maritime sector has integrated the sustainability concept into activities and is developing toward sustainable goals with great balance. This means that the majority of companies have set strategic plans and are taking actions to contribute to achieving sustainability goals. The reporting results show constant progress. To increase the sector's maturity score, the public sector should introduce self-assessment tools to the companies. The aim of this step is to encourage the sector to evaluate the results and thereby make necessary changes according to the evaluation. The self-assessment tools should also be able to evaluate the companies' development effects on other economic sectors and surrounding areas. This is especially important for seaport companies located in a geographically concentrated area. The self-assessment tools should support the sustainability reporting systems, as companies can use the results to their advantage as learning tools.

In the 'Progressive' and 'Matured' levels, the sector has gained remarkable awareness of its actions and achieved strong results in sustainable development. The reporting results show progressive findings. The companies' sustainability management programs are functioning, and the planned actions are fulfilling their aims. To support the sector's development, public institutions should keep evaluating the reporting results in different categories to be aware of the possible shifts and ensure consistent overviews. In order to help the sector, institutions should have development programs for companies whose reporting results show gaps in progress. These development programs should include specific guidelines for designing management processes, strategic planning, operating performance, etc., for the maritime sector. As the sector includes not only industry, services, and goods but also cultural heritage, historical traditions, and coastal life [9], the programs should interact with all these aspects. Public institutions should organize sustainability-related events to keep the awareness level at the maximum and promote the interests of major stakeholders. Although the fourth level is the highest possible level, as the sustainability dimensions change constantly, the sector should be flexible to new development directions.

5.3. Framework for Maritime Policy-Making

This study proposes a new way to achieve sustainable development in a maritime country by incorporating maritime policy into all levels of policy-making (Figure 4). Maritime-related interactions should be included in long-term national strategies, local regional policies, and sectoral policies, and policy implementation should be supported by the multi-level structure of local maritime governance. In a maritime country, the development of the maritime sector has a significant effect on the entire country's economic and social performance, as the dimensions of maritime activities reach beyond the economic sector.

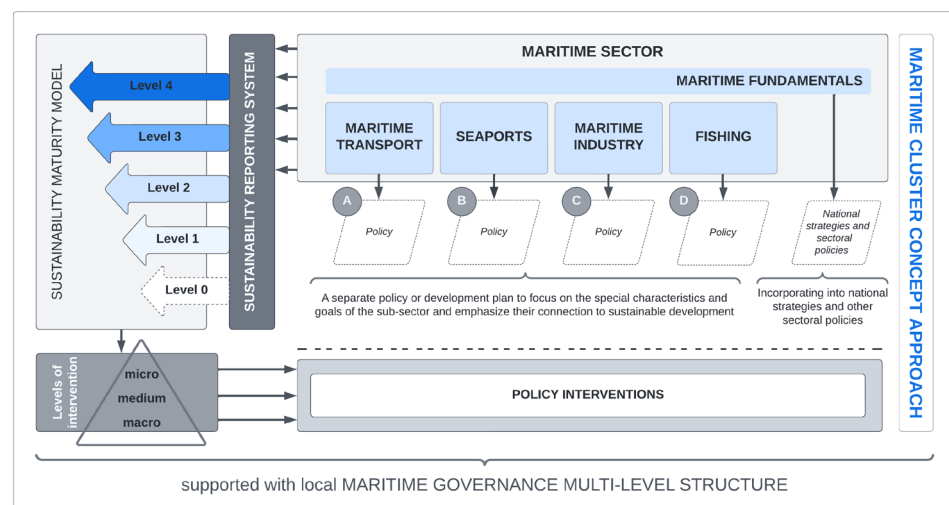


Figure 4. The proposed framework for maritime policy.

In the proposed framework, the maritime sector is divided into five components:

1. Maritime transport—sea and coastal freight and passenger water transport.
2. Seaports—ports and waterways operation services and cargo handling.
3. Maritime industry—shipbuilding and repair, offshore industry, including marine renewable energy and marine support activities for oil and gas, engineering, and mining.
4. Fishing—marine fishing and aquaculture.
5. Maritime fundamentals—historical traditions, cultural heritage, coastal life, marine environment protection, etc.

The division is based on previous maritime cluster research in the Baltic Sea region [36] and the economic data of the Estonian maritime sector [33]. The maritime fundamentals are a horizontal dimension of the entire maritime sector that includes the basics of the maritime sector. The division of the maritime sector into four main economic sectors and one horizontal dimension enables one to design a separate policy or development plan for each sector that focuses on their specificities. The maritime fundamentals should be incorporated into national strategies and local and sectoral policies (e.g., education, science, food, agriculture, energy, security, etc., policies).

The framework proposes supporting the implementation of the policy through the multi-level structure of the local maritime governance, the management of which is coordinated by one responsible institution, but tasks and responsibilities are divided among structures at different levels (ministries, local governments, sub-institutions, etc.). This structure is based on a business management style, and the main benefit is to be able to adapt to changes on an ongoing basis. As government institutions have multiple roles in facilitating SDGs (create expectations and visions; build networks and manage resources; gather knowledge and support learning; support the implementation of activities and policy renewal) [18], the systematic division of tasks and responsibilities between different stakeholders enables one to focus narrowly on achieving the goals. The horizontal and vertical multi-level interdependence created by this approach is an important feature in ensuring the overall sustainable development of a maritime country. In addition, the implementation of this approach benefits from the involvement of a wide range of stakeholders, not only in the policy-making process but throughout the entire implementation, and the dynamism that arises when applying the business management style in the implementation of the policy that is able to adapt to changes on an ongoing basis [37].

To support the maritime sector in sustainable development and to achieve sustainability goals, the public sector has the opportunity to engage on multiple levels (Figure 5). Depending on the level, they can choose from different appropriate approaches and tools. In the proposed framework, the first level is the micro level where support can be offered

directly to a sub-sector or a group of companies. In this case, intervention measures can be, e.g., helping to collect information (economic, financial, or strategic assessment, impact assessment and evaluation, modelling, etc.), strategic planning with visioning future scenarios, conflict management, etc. The aim of the support on the micro level is to help companies and groups to understand the impacts and consequences of sustainability-related actions and plans. The second level is the medium level, which includes actions taken by national institutions to support the entire maritime sector and related sectors through local policy planning and mechanisms. The appropriate approaches and tools include policy analysis, engagement of citizen actions, legal tools, etc. The aim of the second level is to establish a political system supporting the improvement of sustainability, which includes specific tools and action proposals. The third and final level to support maritime companies is the macro level. On this level, the policy-makers are able to support local companies through cooperation with international organizations, EU-level actions, and the promotion of foreign cooperation. The appropriate approaches and tools include active support activities in international working groups and projects, preliminary work in the EU decision processes, and other activities beyond local actions.

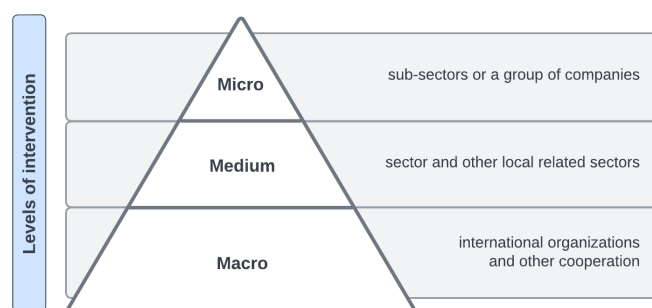


Figure 5. Levels of intervention for policy-makers to choose appropriate approaches and tools.

In the proposed framework, first, the maritime sector is incorporated into all levels of policy-making by finding out and understanding the local and international sustainability-related development possibilities and plans, including integrating the SDGs at the national level, existing and possible new regulations, new technology development directions, science and innovation achievements, etc. As the maritime sector is widely regulated at an international level, integrating international sustainability goals into local actions can be a challenge. This means not only incorporating the goals into policy papers and plans but also listing the related activities in year-based action plans and finding ways to support the implementation. This requires reviewing the existing policies and strategic plans to identify the possible gaps and areas that need to be changed or promoted toward sustainability actions. The revision of policies can be performed using the ESG indicators proposed by Nömmela and Kõrbe Kaare [9] for the assessment of the contribution of maritime policy priorities to the ESG criteria. These indicators measure how the chosen policy priorities and actions contribute to the achievement of ESG criteria related to the SDGs.

To incorporate the maritime sector into all levels of policy-making, setting specific appropriate national and local sustainability goals for each level is required. These goals should be inclusive of the SDGs. This means that maritime-related aspects should be included in all levels of sustainable plans, as the dimensions affect the development anyway. Setting specific and achievable but ambitious targets is an important step, as the final aim should be fully understandable and acceptable by all parties. This step is the most time- and resource-intensive step as it requires a number of strategic analyses and impact assessments and the engagement of all parties, including citizen actions. Setting targets that all parties agree to and understand is one of the cornerstones in the successful achievement of the expected results.

Depending on the sustainable goals, there might be a need to design new policies or change the existing ones corresponding to the agreed sustainability actions. For the four main maritime economic sectors (transport, ports, industry, and fisheries), in the proposed

framework, a specific policy or development plan is designed. The maritime fundamentals should be incorporated into existing national, local, and sectoral policies with a focus on sustainable development. As the maritime sector has a number of specificities that affect the policy design process, it is recommended to use the policy design framework that takes this uniqueness into account. Nõmmela and Kõrbe Kaare proposed a specific framework for designing maritime policy with the ESG approach [9]. The assessment part of this framework should be amended using the draft ESRS indicators in order to achieve common and interconnected measurement results. This reduces the possibility of multiple reports by the companies. With the incorporated policies, legal tools and guidelines should be developed in order to direct the sector in the agreed sustainable direction.

The sustainability maturity model developed previously in this research helps to analyze and guide the sector depending on the maturity score and level. After the new or changed policies have been adopted and legal instruments established, the companies have the possibility to amend their corporate strategies and reporting systems according to the plans. If companies have trouble implementing the new recommendations, the public sector has the possibility of supporting their actions according to the maturity level. It is important to motivate companies to make a joint effort. Otherwise, if the companies only report indicators to fill the obligation from the legal action, the actual contribution will remain minimal, and the overall level of sustainability will not change.

One of the important parts of the proposed framework is the cluster approach. By dividing the maritime sector into four main economic sectors and one horizontal dimension, it supports the implementation of the cluster approach in maritime policy-making. When the maritime sector is divided into components that are directly connected but have different specificities and must incorporate them into related national and sectoral policies, the sectors are united and the interactions between otherwise separate sub-clusters are identified. Although the cluster concept can have different meanings and interpretations, there is a need for a common framework with the cluster approach in the maritime sector that takes into account the similarities in international cluster concepts [36]. In addition, added-value in supporting the maritime sector's development exists by creating a maritime cluster as a legal body based on the cluster concept, which would consist of the largest possible share of maritime sector companies, including core companies, maritime research and educational institutions, creators of innovation, state institutions, etc. The creation of a legal-based maritime cluster can significantly increase the entire sector's potential through cooperation and common knowledge and understanding of sustainable development.

The proposed framework recommends moving policy-making beyond sectoral policies, which could be a reason to separate the maritime sector from other national interests. The novelty is that the maritime sector should be seen as not only one separate economic sector that has a significant effect on a country's economic performance, but also a well-connected component of every maritime country's functioning and achievements. The framework supports the improvement of a maritime country's sustainable development performance since the division of the maritime sector into components in policy-making makes it possible to focus on the specificities of these sub-sectors in relation to sustainable development when setting goals and implementing policy, and the integration of maritime fundamentals into national strategies and other policies maintains maritime as one of the core values of a maritime country at the center of planning all strategic development directions.

6. Discussion and Conclusions

In a maritime country, the effects of the maritime sector's development are beyond one economic sector's boundaries, and the role of the sea and related activities are much more profound. Taking into account the specificities and special priorities of the sector, sustainable development requires stable and focused policy interventions that combine bottom-up (from sector to policymakers) and top-down (from transnational organizations to local stakeholders) approaches. The variety of sustainability-related regulations, standards,

and guides have made strategic planning and sustainable development management in the maritime sector a great challenge. Currently, sectoral policy-making has been widespread in the maritime sector, but in order to achieve sustainability goals, the adoption of an advanced approach is required. Our proposal is a policy-making framework that would support sustainable development in the maritime sector of a maritime country.

The principal aspects of the proposed framework are the maritime sector's division, applying the cluster approach, and supporting implementation with the multi-level structure of the local maritime governance. Firstly, the study proposes dividing the maritime sector into four main economic divisions (maritime transport, seaports, maritime industry, and fisheries) and one horizontal dimension (maritime fundamentals). This enables one to focus on the main sub-sectors that have the largest effect on sustainability issues and design appropriate policies and assess the implementation results. In practice, the main sub-sectors should be covered with necessary information (e.g., sectoral priorities and goals, economic data, non-financial statements, thematic discussions, etc.) using the cluster approach. The recommendation is to design separate policies or development plans for each main sub-sector to highlight the special needs of the sector in different aspects in order to achieve sustainable development. The horizontal dimension of the maritime sector (cultural heritage, historical traditions, coastal life, marine environmental protection, etc.) should be integrated into national strategies and other sectoral policies by analyzing their mutual effects and connections, thus keeping them in focus as core values in the country's development. In practice, maritime fundamentals may not be fully covered by quantitative information to carry out an assessment of sustainable development progress with the maturity model, but their integration into general strategic plans and priorities of other sectors will also be reflected in the development results of these plans and sectors. The latter also highlights the cluster concept in policy-making.

The multi-level structure of the local maritime governance proposed in this study to support the policy-making process aims to divide the activities and responsibilities related to maritime development such that a broad national commitment to the performance of maritime affairs is ensured while keeping the focus on the set goals and those responsible for their implementation. The strategic development of the maritime sector should be coordinated by one responsible government institution, and tasks and responsibilities should be divided among structures at different levels (ministries, local governments, sub-institutions, etc.). It is important to emphasize that, in practice, the division of activities can lead to responsible fragmentation, but to avoid this, special positions should be created at all levels of the governance structure, all of which would be coordinated by one main institution. This structure is also supported by the integration of maritime fundamentals into national strategies and sectoral policies as it increases the importance and awareness of maritime matters in the country as a whole.

The sustainability maturity model developed in this study is a way to evaluate the results of the maritime sector's sustainable development. The model is designed using the top-down approach from different international sustainability-related guides and agreements, including the UN's SDGs. The draft ESRS is incorporated into the model through an indicator system, which makes the model practical when reporting the results both at international and national levels. When the ESRS is fully completed and adopted, the indicator system can be further modified. The model is practically usable as the maturity scores can be calculated in different categories depending on the needs of the policy-makers. Different maturity levels describe the current situation in the category and the aim is to reach the final level and stay there. The study provides suggestions on how to support the maritime sector at each maturity level. The list of suggestions can be further amended by further studies of maritime sustainability.

The study also provides a three-level policy intervention model on how policy-makers can intervene in the development of the maritime sector and support its activities. The model includes micro, medium, and macro levels. Each of the levels has different intervention recommendations, but the list could be amended by further studies. The aim of the

proposed model is to separate the policy interventions as the different levels have dissimilar appropriate approaches and tools. Differentiating the levels provides policy-makers with multiple options to find supporting methods depending on the needs.

Although the results of this study can be incorporated into policy-making practices immediately, the study has limitations that should be taken into account. As the concept of sustainability is wide, the maturity model proposed in this study covers only the most important issues based on international agreements, the draft ESRS, and the UN's SDGs. The sample of the maritime companies included only a limited number of firms because not all companies in Estonia are yet obliged to submit sustainability-related indicators. If the obligation arises, it is possible to increase the number of participants and thereby obtain more information to test the model. The proposed framework has not been tested in real policy-making processes; however, this could be performed in further research.

This study proposes novel practical approaches to supporting the maritime sector in sustainable development to contribute to international sustainability goals. For further research, the proposed framework should be implemented in a maritime country and amended based on the results. Much practice time is required, but it is a valuable next step in maritime sustainability-related research. It is also possible to carry out research in different parts of the proposed framework in separate studies.

Author Contributions: Conceptualization, K.N. and K.K.K.; methodology, K.N.; formal analysis, K.N.; investigation, K.N.; writing—original draft preparation, K.N. and K.K.K.; writing—review and editing, K.N. and K.K.K.; visualization, K.N.; supervision, K.K.K.; funding acquisition, K.K.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Tallinn University of Technology.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Lütkemeyer, F.; Mário, G.; Vaccaro, G.L.R.; Modolo, R.C.E.; Moraes, C.A.M. A maturity model for sustainability in product development. *Int. J. Dev. Res.* **2020**, *10*, 37537–37548.
2. Lister, J. Green Shipping: Governing Sustainable Maritime Transport. *Glob. Policy* **2014**, *6*, 118–129. [CrossRef]
3. Fratila, A.; Gavril, I.A.; Nita, S.C.; Hrebenciuc, A. The Importance of Maritime Transport for Economic Growth in the European Union: A Panel Data Analysis. *Sustainability* **2021**, *13*, 7961. [CrossRef]
4. Stanković, J.J.; Marjanović, I.; Papathanasiou, J.; Drezgić, S. Social, Economic and Environmental Sustainability of Port Regions: MCDM Approach in Composite Index Creation. *J. Mar. Sci. Eng.* **2021**, *9*, 74. [CrossRef]
5. Karagiannis, I.; Vouros, P.; Sioutas, N.; Evangelinos, K. Mapping the maritime CSR agenda: A cross-sectoral materiality analysis of sustainability reporting. *J. Clean. Prod.* **2022**, *338*, 130139. [CrossRef]
6. Bergek, A.; Bjørgum, Ø.; Hansen, T.; Hanson, J.; Steen, M. Sustainability transitions in coastal shipping: The role of regime segmentation. *Transp. Res. Interdiscip. Perspect.* **2021**, *12*, 100497. [CrossRef]
7. Fasoulis, I.; Rafet, E.K. Embracing Sustainability in Shipping: Assessing Industry's Adaptations Incited by the Newly Introduced 'triple bottom line' Approach to Sustainable Maritime Development. *Soc. Sci.* **2019**, *8*, 208. [CrossRef]
8. Ballhorn, R. The Role of Government and Policy in Sustainable Development. *McGill Int. J. Sustain. Dev. Law Policy/Rev. Int. De Droit Et Polit. Du Développement Durable De McGill* **2005**, *1*, 19–27. Available online: <https://www.jstor.org/stable/24352488> (accessed on 15 September 2022).
9. Nömmela, K.; Körbe Kaare, K. Maritime Policy Design Framework with ESG Performance Approach: Case of Estonia. *Economies* **2022**, *10*, 88. [CrossRef]
10. Pantouvakis, A.; Vlachos, I. Talent and leadership effects on sustainable performance in the maritime industry. *Transp. Res. Part D* **2020**, *86*, 102440. [CrossRef]
11. Zaucha, J.; Matczak, M. Role of maritime ports and shipping in the creation of the economic value of the sea areas. *SHS Web Conf.* **2018**, *58*, 01033. [CrossRef]
12. Mudronja, G.; Jugović, A.; Škalamera-Alilović, D. Seaports and Economic Growth: Panel Data Analysis of EU Port Regions. *J. Mar. Sci. Eng.* **2020**, *8*, 1017. [CrossRef]

13. European Commission. *The EU Blue Economy Report 2022*; Publications Office of the European Union: Luxembourg, 2022. Available online: <https://op.europa.eu/en/publication-detail/-/publication/156eecd-d7eb-11ec-a95f-01aa75ed71a1/language-en> (accessed on 15 September 2022).
14. Marine Management Organisation. *Social Impacts and Interactions Between Marine Sectors*; A Report Produced for the Marine Management Organisation, MMO Project No: 1060; Marine Management Organisation: Newcastle, UK, 2014; p. 273, ISBN 978-1-909452-30-5.
15. OECD. *Better Policies for Sustainable Development 2016: A New Framework for Policy Coherence*; OECD Publishing: Paris, France, 2016. [CrossRef]
16. Kronfeld-Goharani, U. Maritime economy: Insights on corporate visions and strategies towards sustainability. *Ocean Coast. Manag.* **2018**, *165*, 126–140. [CrossRef]
17. Masuda, H.; Kawakubo, S.; Okitasari, M.; Morita, K. Exploring the role of local governments as intermediaries to facilitate partnerships for the Sustainable Development Goals. *Sustain. Cities Soc.* **2022**, *82*, 103883. [CrossRef]
18. United Nations. *Transforming Our World: The 2030 Agenda for Sustainable Development*; Resolution Adopted by the General Assembly on 25 September 2015, A/RES/70/1; United Nations: New York, NY, USA, 2015.
19. Wang, X.; Yuen, K.F.; Wong, Y.D.; Li, K.X. How can the maritime industry meet Sustainable Development Goals? An analysis of sustainability reports from the social entrepreneurship perspective. *Transp. Res. Part D* **2020**, *78*, 102173. [CrossRef]
20. European Financial Reporting Advisory Group. Current Non-Financial Reporting Formats and Practices, Appendix 4.6: Stream A6 Assessment Report. February 2021. Available online: https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2FEFRAG%2520PTF-NFRS_A6_FINAL.pdf (accessed on 29 September 2022).
21. Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 Amending Directive 2013/34/EU as Regards Disclosure of Non-Financial and Diversity Information by Certain Large Undertakings and Groups. *Off. J. Eur. Union* **2014**, L330, 1–15. Available online: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0095&from=EN> (accessed on 15 September 2022).
22. Proposal for a Directive of the European Parliament and of the Council amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as Regards Corporate Sustainability Reporting. Brussels, 21 April 2021, COM(2021) 189 Final, 2021/0104 (COD). Available online: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0189&from=EN> (accessed on 12 September 2022).
23. European Financial Reporting Advisory Group. Draft European Sustainability Reporting Standards, a Cover Note for Public Consultations. April 2022. Available online: https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2FESRS_CN.pdf (accessed on 15 July 2022).
24. OECD. Policies to Enhance Sustainable Development. 2001. Available online: <https://www.oecd.org/greengrowth/1869800.pdf> (accessed on 12 September 2022).
25. Bititci, U.S.; Garengo, P.; Ates, A.; Nudurupati, S.S. Value of maturity models in performance measurement. *Int. J. Prod. Res.* **2015**, *53*, 3062–3085. [CrossRef]
26. Pigosso, D.C.A.; Rozenfeld, H.; McAloone, T.C. Ecodesign maturity model: A management framework to support ecodesign implementation into manufacturing companies. *J. Clean. Prod.* **2013**, *59*, 160–173. [CrossRef]
27. Housni, F.; Boumane, A.; Rasmussen, B.D.; Britel, M.R.; Barnes, P.; Abdelfettah, S.; Lakhmas, K.; Maurady, A. Environmental sustainability maturity system: An integrated system scale to assist maritime port managers in addressing environmental sustainability goals. *Environ. Chall.* **2022**, *7*, 100481. [CrossRef]
28. Boullauzan, Y.; Sys, C.; Vanelander, T. Developing and demonstrating a maturity model for smart ports. *Marit. Policy Manag.* **2022**. [CrossRef]
29. De Almeida Santos, D.; Luiz Gonçalves Quelhas, O.; Francisco Simões Gomes, C.; Perez Zotes, L.; Luiz Braga França, S.; Vinagre Pinto de Souza, G.; Amarante de Araújo, R.; da Silva Carvalho Santos, S. Proposal for a Maturity Model in Sustainability in the Supply Chain. *Sustainability* **2020**, *12*, 9655. [CrossRef]
30. Vasquez, J.; Aguirre, S.; Puertas, E.; Bruno, G.; Priarone, P.C.; Settineri, L. A sustainability maturity model for micro, small and medium-sized enterprises (MSMEs) based on a data analytics evaluation approach. *J. Clean. Prod.* **2021**, *311*, 127692. [CrossRef]
31. Nömmela, K.; Körbe Kaare, K. Evaluating Maritime Cluster Economic Impact: The Maritime Cluster Impact Index. In *Reliability and Statistics in Transportation and Communication*; Springer: Berlin/Heidelberg, Germany, 2022. [CrossRef]
32. Neumann, B.; Ott, K.; Kenchington, R. Strong sustainability in coastal areas: A conceptual interpretation of SDG 14. *Sustain. Sci.* **2017**, *12*, 1019–1035. [CrossRef]
33. Estonian e-Business Register. Data on Companies' Annual Reports 2020 and 2021, Centre of Registers and Information. Available online: <https://ariregister.rik.ee/eng> (accessed on 2 October 2022).
34. European Commission. Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises. *Off. J. Eur. Union* **2003**, L124, 36–41.
35. *Accounting Act. Passed 20.11.2002, RT I 2002, 102, 600*; Parliament of Estonia Riigikogu: Tallinn, Estonia, 2002.
36. Nömmela, K.; Körbe Kaare, K. Strategic Development of Maritime Related Industries: The Role of Maritime Cluster Researches. *Ann. DAAAM Proc.* **2021**, *10*, 500–507. [CrossRef]
37. Łukaszuk, T. The Concept of Maritime Governance in International Relations. *Stos. Międzynarodow—Int. Relat.* **2018**, *4*, 54. [CrossRef]