sustainability

MDPI

Article

Strategic Management Control Tools for the Sustainability of Seaports: A Scoping Review

Jorge Martins *, Ana Costa, Carla Campos, Ana Sousa and Inês Faria

Higher Institute of Accounting and Administration, University of Aveiro, 3810-193 Aveiro, Portugal; accosta@ua.pt (A.C.); carla.campos@ua.pt (C.C.); alsousa@ua.pt (A.S.); inesvieirafaria@ua.pt (I.F.)
* Correspondence: jorgepmartins@ua.pt

Abstract: This study offers an analysis of existing research on sustainability and its link to accounting and management control in the port sector. Existing studies do not provide a comprehensive discussion of management accounting and control tools in this context, despite recognizing the relevance of the topic. A scoping review was used as a methodological basis, with the aim of mapping the literature on the role of accounting and management control, as well as their relationship with the triple bottom line associated with the various levels of sustainability in this sector. The results point to a diversity of tools used in developed countries, where interest in efficiency, sustainability, and strategic alignment stands out.

Keywords: management control; seaports; sustainability; triple bottom line; scoping review

Citation: Martins, J.; Costa, A.; Campos, C.; Sousa, A.; Faria, I. Strategic Management Control Tools for the Sustainability of Seaports: A Scoping Review. *Sustainability* **2024**, *16*, 9247. https://doi.org/10.3390/su16219247

Academic Editors: Helena Costa Oliveira, Gualter Couto and Tim Gray

Received: 31 July 2024
Revised: 8 October 2024
Accepted: 23 October 2024
Published: 24 October 2024

1. Introduction

In recent years, integrating sustainability into accounting and management control systems (MCSs) has become a topic of growing importance, particularly in the dynamic port sector. This article proposes a comprehensive review of studies exploring the intersections among sustainability, accounting, and management control in the port context. Although the literature on these topics is vast, a synchronic approach used to examine the interactions among these three elements has been relatively underdeveloped in the academic sphere. This constitutes an original challenge for this study, which aims to fill this gap.

The port sector is at an inflection point, driven by rapid growth and increasing pressure to meet stringent sustainability requirements [1,2]. In this context, the motivation for this study arises from an urgent need to investigate how management accounting and control tools can be applied to reconcile economic growth with sustainable practices, responding strategically to current needs.

However, there is a significant gap in the literature on the specific application of MCSs to promote sustainable practices in the port context. This study aims to specifically fill that gap by offering an analysis of tools that can support port managers in facing current challenges in their organizations.

The originality of this research lies in its ability to map and analyze the management control tools applicable to sustainability in ports. By exploring this under-researched field, the study aims not only to document the relevance of the topic but also to guide the adoption of innovative and sustainable practices in port management. Thus, the central motivation is to respond to the urgency of adapting the port sector to a new reality of sustainable development, offering solutions to the challenges that this adaptation entails through management accounting and control tools.

This study is structured into five sections. The first section deals with the preliminary aspects of the scientific approach adopted; the second focuses on a review of the relevant literature; the subsequent sections present, sequentially, the research methodology, the results, and a discussion of the results; and finally, the fifth section sets out the conclusions of this research.

2. Literature Review

2.1. The Strategic Role of Ports and the Challenges of Sustainability

The active role of the port sector in the economic development of countries is widely recognized [3]. Traditionally seen as central infrastructures, ports are key to integrating global and local markets, driving the process of globalization based on efficiency [4–6].

In addition to their economic function, seaports play a crucial role in promoting territorial cohesion and regional development, mitigating economic disparities. However, there is a lack of studies looking at the economic impact of ports from a spatial econometric perspective [4].

In the global trade context, maritime transport is essential for the flow of raw materials, products, and consumer goods worldwide. To remain competitive, this sector has sought to increase its efficiency by reducing unit costs per item transported and modernizing processes at port terminals [7].

Faced with emerging challenges, such as the growth of port activity, it has become a priority to introduce new concepts and principles of sustainability [1,2], especially when combined with expanding port activity [2,8].

Today, this transportation route is considered an efficient and economically viable option for large-scale transportation [6], recognized for its ability to transport large volumes of cargo with low fuel consumption compared with other means of transport; however, its impacts on sustainability in general and the environment in particular cannot be overlooked [8–10].

It is estimated that more than 80% of global trade, by volume, is transported by sea, and that this percentage is even higher for most developing countries [11]. As a result, it is legitimate to question the significance of relevant economic growth and its impact on sustainability at all levels.

Despite growing recognition of the importance of sustainability issues in achieving organizational success, research into management control and its relationship with sustainability is still an under-explored area in the academic context [12,13].

2.2. The Central Role of Accounting and Management Control

Today, factors such as efficiency, transparency, and informed decision-making play a number of strategic roles. Alongside financial accounting, but collaboratively, control and management accounting focus on providing analysis and interpreting accounting data using tools that enable managers to make strategic decisions for sustainability and long-term success [14,15].

In the face of increasing environmental and social pressures, sustainability has become a strategic priority for companies. In this context, MCSs play a crucial role in integrating sustainability principles and practices into organizations [16]. MCSs align organizational and behavioral structures with companies' economic objectives, monitoring, evaluating, and boosting their performance. They are also essential in integrating sustainable development, facilitating the dissemination of practices aligned with social, environmental, and economic goals [17].

By incorporating sustainability into management processes, MCSs enable more effective risk management, the seizing of opportunities, and the creation of long-term value for all stakeholders [16].

Therefore, companies need appropriate management tools to incorporate sustainability issues into decision-making processes, becoming more proactive and transparent in managing their sustainable activities. This integration should consider two corporate perspectives on sustainability: the traditional external perspective, focused on disclosing sustainability information, and the internal perspective, aimed at continuously improving sustainability performance [18,19].

For these reasons, companies have been adopting sustainability management control tools. On the one hand, these tools measure and communicate the social, environmental, and financial performance needed to optimize management, align employee behavior, and

support decision-making processes. On the other hand, these tools increase the reliability of sustainability disclosures, promoting more fluid and effective communication between the company and the external environment, facilitating stakeholder involvement [20].

In the port context, MCSs support, improve, and guide the strategic decision-making process [14,15,21], and their integration allows us to go beyond mere accounting, underpinning the strategic definition of port tariffs [22–24].

Accounting and management control, integrated into an efficient port system, play an essential role [14] in the operational and financial success of these vital infrastructures for socioeconomic development. These areas are fundamental in assessing the performance of resources and supporting, thus improving and guiding the strategic decision-making process in the port context [14,15,21].

MCSs support and optimize the decision-making process, especially when strategic decisions affect other entities, with a view to mutual competitive advantages [15]. Therefore, cost management and control are essential for port system efficiency, along with regulation and price reductions [24].

Performance is intrinsically related to the choice of control systems aligned with a port's strategy, and there is no single universally successful control system [25]. From this perspective, there is an urgent need for a balance among control, strategy, and organizational culture.

Taking the case of the port sector in Greece, studied by Triantafylli et al. [25], three types of MCSs stand out:

1. Basic MCSs are used to collect essential information for planning and establishing daily operations.
2. Cost MCSs are implemented with a focus on minimizing costs. In the Greek example, defining a low-cost strategy tends to favor this type.
3. MCSs of external information are used to gather information related to compliance with the requirements of the goods owners. Companies seeking differentiation prefer control systems with an external focus.

An MCS can be a valuable tool for improving management and coordination, favoring effectiveness and efficiency regardless of the organizational model adopted by the seaport [26]. The scarcity of MCSs related to environmental issues and the consequent activities in ports stands out, highlighting that the quality and quantity of information on environmental activities is insufficient.

2.3. Triple Bottom Line (TBL): The Dimensions of Sustainability

Sustainability is determined by various aspects. Thus, there is no single agreed definition [20,27,28], insofar as its development process is intrinsic to underlying changes in organizational culture.

Today, organizations are facing growing internal and external pressures that encourage them to adopt sustainability practices, a behavior that is consistent with mimetic isomorphism [20]. Consequently, in the last decade, the measurement of organizational success—once based solely on profit—has led to a new framework based on sustainable development [29], grounded in three interconnected and overlapping pillars: the TBL [29,30].

First proposed in 1994 and then in 1997 in the book Cannibals with Forks: The Triple Bottom Line of 21st Century Business [30], the TBL approach to evaluating business performance encompasses and promotes socially responsible and environmentally sustainable business practices by balancing the social (people), environmental (planet), and economic (profit) dimensions [8,29–32].

In the context of the global energy crisis and environmental degradation, sustainable development has emerged as the main strategic direction for the port sector [33]. This approach involves maintaining profitability while promoting sustainability through social responsibility and environment-related activities [8,34]. This focus has the potential to transform seaports into a profitable and environmentally responsible industry in the coming decades, cultivating a commitment to environmental responsibility [35]. When seaports

operate with high sustainability standards, they are generally more likely to attract support from governments, local communities, and potential investors [8].

Figure 1 shows a Venn diagram of three overlapping circles, each representing a different pillar of sustainability in the port efficiency context.

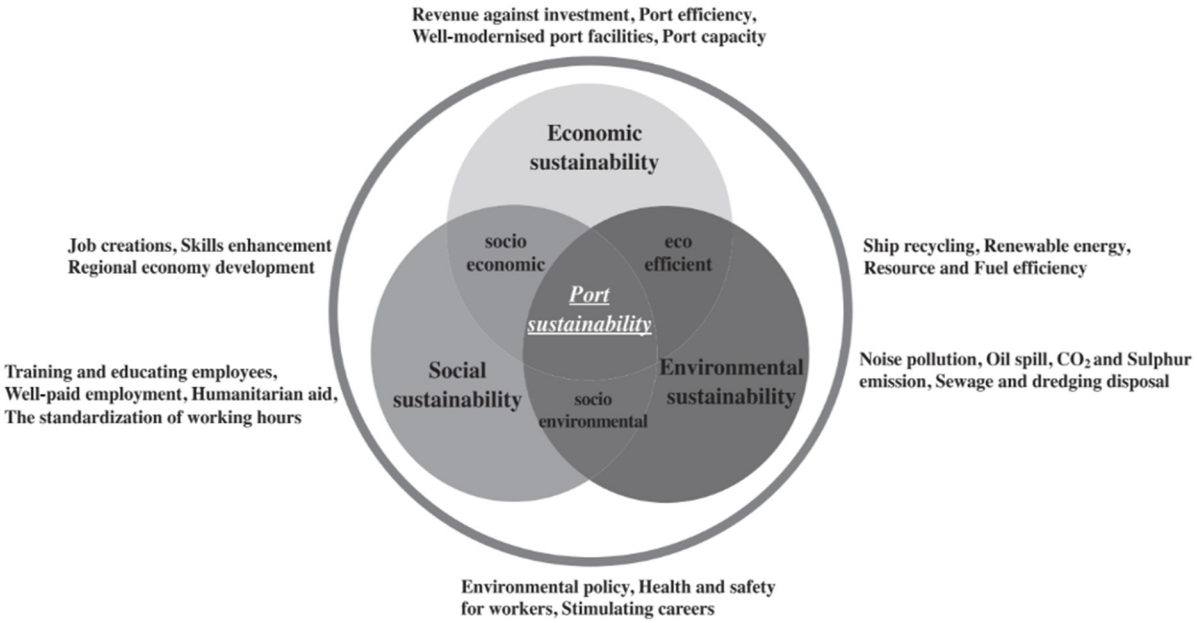

Figure 1. Triple bottom line integrated into the port context. Reproduced from ([8], p. 50). © 2024 Elsevier Ltd.

The top circle illustrates economic sustainability. This pillar is characterized by the following objectives: maximizing revenue in relation to the investment made, modernizing port infrastructure, and increasing the operational capacity of ports. The left circle deals with social sustainability, highlighting the training and education of workers, the provision of well-paid jobs, humanitarian support, and regulation of working hours. The right circle refers to environmental sustainability: reducing noise pollution, oil spills, and CO_2 and sulfur emissions and improving sewage treatment and dredging.

The intersections among the circles reveal areas of overlap and synergy among the different pillars of sustainability. The intersection between economic and social sustainability highlights job creation and skill development, which benefit both economic growth and social well-being. The intersection between economic and environmental sustainability focuses on efficiently using resources and fuels, which can contribute to more sustainably managing financial resources. The intersection between social and environmental sustainability highlights the importance of environmental policies and worker health and safety, which are essential for a safe and sustainable working environment. Port efficiency is where all three circles overlap, representing the successful integration of the three pillars of sustainability: economic, social, and environmental. This central point indicates the holistic approach needed to achieve truly sustainable port management, where economic, social, and environmental benefits are simultaneously balanced and promoted.

2.3.1. Social Sustainability

Social sustainability positively impacts employee quality of life and involves promoting well-being for the surrounding community's benefit [10,35,36]. Factors such as ethics, working conditions, and corruption, among others, should be considered guidelines for achieving stability from a social perspective.

In the last decade, seaports have excelled in several areas, driving transformations and facing pressures both socially and environmentally. In response to these pressures, corporate social responsibility (CSR) has been gradually integrated into this sector [37,38].

The relationship between sustainable development and CSR also shows an upward trend in academic research [39].

CSR involves adopting practices related to social, environmental, and economic aspects. In turn, this is intrinsically linked to the concept of TBL, guiding organizations not to look exclusively at themselves but also to benefit society in general [27] and, in particular, mitigate the negative impacts caused by seaport activity [40]. Vanelslander [37] investigated the importance of CSR objectives in the port context. In general, the results indicated a greater focus on social concerns, highlighting a commitment to issues that directly impact the community and social relations.

2.3.2. Environmental Sustainability

Concern for the environmental dimension implies taking responsibility for its impacts and publicizing efforts to reduce the ecological footprint [10]. Environmental sustainability has emerged as a concern in various areas of society, especially those with the greatest impact on economic growth, including seaports, which play a vital role as access points to globalization [38,41].

The core of sustainability in ports is the promotion of eco-economic performance, a reduction in CO_2 emissions, the search for safer methods in the provision of logistics services, environmental preservation, and a reduction in the consumption of natural resources for the benefit of present and future generations [37,42,43].

However, this sector still operates with antiquated fleets that predominantly use fossil fuels. Thus, to tackle this problem, the UNCTD [11] advocates effective regulatory intervention with stronger investment in green technologies and fleets to achieve carbon neutrality by 2050. From the perspective of Acciaro [32], environmental responsibility in the port sector is driven by three factors:

1. The need to comply with current and future regulations;
2. The intention to identify efficiency gains by incorporating environmental aspects into a company's strategy; and
3. The establishment of an environmentally responsible image to gain a competitive advantage.

2.3.3. Economic Sustainability

Economic sustainability is related to economic performance, including profit, cost reduction, economic growth, and organizational development. It is also related to covering financial information but is not limited to this area. It includes better and more responsible business practices and job creation to achieve financial success through equitable and sustainable economic growth from social and environmental perspectives [10,36,44].

Triantafylli et al. [25] showed that efficiency in the Greek port sector, especially through low-cost strategies, is an example of how economic sustainability can be achieved in port operations and investments.

Management accounting plays a crucial role in this process, providing a detailed analysis of costs and identifying opportunities for reducing expenses and optimizing resources. This is particularly relevant when we consider the observation of Zhao et al. [33], which combines an efficient customs process with improved port logistics performance, increasing the volume of trade and, consequently, the sustainable economic development of the port.

In addition, Batalha et al. [40] highlighted the complex interrelationship between social and economic development in ports, making it difficult to separate these concepts. When assessing the impact of the socioeconomic environment of ports, it is important to account for a country's economic situation and development prospects. This is because the economic reality of seaports is intrinsically related to economic development, both nationally and internationally, since demand conditions, cyclical economic development, inflation, and unemployment are variables that affect this market segment [45].

3. Methodology

Based on the methodological structure proposed by Arksey et al. [46], this research adopts the scoping review methodology to map the literature on management control and sustainability applied to the port sector. The main objective is to identify approaches, motivations, and challenges underlying the research, establishing trends and identifying gaps in the integration of management control tools and sustainable practices.

Scoping reviews are a method of systematically unifying research and research aims to define the state of the art in a specific area [46,47]. In this methodology, data are grouped to identify key concepts, possible research gaps, and sources of evidence in the evaluation and formulation of policies, research, and practice [47]. This methodology is particularly relevant in complex and under-researched areas; it translates into an interactive process in which researchers reflect on each stage and, when necessary, repeat some of them to ensure a comprehensive approach to the literature.

Accounting for the specificities underlying the methodology, we now describe the framework stages that led to this scoping review:

Stage 1: Identifying the Research Question

Formulating research questions is a guideline and recurring point of reference in resolving uncertainties in the research process. Therefore, this scoping review seeks to answer the following question:

In the current panorama of research approaches, motivations, and constant challenges, do accounting and management control influence the various dimensions of sustainability in the port context?

This question is considered broad enough to enable a comprehensive understanding of this subject.

Stage 2: Identifying Relevant Studies

This stage focuses on identifying relevant studies by developing and applying specific criteria to determine the relevance of each study in relation to the research question outlined in the previous stage.

The systematic search for relevant information sources is carried out with precision and methodology to ensure that only relevant and significant studies are included, thus contributing to the robustness and relevance of the research. To ensure a broad scope for capturing relevant articles and studies, the following information sources were used: Scopus; Web of Science; Academic Search Complete; Business Source Complete; Google Scholar; and the snowball approach.

When identifying potentially relevant studies, the search terms were determined according to the subject being investigated. This careful choice and the adjacent criteria ensure that the research is comprehensive and aligned with the topics of interest. Thus, the search terms were defined according to the topic under study, incorporating various synonyms to ensure that we did not exclude relevant research, even if they used different terms.

MCSs

- MCSs;
- management control;
- management control tools;
- accounting and management control;
- managerial accounting instruments;
- cost accounting.

Maritime sector

- maritime sector;
- ports;
- maritime ports;
- seaports;
- maritime industry;

- shipping marine industry;
- green ports.

Sustainability

- sustainability;
- sustainable development;
- environmental accounting;
- economic sustainability;
- environmental management accounting metrics;
- TBL;
- environmental cost accounting.

After determining the search terms, we decided to set some limits. Generally, these limits (e.g., restricted time limits and articles published in other languages) are conditioned by budget and time constraints, although these search conditions are also defined by practical terms; the more conditions that are defined, the greater the likelihood of excluding appropriate studies [46].

The limits of this research include the time period, ranging from the year 2000 to the present day. In addition, the delimitation of the study area focused on the academic domains of "business, management, and accounting".

As for the snowball approach, as there are no limits, we referred to a technique whereby, from an initial set of relevant articles, it is possible to find others based on the references cited in these documents. Moreover, as the name suggests, this methodology resembles a snowball that grows as new articles are discovered, ensuring comprehensive coverage of the state of the art being investigated.

Stage 3: Study Selection

Identifying relevant articles detected several studies that were not in line with the topics under analysis. To maintain methodological rigor, articles that did not directly address the research question in their abstract were thoroughly excluded. In addition, because different sources of information were used, some articles were excluded because they were duplicates, to guarantee the integrity and impartiality of the results.

- **Title and Abstract Evaluation: Initial Selection**

The titles and abstracts of potentially relevant articles underwent an initial screening process, avoiding the misallocation of resources and effort in acquiring articles that did not fit the research [48]. In this process, if the information in the title and abstract is dubious in relation to the subject under analysis, the researcher chooses to review the introduction and conclusion, requiring full access to the document.

Regarding articles without full access, efforts were made to contact the relevant authors, explaining the purpose of this research and the potential importance of the article. Efforts were also made to contact library services and to obtain them through loans from alternative sources.

Once the articles were identified and their accessibility confirmed, the next stage required reading them in full, ensuring that the inclusion was thoughtful and conscious. We did not assume that the abstracts were representative of the full article, but rather, that they provided a quick overview of the overall content, helping those interested to decide whether the article was relevant to their needs. Aware of this limitation, we opted to read the whole article to capture all nuances and details.

The process from Stage 2 to Stage 3 is represented in Figure 2.

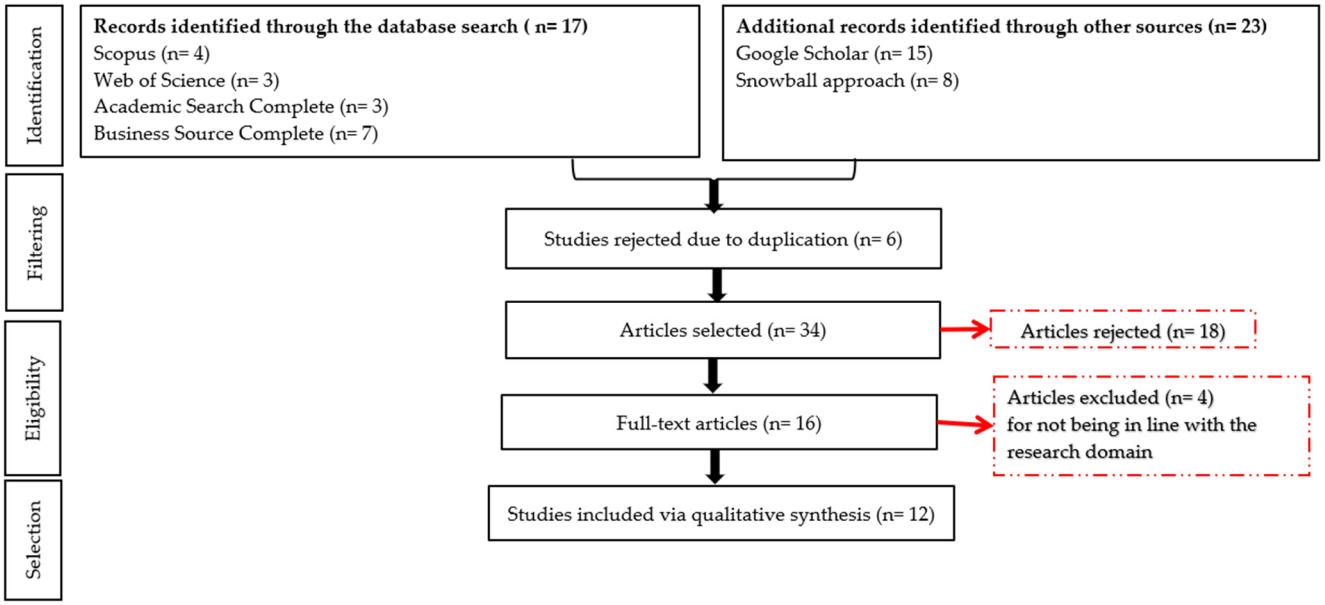

Figure 2. PRISMA flowchart of results.

Stage 4: Data Mapping

In the process of appropriately and methodologically selecting articles, all potentially relevant articles were subjected to a critical analysis using a reading sheet model. This allowed them to be grouped and mapped with all their relevant characteristics, keeping the researchers aligned with the issue under investigation.

At this stage, various eligibility and relevance criteria were also considered, providing a wide-ranging assessment that culminated in a reasoned decision on the inclusion or exclusion of each document, contributing to the rigor and robustness of this methodology.

Based on the reading sheet, which compiles the essential information extracted from the articles, the usefulness of the narrative review was considered using the descriptive–analytical data technique. This approach proved to be useful, making it possible to establish a uniform analytical structure for all the articles selected by incorporating the charting phase. This is a technique for synthesizing and interpreting qualitative data involving several steps, including sorting information, drawing up graphs/tables for visualization, and organizing this information. Using keywords and relevant themes, this organizational technique extracts and visually represents the qualitative findings, contributing to our understanding and analysis of trends and patterns in the literature.

Stage 5: Compiling, Summarizing, and Presenting the Results

At this stage, with a "map" of relevant information on the nuclear articles intrinsic to the research, the information is disseminated by presenting a narrative that elucidates the lessons learned from this process. This includes identifying gaps and guidelines for future research to point academia in directions that will lead to new discoveries and insights.

4. Results and Discussion

To provide a clear and organized view of the selected articles, we present Table 1, which synthesizes the main information extracted from each study. The table is structured with a focus on the following essential elements: the authors' names, the article reference, the primary objectives of each study, the methodology used, and the entity involved in the research. These elements were chosen because they are fundamental for understanding the scope and approach of each work, enabling a comparative analysis across the different studies.

Table 1. Summary of the main characteristics of the studies analyzed.

Author [Ref.]	Objective(s) of the Study	Methodology	Entity
[49]	Implementing a strategic management system at the Valencia Port Authority.	Case study	Valencia Port Authority
[50]	Implementation of Lean enterprise principles and tools in port activities.	Case study	Port of Mobile
[51]	Analysis of definitions and advantages and an introduction to the use of the balanced scorecard (BSC) as a competitive advantage, business performance measures, and port management techniques.	Systematic literature review	Not applied
[24]	To define a method to apply in Portuguese port administrations to justify the tariffs to be charged for various services.	Case study	Portuguese port administrations
[26]	To analyze the role of MCSs in supporting the decision-making process of port authorities, maritime agents, and cruise companies in preventing and reducing negative environmental effects of maritime ports.	Case study	Port of Naples
[52]	Developing a sustainable maritime BSC (SMBSC) considering economic, social, and environmental indicators.	Case study	Port of Alexandria
[15]	To investigate the MCSs in support of decision-making processes to prevent and reduce the negative environmental effects of seaports.	Case study	Port of Naples
[53]	Modeling an integrated framework to boost port performance, including performance measurements, using the BSC and Political, Economic, Sociological, Technological, Legal, and Environmental (PESTLE) methods (analysis of political, economic, social, technological, legal, and environmental factors) with the concepts of sustainability, smart port, and green port.	Systematic literature review	Not applied
[23]	Understanding and analyzing modern cost accounting methods and their implications for planning, control, and decision-making, identifying advantages and disadvantages, investigating implementation policies, and highlighting the benefits of these systems for measuring costs.	Case study	Port of Sudan
[22]	Revisiting the pricing of maritime services in South African ports.	Case study	Transnet National Port Authority
[21]	To analyze the development and implementation of a BSC/SMBSC in the Cartagena Port Authority, providing relevant information for academic knowledge and exploring the fusion of the TBL concept within the SBSC.	Case study	Port of Cartagena
[54]	Identifying and categorizing the different Lean practices implemented in the maritime industry, as well as the main barriers to and benefits of their implementation.	Systematic literature review	Not applied

The inclusion of the study's objectives and methodology provides a detailed view of the intentions and approaches of each research, while the identification of the involved entities helps to contextualize the environment or sector in which the studies were applied.

Figure 3 analyzes the frequency of keywords in the articles found on Scopus and revealed the relationship and connection between the concepts in the titles, abstracts, and keywords. Using VOSviewer software (version 1.6.20)., all the keywords in the articles were collected and counted. The mapping considered a minimum of five occurrences of each keyword, resulting in two distinct clusters. The main cluster, which is more relevant,

represented by a palette of cooler colors (blue, purple), covers topics related to ports, port authorities, and sustainability, with a greater focus between 2019 and 2020. The secondary cluster highlights the interconnection between decision-making and MCSs, reflected by a warmer color (yellow), with more recent studies (2021 and 2022). The size of the circle represents the weight of the item, indicating the occurrence frequency of the keyword. The relationship between the nodes is stronger the closer they are to determining the central theme of the body of documents, i.e., their main lines of research.

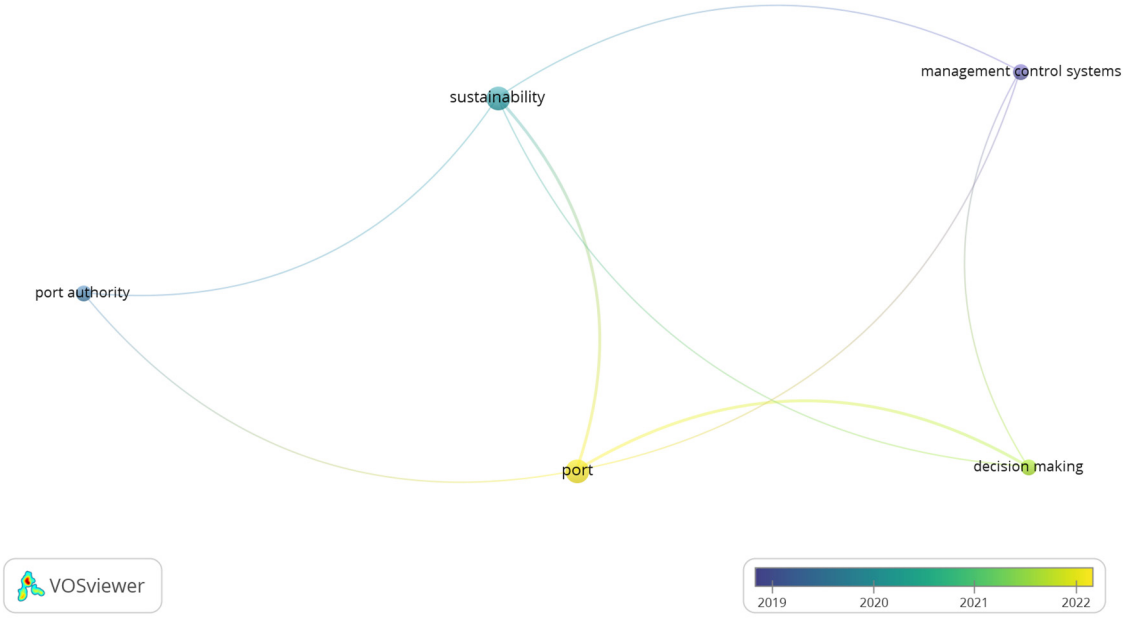

Figure 3. Keyword network map. Data taken from the Scopus database and processed using VOSviewer software (version 1.6.20).

4.1. Analysis of Articles

The publications analyzed demonstrated a range of management control tools, from MCSs to more advanced tools, allowing us to understand how accounting and management control are intertwined in various dimensions with sustainability. The relationship between management accounting and sustainability has intensified as organizations seek to incorporate sustainable practices into their operations. One example of this trend is evaluating sustainable performance [15].

In fact, traditional management accounting predominantly focuses on financial performance. However, integrating sustainability indicators, such as waste management [15], extends its reach. In this context, management accounting plays a crucial role in measuring and monitoring these indicators, providing essential information for decisions that reconcile economic performance with environmental sustainability.

4.1.1. Lean

Implementing the Lean philosophy in the port sector has proved useful in resolving capacity problems related to expansion, as well as identifying and eliminating waste, to meet customer needs, providing an increase in efficiency and both cost and time reduction in processes [54]. Notably, the main obstacles to implementation relate to a lack of know-how, employee training, and management involvement and commitment.

Also in the Lean context, Loyd et al. [50] analyzed the Port of Mobile in Alabama, United States, where there was a significant increase in the ability to manage more transport wagons and a reduction in loading and unloading times. This emphasized that changing to a Lean approach is a gradual and constantly evolving process rather than a final and definitive destination.

Successfully implementing this tool has also increased clients and organizational growth. Among the key factors in achieving these results are continuous investment in process improvement and employee development, which are necessary to further eliminate waste and optimize the working environment [50].

4.1.2. Activity-Based Costing (ABC)

Elyass et al. [23] analyzed the influence of contemporary accounting systems on the operations, planning, control, and decision-making in seaport organizations, emphasizing ABC. They found that, when integrated with a budgeting system, this costing system provided significant benefits to the Port of Sudan.

Around 20% of the articles analyzed consider ABC to be the tool best suited to accurately determining the costs incurred for each activity and, therefore, supporting decisions on port tariffs in the South [22–24].

Mthembu et al. [22] argued that reforming maritime service pricing should incorporate ABC in conjunction with the user-pays principle, considering it one of the best international practices. The authors also mention that this approach is recommended by several port users in South Africa.

4.1.3. Balanced Scorecard (BSC)

In the technique fusion approach, considering integration with ABC, Divandri et al. [51] pointed out that, together with the BSC, it is possible to drive the realization of strategy and achieve competitive advantage.

In promoting environmental performance, the importance of applying key performance indicators (KPIs) when interlinked with BSC development can be identified in measuring and controlling effectiveness and efficiency in port waste management [15].

The BSC is highlighted as a valuable tool for guiding companies in implementing sustainable strategies; however, the literature on using this strategic tool in the port sector is still under development [21].

The benefits of the BSC include improvements in organizational culture, orientation toward customer satisfaction, teamwork, and strategic goals [49], as well as identifying environmental sustainability and energy efficiency strategies that result in effective and efficient solutions [15]. In addition, efficiently using this tool can optimize equipment scheduling, reducing the time ships spend in port and increasing terminal productivity [51].

To boost port performance regarding sustainability, Praharsi et al. [53] proposed integrating the BSC and the Political, Economic, Sociological, Technological, Legal, and Environmental (PESTLE) method, a strategic analysis tool used to assess the external environment. While the BSC measures a port's internal performance, PESTLE measures external performance. The authors demonstrate that merging these two tools to achieve greater production efficiency reduces port stay times and labor costs, improving environmental management and achieving port sustainability.

The BSC has also transformed port management in the Port of Valencia, allowing it to evolve from a system of individualized objectives to a long-term strategic management system with an emphasis on continuous improvement. Therefore, the authors are led to view this tool more as a management approach aimed at global optimization and less as a financial instrument. Despite the benefits, there are limitations related to the complexity of implementation, and the continued need for research into applying the BSC as a strategic management approach has also been highlighted [49].

To simplify the implementation process, it is important to ensure the support of top management as well as specialized external consultants [21].

4.1.4. Sustainable Maritime Balanced Scorecard (SMBSC)

Based on the four perspectives, Sislian et al. [52] introduced new viewpoints on the BSC in the port context by incorporating the TBL framework, creating the SMBSC to include port sustainability in the Port of Alexandria, Egypt.

The SMBSC proved useful and easy to implement, taking on the position of a business partner by enabling higher levels of productivity and better financial results alongside the implementation of medium- and long-term social and environmental sustainability indicators. A few factors stood out, particularly those based on efficiently scheduling operations, with a reduction in time spent at the port and an increase in terminal productivity with unequivocal impacts on the environment and society as a whole. By providing strategic information on emissions and fuel planning, the efficiency determination also showed low administrative costs after investments in sustainable technologies, as well as real-time analysis of emission-related data collection.

4.2. Critical and Multidimensional Reflection

To complement and provide an additional perspective on integrating accounting and management control tools with sustainability in the port context, we decided to carry out a multidimensional critical reflection, shown in Figure 4.

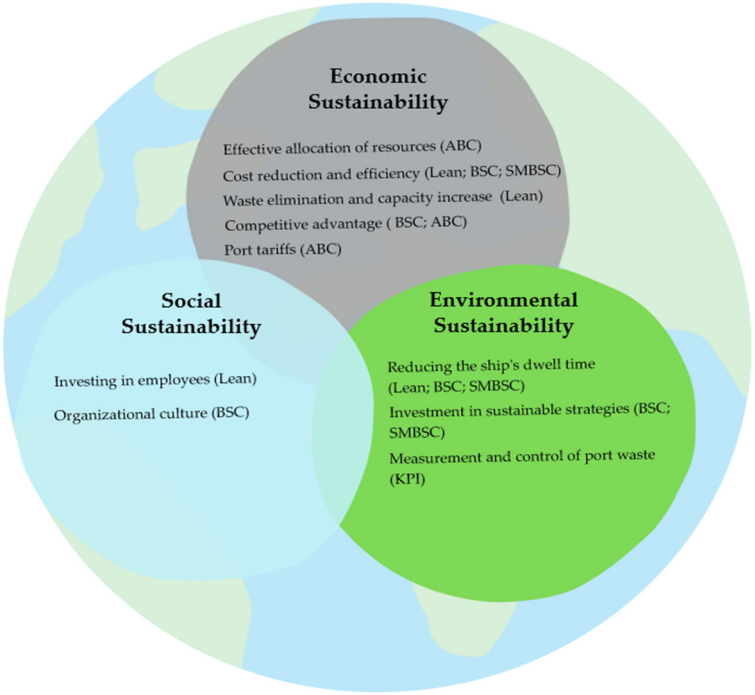

Figure 4. Multidimensional critical reflection.

Based on the potential impact factors and benefits mentioned for each tool in the previous section, we proceeded to integrate them into the various dimensions of sustainability.

As far as social sustainability is concerned, this research shows that Lean emphasizes the importance of investing in employees, with the aim of contributing to their professional development and well-being. This approach reinforces the company's social responsibility by promoting a healthy and fair working environment in the port sector. On the other hand, implementing the BSC has improved organizational culture, thus influencing attitudes and behavior. An organizational culture aligned with sustainability promotes ethical practices, community integration, and social responsibility.

Environmental sustainability is a fundamental principle in the search for a balance between human activities and the environment. It involves adopting practices that preserve and regenerate natural resources, minimizing negative impacts on ecosystems and biodiversity. In this context, the BSC and the SMBSC are tools that focus on sustainable strategies by implementing operational practices aimed at environmental sustainability, promoting environmental preservation and the conscious management of natural resources in the port context. In turn, KPIs allow for the measurement and control of port waste, enabling the efficient management of the waste generated in the port, making it possible to

reduce the costs associated with handling waste and minimize negative economic impacts. Lean, the BSC, and the SMBSC demonstrate their effectiveness in reducing vessel dwell times, providing the opportunity to reduce pollutant emissions and resource consumption during port operations. This efficiency reduces the carbon footprint and minimizes environmental impacts.

In addressing the field of sustainability at an economic level, several areas stand out wherein tools can significantly reduce costs and increase efficiency, namely, Lean, the BSC, and the SMBSC. In this context, increasing efficiency and reducing costs contribute to economic sustainability, allowing operations to be more profitable and viable in the long term. In addition, ABC offers the potential to maintain economic sustainability by maintaining a competitive advantage and assisting in setting port tariffs.

In the context of our critical reflection, both Lean and the BSC reveal a significant ability to integrate the three dimensions of sustainability into their approaches. With its focus on efficiency and eliminating waste, Lean directly contributes to economic and environmental sustainability while promoting a positive working environment. The BSC, for its part, offers a comprehensive framework that allows organizations to monitor and improve their performance in all dimensions of sustainability.

5. Conclusions

The results of this research provide an understanding of management control's role in the port context, emphasizing the interaction with sustainability at various levels. This highlights the diversity of management control tools applied to seaports. Analysis of the articles revealed that management accounting and its control impact sustainability, as evidenced by the way these practices and tools are applied to promote sustainable management.

The Lean philosophy, for example, has shown how eliminating waste and optimizing processes increases efficiency and reduces costs [50,54]. ABC stands out by helping managers to better determine costs and make decisions on port tariffs [22–24]. The BSC and the SMBSC demonstrate the alignment of sustainability strategies with operational performance, improving efficiency while contributing to reducing environmental impacts [51–53].

By applying the framework adopted by Arksey et al. [46], the conclusions can be aligned with strategic objectives, providing insights into the diversity of management strategies and exploring new ways to improve efficiency, sustainability, and competitiveness. From a holistic perspective, the studies highlight the interest in efficiency, sustainability, and strategic alignment in port management, pointing to a future in which this sector stands out not only for its operational efficiency but also for its commitment to practices associated with social and environmental responsibility.

This evidence shows how accounting and management control practices not only manage financial resources but also drive sustainability through methods that improve efficiency, reduce waste, and promote responsible environmental practices. Analysis of the articles proved that accounting and management control are essential to supporting and implementing sustainable practices in the port sector.

Given the small number of publications, this is an under-explored topic. Therefore, we recognize the inherent limitations of this research, which may impact the results and interpretations. Notably, our literature review approach, although comprehensive, may not have captured all the recent developments in the field. In addition, the specific characteristics of different ports should be accounted for in the conclusions drawn.

Furthermore, the absence of studies addressing the synergistic interaction of MCSs and tools applied to this sector may represent a gap in our comprehensive understanding of management control and accounting in their connection with sustainability. This highlights the need for a more in-depth analysis of how these areas can be effectively integrated.

However, the results show synergistic links between accounting and management control and sustainability, with these areas effectively serving an effective strategy for driving sustainable performance in seaports.

We hope that these conclusions will contribute to and enrich potential policies for port authorities and operators, such as encouraging the adoption of tools that promote the integration of sustainability-oriented accounting and MCSs, for example, by attracting investment in technologies that boost operational efficiency and environmental sustainability. In addition, it is essential to invest in specialized training for employees, a factor that promotes improved transparency and accountability.

Despite the contributions made here, there is room for further research into the subject, and we suggest using ABC to quantify the environmental costs associated with port operations and to determine the cost of sustainable practices.

Author Contributions: Methodology, J.M.; validation, A.S. and I.F.; formal analysis, A.C., C.C. and J.M.; investigation, A.C., C.C., J.M., A.S. and I.F.; writing—original draft preparation, J.M., A.S. and I.F.; writing—review and editing, A.C., C.C. and J.M.; visualization, A.S. and I.F.; supervision, A.C., C.C. and J.M.; project administration, A.C., C.C. and J.M.; funding acquisition, J.M.; resources, A.S. and I.F.; software, A.C. and C.C. All authors have read and agreed to the published version of the manuscript.

Funding: This study was funded by the PRR—Recovery and Resilience Plan and the NextGenerationEU funds at the University of Aveiro as part of the Business Innovation Agenda "NEXUS: Innovation Pact—Green and Digital Transition for Transport, Logistics, and Mobility" (Project No. 53 with application C645112083-00000059).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

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

References

1. Jeevan, J.; Mohd Salleh, N.H.; Abdul Karim, N.H.; Cullinane, K. An Environmental Management System in Seaports: Evidence from Malaysia. *Marit. Policy Manag.* **2022**, *50*, 1118–1135. [CrossRef]
2. Lam, J.S.L.; Notteboom, T. The Greening of Ports: A Comparison of Port Management Tools Used by Leading Ports in Asia and Europe. *Transp. Rev.* **2014**, *34*, 169–189. [CrossRef]
3. Chang, Y.T.; Shin, S.H.; Lee, P.T.W. Economic Impact of Port Sectors on South African Economy: An Input-Output Analysis. *Transp. Policy* **2014**, *35*, 333–340. [CrossRef]
4. Bottasso, A.; Conti, M.; Ferrari, C.; Tei, A. Ports and Regional Development: A Spatial Analysis on a Panel of European Regions. *Transp. Res. Part A Policy Pract.* **2014**, *65*, 44–55. [CrossRef]
5. Ha, M.H.; Yang, Z.; Notteboom, T.; Ng, A.K.Y.; Heo, M.W. Revisiting Port Performance Measurement: A Hybrid Multi-Stakeholder Framework for the Modelling of Port Performance Indicators. *Transp. Res. E Logist. Transp. Rev.* **2017**, *103*, 1–16. [CrossRef]
6. Hossain, T.; Adams, M.; Walker, T.R. Role of Sustainability in Global Seaports. *Ocean Coast. Manag.* **2021**, *202*, 105435. [CrossRef]
7. Marques, R.C.; Fonseca, Á. Market Structure, Privatisation and Regulation of Portuguese Seaports. *Marit. Policy Manag.* **2010**, *37*, 145–161. [CrossRef]
8. Lim, S.; Pettit, S.; Abouarghoub, W.; Beresford, A. Port Sustainability and Performance: A Systematic Literature Review. *Transp. Res. D Transp. Environ.* **2019**, *72*, 47–64. [CrossRef]
9. Hua, C.; Chen, J.; Wan, Z.; Xu, L.; Bai, Y.; Zheng, T.; Fei, Y. Evaluation and Governance of Green Development Practice of Port: A Sea Port Case of China. *J. Clean. Prod.* **2020**, *249*, 119434. [CrossRef]
10. Cabezas-Basurko, O.; Mesbahi, E.; Moloney, S.R. Methodology for Sustainability Analysis of Ships. *Ships Offshore Struct.* **2008**, *3*, 1–11. [CrossRef]
11. United Nations Conference on Trade and Development. *Review of Maritime Transport 2023—Towards a Green and Just Transition*; United Nations Conference on Trade and Development: Geneva, Switzerland, 2023.
12. Crutzen, N.; Zvezdov, D.; Schaltegger, S. Sustainability and Management Control. Exploring and Theorizing Control Patterns in Large European Firms. *J. Clean. Prod.* **2017**, *143*, 1291–1301. [CrossRef]
13. Lueg, R.; Radlach, R. Managing Sustainable Development with Management Control Systems: A Literature Review. *Eur. Manag. J.* **2016**, *34*, 158–171. [CrossRef]
14. Di Vaio, A.; Varriale, L. Management Control Systems for the Water Concessionaires Governance: A Multiple Cases Study in the Italian Seaports. In *Strengthening Information and Control Systems the Synergy Between Information Technology and Accounting Models*; Mancini, D., Dameri, R.P., Bonollo, E., Eds.; Springer: Berlin/Heidelberg, Germany, 2016; Volume 14, pp. 145–156. [CrossRef]

15. Di Vaio, A.; Varriale, L.; Trujillo, L. Management Control Systems in Port Waste Management: Evidence from Italy. *Util. Policy* **2019**, *56*, 127–135. [CrossRef]
16. Quesado, P.; Silva, R.; Oliveira, H.C. Management Control Systems and Sustainability: A Bibliometric Analysis. *Sustainability* **2024**, *16*, 5067. [CrossRef]
17. Gond, J.P.; Grubnic, S.; Herzig, C.; Moon, J. Configuring Management Control Systems: Theorizing the Integration of Strategy and Sustainability. *Manag. Account. Res.* **2012**, *23*, 205–223. [CrossRef]
18. Maas, K.; Schaltegger, S.; Crutzen, N. Integrating Corporate Sustainability Assessment, Management Accounting, Control, and Reporting. *J. Clean. Prod.* **2016**, *136*, 237–248. [CrossRef]
19. Arjaliès, D.-L.; Mundy, J. The Use of Management Control Systems to Manage CSR Strategy: A Levers of Control Perspective. *Manag. Account. Res.* **2013**, *24*, 284–300. [CrossRef]
20. Corsi, K.; Arru, B. Role and Implementation of Sustainability Management Control Tools: Critical Aspects in the Italian Context. *Account. Audit. Account. J.* **2020**, *34*, 29–56. [CrossRef]
21. Suárez-Gargallo, C.; Zaragoza-Sáez, P. Port Authority of Cartagena: Evidence of a Sustainability Balanced Scorecard. *Sustain. Dev.* **2023**, *31*, 3761–3785. [CrossRef]
22. Mthembu, S.E.; Chasomeris, M. Revisiting Marine Services Pricing in South Africa's Ports. *WMU J. Marit. Aff.* **2023**, *23*, 5–24. [CrossRef]
23. Elyass, M.A.; Elshareef, A.M.; Abdullah, Y.A.G.S. The Role of Contemporary Cost Accounting Systems in Planning, Decision-Making and Controlling, in Sudanese Sea Port Corporation. *J. Sci. Technol.* **2022**, *3*, 1–20.
24. Martins, A.; Jorge, S.; Sá, P. Price Regulation and Cost Accounting: The Case of the Portuguese Seaport Sector. *Int. J. Law Manag.* **2013**, *55*, 444–463. [CrossRef]
25. Triantafylli, A.A.; Ballas, A.A. Management Control Systems and Performance: Evidence from the Greek Shipping Industry. *Marit. Policy Manag.* **2010**, *37*, 625–660. [CrossRef]
26. Di Vaio, A.; Varriale, L. Management Control Systems in Inter-Organizational Relationships for Environmental Sustainability and Energy Efficiency: Evidence from the Cruise Port Destinations. *Lect. Notes Inf. Syst. Organ.* **2018**, *24*, 43–55. [CrossRef]
27. Glavič, P.; Lukman, R. Review of Sustainability Terms and Their Definitions. *J. Clean. Prod.* **2007**, *15*, 1875–1885. [CrossRef]
28. Rogers, K.; Hudson, B. The Triple Bottom Line The Synergies of Transformative Perceptions and Practices for Sustainability. *J. Organ. Dev. Netw.* **2011**, *43*, 3–9.
29. Loviscek, V. Triple Bottom Line toward a Holistic Framework for Sustainability: A Systematic Review. *Rev. Adm. Contemp.* **2021**, *25*, e200017. [CrossRef]
30. Elkington, J. Enter the Triple Bottom Line. In *The Triple Bottom Line: Does It All Add Up?* Henriques, A., Richardson, J., Eds.; Routledge: Abingdon, UK, 2004; pp. 1–16. [CrossRef]
31. Jaegler, A.; Sarkis, J. The Theory and Practice of Sustainable Supply Chains. *Supply Chain Forum* **2014**, *15*, 2–5. [CrossRef]
32. Acciaro, M. Environmental Social Responsibility in Shipping: Is It Here to Stay? *Q. Newsl. Int. Assoc. Marit. Econ.* **2012**, *32*, 27–30.
33. Zhao, C.; Wang, Y.; Gong, Y.; Brown, S.; Li, R. The Evolution of the Port Network along the Maritime Silk Road: From a Sustainable Development Perspective. *Mar. Policy* **2021**, *126*, 104426. [CrossRef]
34. Di Vaio, A.; Varriale, L. Management Innovation for Environmental Sustainability in Seaports: Managerial Accounting Instruments and Training for Competitive Green Ports beyond the Regulations. *Sustainability* **2018**, *10*, 783. [CrossRef]
35. Narula, K. Emerging Trends in the Shipping Industry—Transitioning Towards Sustainability. *Marit. Aff. J. Natl. Marit. Found. India* **2014**, *10*, 113–138. [CrossRef]
36. Bahadur, W.; Waqquas, O. Corporate Social Responsibility for Sustainable Business Management. *J. Sustain. Soc.* **2013**, *2*, 92–97. [CrossRef]
37. Vanelslander, T. Seaport CSR: Innovation for Economic, Social and Environmental Objectives. *Soc. Responsib. J.* **2016**, *12*, 382–396. [CrossRef]
38. Klimek, H.; Michalska-szajer, A.; Dąbrowski, J. Corporate Social Responsibility of the Ports of Szczecin and Ś Winouj ś Cie Zeszyty Naukowe Corporate Social Responsibility of the Ports of Szczecin and Świnoujście. *Sci. J. Marit. Univ. Szczec.* **2020**, *61*, 99–107. [CrossRef]
39. Ye, N.; Kueh, T.B.; Hou, L.; Liu, Y.; Yu, H. A Bibliometric Analysis of Corporate Social Responsibility in Sustainable Development. *J. Clean. Prod.* **2020**, *272*, 122679. [CrossRef]
40. Batalha, E.; Chen, S.L.; Pateman, H.; Zhang, W. The Meaning of Corporate Social Performance in Seaports: The Managers' Perspective. *WMU J. Marit. Aff.* **2020**, *19*, 183–203. [CrossRef]
41. Strupp, C. Seaports in Transition. Global Change and the Role of Seaports since the 1950s. *Plan. Perspect.* **2016**, *31*, 115–119. [CrossRef]
42. Notteboom, T.; Lam, J.S.L. Dealing with Uncertainty and Volatility in Shipping and Ports. *Marit. Policy Manag.* **2014**, *41*, 611–614. [CrossRef]
43. Gibbs, D.; Rigot-Muller, P.; Mangan, J.; Lalwani, C. The Role of Sea Ports in End-to-End Maritime Transport Chain Emissions. *Energy Policy* **2014**, *64*, 337–348. [CrossRef]
44. Rounaghi, M.M. Economic Analysis of Using Green Accounting and Environmental Accounting to Identify Environmental Costs and Sustainability Indicators. *Int. J. Ethics Syst.* **2019**, *35*, 504–512. [CrossRef]

45. Gaidelys, V.; Benetyte, R. Analysis of the Competitiveness of the Performance of Baltic Ports in the Context of Economic Sustainability. *Sustainability* **2021**, *13*, 3267. [CrossRef]
46. Arksey, H.; O'Malley, L. Scoping Studies: Towards a Methodological Framework. *Int. J. Soc. Res. Methodol. Theory Pract.* **2005**, *8*, 19–32. [CrossRef]
47. Daudt, H.M.L.; Van Mossel, C.; Scott, S.J. Enhancing the Scoping Study Methodology: A Large, Inter-Professional Team's Experience with Arksey and O'Malley's Framework. *BMC Med. Res. Methodol.* **2013**, *13*, 48. [CrossRef]
48. Pham, M.T.; Rajić, A.; Greig, J.D.; Sargeant, J.M.; Papadopoulos, A.; Mcewen, S.A. A Scoping Review of Scoping Reviews: Advancing the Approach and Enhancing the Consistency. *Res. Synth. Methods* **2014**, *5*, 371–385. [CrossRef]
49. Aparisi-Caudeli, J.A.; Giner-Fillol, A.; Pérez-García, E.M. Evidence on Implementing a Balanced Scorecard System at the Port Authority of Valencia. *Glob. J. Bus. Res.* **2009**, *3*, 93–117.
50. Loyd, N.; Jennings, L.C.; Siniard, J.; Spayd, M.L.; Holden, A.; Rittenhouse, G. Application of Lean Enterprise to Improve Seaport Operations. *Transp. Res. Rec.* **2009**, *2100*, 29–37. [CrossRef]
51. Divandri, A.; Yousefi, H. Balanced Scorecard: A Tool for Measuring Competitive Advantage of Ports with Focus on Container Terminals. *Int. J. Trade Econ. Financ.* **2011**, *2*, 472–477. [CrossRef]
52. Sislian, L.; Jaegler, A. A Sustainable Maritime Balanced Scorecard Applied to the Egyptian Port of Alexandria. *Supply Chain Forum* **2018**, *19*, 101–110. [CrossRef]
53. Praharsi, Y.; Hardiyanti, F.; Puspitasari, D.; Akseptori, R.; Maharani, A. An Integrated Framework of Balance Scorecard-PESTLE-Smart and Green Port for Boosting the Port Performance. In Proceedings of the International Conference on Industrial Engineering and Operations Management Monterrey, Monterrey, Mexico, 3–5 November 2021; pp. 1643–1653.
54. Neves, A.; Godina, R.; Erikstad, S.O. Enhancing Efficiency in the Maritime Industry Through Lean Practices: A Critical Literature Review of Benefits and Barriers. In *FAIM—Flexible Automation and Intelligent Manufacturing*; Springer: Berlin/Heidelberg, Germany, 2024; pp. 1–14. [CrossRef]