sustainability

MDPI

Article

Environmental Mainstreaming in Greek TEN-T Ports

Constantinos Chlomoudis [1], Petros Pallis [1] and Charalampos Platias [2,*]

[1] Department of Maritime Studies, University of Piraeus, 18534 Piraeus, Greece; chlom@unipi.gr (C.C.); ppallis@unipi.gr (P.P.)
[2] Department of International, European & Area Studies, Panteion University of Social & Political Sciences, 17671 Athens, Greece
* Correspondence: ch.platias@panteion.gr

Abstract: Along with recent fundamental changes in several aspects of the port industry, ports come up against formidable environmental challenges. It is thus important and often imperative to mainstream environmental concerns in their operation, planning, and development; improve their environmental performance; and make the transition to sustainable production and consumption patterns. The industry's greening is largely underpinned by European Union (EU) transport and port policy, with major European initiatives such as the Trans-European Transport Network (TEN-T), the European Green Deal, and Blue Growth expected to give new impetus. This paper examines environmental mainstreaming in Greek TEN-T ports and their ability to cope with upcoming challenges based on questionnaire responses by 23 port authorities and taking into account the relevant progress made by ESPO port members. We argue that all respondents have gradually become aware of the need to move towards an environment-friendly operation and development, but progress is slow, and there is still a lot to be done. Performances vary and depend on different factors, while ports are faced with significant challenges and various constraints. Nevertheless, new environmental standards present a real opportunity for Greek ports to undertake deep structural changes, especially in view of current and future European port policy.

Keywords: Greek TEN-T ports; port operation and development; environment; sustainability; European port policy

Citation: Chlomoudis, C.; Pallis, P.; Platias, C. Environmental Mainstreaming in Greek TEN-T Ports. *Sustainability* **2022**, *14*, 1634. https://doi.org/10.3390/su14031634

Academic Editor: Phoebe Koundouri

Received: 28 December 2021
Accepted: 27 January 2022
Published: 30 January 2022

1. Introduction

In the context of environmental mainstreaming, ports are called upon to adjust and reorganize their business strategy, governance, operation, and development through the integration of environmental considerations and objectives. The purpose is to deal with environmental problems, pressures, and challenges as well as considerably improve ports' environmental performance and footprint. At the same time, by delivering on the environmental pillar of sustainable development, ports edge closer to a sustainable transition and future.

This article takes stock of the progress made by Greek Trans-European Transport Network (TEN-T) ports towards environmental mainstreaming and their ability to cope with existing and upcoming challenges. Thus, it looks into a core subject of sustainable port operation and development and addresses a fundamental but rather overlooked issue of the sustainability debate.

It is surprising to note that environmental mainstreaming in Greek TEN-T ports is far underrepresented in academic research and discussion, notwithstanding its particular relevance. This results from heightening environmental pressures from port activities and development, on the one hand, and the sustainability paradigm, EU policy, regulation, and interventions on the other. In this respect, this article seeks to help close the gap, providing and analyzing data from Greece's major ports. Our analysis has been based on questionnaire responses by 23 Greek port authorities, as well as on a comparison between the latter and ESPO members. As explained in the relevant section below, the

research methodology was selected with a view to an evidence-based approach despite the very limited data background and information on the subject. Results are regarded and discussed within the framework of major recent EU initiatives such as the European Green Deal, Blue Growth, and the Trans-European Transport Network, which are considered game changers.

Apart from the introductory remarks in Section 1, our paper is structured as follows: Section 2 attempts a review of the academic research and existing literature on the subject. Section 3 presents the analysis methodology and the sources for our survey. Section 4 describes the main findings of our analysis of Greek TEN-T ports' environmental performance and offers a comparison with members of the European Sea Ports Organization (ESPO). Section 5 seeks to place these findings in a broader analysis and evaluation context and sets out key requirements for Greek ports to be able to improve their environmental performance substantially. Finally, Section 6 draws some conclusions from our analysis and looks at future prospects.

2. Literature Review

Contemporary academic research and literature on ports and the port industry increasingly focuses on the environmental dimension. The latter forms an integral part of the port sustainability debate, which gains in significance as the sustainability paradigm becomes predominant and ports are gradually recognized as engines of growth.

Port operation and development have a strong environmental impact, which increases as ports intensify or expand their activities, grow in size, and/or participate in transport corridors and logistics chains [1–3]. Today, the environmental footprint of ports and the port industry increasingly gives rise for concern. As a result, port operation and development—in theory and in reality—attract considerable interest. The academic debate centers on the environmental dimension of port operation, green ports, and sustainable development. A review of growing scientific literature reveals a broad, multifaceted, and cross-disciplinary discussion [4–7]. At the same time, the port industry itself also seems to be focusing more and more on the abovementioned issues [8,9].

The need to find the most appropriate solutions leads to (i) mainstreaming environmental concerns in policy design, policy- and law-making, or actions generally addressed to the port industry and (ii) greener initiatives and/or solutions on the part of ports. Requirements for the transition to a more sustainable paradigm and options towards achieving it are obviously far more demanding [10–14]. At the same time, however, they are extremely hard to be met given that they go through large-scale, radical changes across all areas of port organization, operation, and development.

In any event, ports gradually pursue environmental ambitions and further their environmental goals. A strong impetus in this direction comes from the new paradigm and European Union (EU) policy- and law-making, which push for port modernization, as well as from new financing opportunities for relevant projects. Added—and continuously growing—pressure arises from every major initiative taken at EU level over the past few years, given that the environment as a horizontal concern spans a broad spectrum of EU policies [15,16]. Additionally, environment-related challenges are inherent in port operation and development given the very nature of the industry, and they will continue unabated and most probably intensify in the coming future. Although the abovementioned pressures are not deemed strong enough to push towards the transition to a green economy, much less to ensure a shift towards sustainability, they could help ports improve their environmental performance in terms of their overall operation and development. They could contribute to a greener EU transport system to the extent that ports decisively impact stakeholders, transport corridors, and the logistics chains in which they participate [17–19].

Drawing our attention to Greece, in an entirely new and also rapidly changing setting, Greek ports may be subject to intense modernization pressures and able to positively respond to them, taking advantage of opportunities that arise. Questions to be raised in this context are to what extent ports are mature and ready to integrate the environmental

dimension in their activities and development prospects and whether they will potentially take initiatives in order to influence the port communities around them and the transport chains to which they belong. These questions are all the more relevant in view of (i) the radical changes expected in the port industry in general and ports in particular over the coming years as they adjust to new needs and requirements [20,21] and (ii) all the policy elements, regulatory interventions, and actions put in place in the context of the European Green Deal and other major EU initiatives such as the Trans-European Transport Network (TEN-T) and Blue Growth, which are expected to drastically alter the landscape for ports.

Notwithstanding the growing academic research on the environmental dimension and sustainability of ports and the obvious importance of environmental mainstreaming in Greek ports, in particular, scientific interest in the latter has been lacking to this day. The authors hope that the questions posed above along with our research findings will give added value to the relevant literature and stimulate further scientific discussion and future research.

3. Materials and Methods

Our analysis focuses on Greece's TEN-T seaports. Five out of the 25 Greek TEN-T ports (i.e., the ports of Heraklion, Igoumenitsa, Patra, Piraeus, and Thessaloniki) form part of the Greek section of the "Orient/East Med Corridor" and thus belong to the "Core TEN-T Corridor" (hereinafter "Core TEN-T ports"). The remaining twenty, namely Chalkida, Chania (Souda), Chios, Corfu, Elefsina, Kalamata, Katakolo, Kavala, Kyllini, Lavrio, Mykonos, Mytilini, Naxos, Paros, Rafina, Rhodes, Santorini, Skiathos, Syros, and Volos, belong to the "Comprehensive TEN-T" (hereinafter "Comprehensive TEN-T ports") [22]. In terms of their geographical location in Greece (see Scheme 1), almost half (48%) are located in the country's mainland, while the other are insular ports (located on 13 Greek islands).

Scheme 1. TEN-T ports in Greece; Source: European Commission, TENTec Public Portal, 2021, Authors.

The abovementioned ports are Greece's most important ports in terms of traffic and passenger volumes and are deemed to be "of international interest or national importance" under Common Ministerial Decision No. 8315.2/02/07 (Government Gazette, Issue B 202/16 February 2007) [23]. In this respect, they are subject to strong environmental pressures and face formidable challenges. Moreover, improving their environmental performance would bring significant benefits to their broader regions and Greece as a whole.

We cannot overlook the heterogeneity of Greece's TEN-T ports: they have different physical, technical, and economic characteristics, different distinctive features such as geographical location and spatial planning, transport interconnections, ownership/company status, etc. [24,25]. For instance, all Core TEN-T ports in Greece operate as Sociétés Anonymes (hereinafter "SAs"), whereas more than half of the Comprehensive TEN-T ports operate as Municipal Port Authorities (hereinafter "MPAs"). Meanwhile, the environmental issues and challenges they face and their ability to address them also differ substantially. It should be noted that environmental challenges and corresponding requirements are quite different in terms of activities (freight or passenger traffic, cruise ships, bulk cargo, containers, etc.). Such attributes obviously make it harder to categorize Greek TEN-T ports in groups and form generalized conclusions and evaluation findings. We seek to provide a contribution to the current academic research by analyzing the general framework and relevant conditions, placing particular emphasis on common characteristics and highlighting the differences that call for a different interpretation and analysis.

As regards our survey, we identified the characteristics upon which the population would be assessed while collecting primary data [26]. The survey was conducted between September 2019 and April 2020 and concerns Greece's 25 TEN-T (sea) ports (Table 1). All other ports in Greece (out of 93 port authorities in total) were excluded from the population of the survey due to their small size. We opted for the key informant method, whereby the questionnaire is sent to the person with the most comprehensive knowledge on the survey subject, in order to ensure the reliability of the answers [27,28]. In our survey, the Chairman of each of the 25 port authorities was chosen as the "key informant", to whom the questionnaire was addressed.

Table 1. Overview of Greek TEN–T ports.

Port Authority	Acronym	Société Anonyme (SA)	Municipal Port Authorities (MPA)	Respondent	Core TEN-T	Comprehensive TEN-T
Chalkida	PAChal	√		√		√
Chania	PAChan		√	√		√
Chios	PAChi		√	√		√
Corfu	PACo	√		√		√
Elefsina	PAE	√		√		√
Heraklion	PAHe	√		√	√	√
Igoumenitsa	PAI	√		√	√	
Kalamata	PAKal		√	√		√
Katakolo	PAKat		√	√		√
Kavala	PAKav	√		√		√
Kyllini	PAKy		√	√		√
Lavrio	PAL	√		√		√
Mykonos	PAMyk		√	√		√
Mytilini	PAMyt		√	√		√
Naxos	PAN		√	√		√
Paros	PAPar		√	√		√
Patras	PAPa	√		√	√	
Piraeus	PAP	√		√	√	
Rafina	PARa	√		√		√
Rhodes	PARh		√	√		√
Santorini	PASa		√			√
Skiathos	PASk		√	√		√
Syros	PASy		√			√
Thessaloniki	PAT	√		√	√	
Volos	PAV	√		√		√

Source: Authors, 2021.

Our survey sample (Table 1) coincides with the population targeted by the survey and is characterized by considerable heterogeneity, as further elaborated below, enhancing the potential for generalizing our survey findings [29–32]. Nearly all Greek TEN-T ports (23 out of the total 25) participated in our survey (hereinafter "respondents") with the exception of Santorini and Syros. Given the method adopted, the number of respondents can thus be considered satisfactory [33] and statistically acceptable [29–32].

The methodology of our research closely parallels the ESPO methodology, also followed by Puig et al. in their recent research [34]. The questions asked in our questionnaire, the types, and the range of data collected for Greek TEN-T ports generally reflect the main categories and indicators used by the ESPO to evaluate the environmental performance of its members and identify trends. This enables us to make a comparison between Greek TEN-T and ESPO ports, providing useful insights. We particularly look at responses, mostly categorized by subgroup (see Section 4.1.1), interested in drawing conclusions on any potential impetus to the environmental performance of ports, and having ESPO Member responses as a sort of reference point (see Section 4.2).

4. Results

4.1. The Environmental Performance of Greek TEN-T Ports in Their Own Eyes

4.1.1. Evaluation/Self-Evaluation

The majority of Greek TEN-T ports that participated in our survey (57%) are not developing any evaluation or self-evaluation action for their environmental performance. However, most SAs (66.6%) and all Core TEN-T ports evaluate their environmental performance. As shown in Tables 2 and 3, a clear distinction can be made, on the one hand, between Core and Comprehensive TEN-T ports, and, on the other hand, between MPAs and SAs. In more detail, all five (5) Core TEN-T ports (100%) have initiated actions to evaluate their environmental performance compared with only five (5) out of eighteen (18) Comprehensive TEN-T ports (i.e., 27%) and only two (2) out of eleven (11) municipal ports (i.e., 18%).

Table 2. Evaluation of respondents' environmental performance.

Port Authority	Yes	No
PAV	X	
PAT	X	
PAL		X
PAPa	X	
PAHe	X	
PARa	X	
PAP	X	
PAE		X
PAKav		X
PACo	X	
PAI	X	
PAChal		X
PAMyt		X
PAKal		X
PAKat		X
PAKy		X
PAMyk	X	
PAN		X
PAPar	X	
PARh		X
PASk		X
PAChan		X
PAChi		X

Source: Authors, 2021.

Table 3. Evaluation of respondents' environmental performance (total and by groups).

Answer	Total	Sociétés Anonymes (SAs—12 in Total)	Municipal Port Authorities (MPAs—11 in Total)	Core TEN-T Ports (5 in Total)	Comprehensive TEN-T Ports (18 in Total)
Yes	10	8	2	5	5
No	13	4	9	0	13

Source: Authors, 2021.

These findings reveal the environmental awareness of SAs (i.e., Greece's major ports) as a growing component of their overall corporate strategy. Nevertheless, much remains to be done by Comprehensive Greek TEN-T ports, which struggle to integrate environmental issues in their operation and eventually prioritize evaluation and self-evaluation actions.

4.1.2. Environmental Management Procedures and Indicators

As regards environmental management procedures and indicators (see Table 4), a top priority for respondents is keeping an inventory of relevant environmental legislation, albeit at different percentages for SAs (58%), MPAs (100%), Core TEN-T ports (80%), and Comprehensive TEN-T ports (78%). This perhaps suggests that smaller ports might strategically choose to only meet the minimum requirements laid down in the legislation. Other top choices in this category for SAs (accounting for 75% of answers) and Core TEN-T ports (75%, 100%, and 75%, respectively) are certified Environmental Management Systems (EMS), e.g., International Organisation for Standardisation (ISO), Eco-Management and Audit Scheme (EMAS) or Port Environmental Review System (PERS); environmental policy; and environmental monitoring programs. These are not at all followed by MPAs and only slightly by Comprehensive TEN-T ports (28%, 22%, and 22%, respectively). Respondents pay little attention (13%) to having reference to ESPO's guideline documents, keeping an inventory of Significant Environmental Aspects (SEAs), documenting environmental responsibilities of key personnel, and making their environmental reports publicly available. These options have only been selected by three SAs, two of which are Core TEN-T ports. In light of the above, the substantial heterogeneity of Greece's ports becomes evident and differences in terms of environmental awareness are revealed once again between SAs and MPAs and between Core and Comprehensive TEN-T ports.

Table 4. Greek TEN-T ports' environmental management procedures and indicators.

		Total	SAs	MPAs	Core	Comprehensive
A.	EMS [1] (ISO [2], EMAS [3], PERS [4])	9	9	0	4	5
B.	Environmental policy	9	9	0	5	4
C.	Envir. policy reference to ESPO guideline docs	3	3	0	2	1
D.	Environmental legislation	18	7	11	4	14
E.	Inventory of SEAs [5]	3	3	0	2	1
F.	Targets for environmental improvement	7	6	1	3	4
G.	Environmental training	5	4	1	3	2
H.	Environmental monitoring	9	9	0	5	4
I.	Document envir. responsibilities of key personnel	3	3	0	2	1
J.	Publicly available environmental report	3	3	0	2	1

Source: Authors, 2021; [1] Certified Environmental Management System (EMS); [2] International Organisation for Standardisation (ISO); [3] Eco-Management and Audit Scheme (EMAS); [4] Port Environmental Review System (PERS); [5] Significant Environmental Aspects (SEAs).

4.1.3. Environmental Monitoring Programs

Indicators for ports' environmental monitoring programs show the environmental issues that respondents prioritize. Table 5 shows a majority of positive answers (with 78% against the total), but also for groups of respondents, i.e., 83% of SAs, 100% of Core TEN-T ports, and 72% of Comprehensive TEN-T ports. Among the top environmental monitoring indicators chosen

by respondents (66% or 12 out of 18) are port waste and water consumption. The monitoring of energy efficiency was chosen by 11 out of 18 respondents that answered positively (i.e., 61%), followed by water, noise, and air quality (at 50%, 39%, and 33%, respectively), suggesting that these issues are of growing importance to ports. Notwithstanding their substantial impact on port operation and development, monitoring sediment quality, their carbon footprint, marine ecosystems, and soil quality may be ranked as low importance based on respondents' answers (selected by only one respondent that answered positively, i.e., 5.5%). Monitoring port waste, water consumption, and energy efficiency are top priorities for all groups of respondents, i.e., SAs (70%, 90%, and 90%, respectively), Core TEN-T ports (75%, 100%, and 100%, respectively), MPAs (62%, 37.5%, and 25%, respectively), and comprehensive TEN-T ports (61.5%, 54%, and 46%, respectively).

Table 5. Greek TEN-T ports' Environmental Monitoring Indicators.

Selected Options	Total	SAs	MPAs	Core	Comprehensive
Yes	18	10	8	5	13
No	5	2	3	0	5
If yes, in which of the following:					
Port waste	12	7	5	4	8
Energy efficiency	11	9	2	5	6
Water quality	9	6	3	5	4
Water consumption	12	9	3	5	7
Noise	7	7	0	4	3
Air quality	6	5	1	4	2
Sediment quality	1	1	0	1	0
Carbon footprint	1	1	0	1	0
Marine ecosystems	1	1	0	1	0
Soil quality	3	3	0	2	1
Terrestrial habitats	2	2	0	1	1

Source: Authors, 2021.

4.1.4. Top Ten Environmental Priorities

A noteworthy finding is the top ten list of respondents' environmental priorities monitored over the 2019–2020 period (Table 6). In more detail, Environmental Contamination/Contingency Plans undoubtedly top the sector's environmental concern. A total of 19 out of 21 respondents (90%) clearly state the need for contingency plans to be in place in order for ports to be able to tackle environmental emergencies. Waste is also among their top environmental priorities: waste generated by port-based activities (ranked second) and waste delivered by ships calling at the port (ranked fourth). Energy consumption/renewable energy completes the top three environmental priorities given that it is chosen by 14 out of 21 respondents (or 67%), meaning that these ports are aware of the need to improve their energy efficiency. Air quality and vessel emissions are ranked fifth and sixth, respectively, selected by 10 out of 21 respondents (48%). It should be pointed out that air pollution in port areas can come from vessels navigating in the port or at berth, port operations, and related land traffic within the port area. Some ports are also sites of industrial activities and clusters, thus raising air pollution concerns. Respondents also attach particular importance to the port's relationship with the local community. Since the majority of ports are located in or near urban areas, they need to address the general concerns of local citizens. Load leakage is ranked eight, as ports need to prevent leakages from port-based activities and avoid or, in the worst case, minimize their spreading. Electricity supply on land/cold-ironing comes behind energy efficiency and air pollution as a top environmental priority (chosen by 11 out of 21 respondents, or 52%). Respondents place dust at the bottom of the list, mainly alluding to potential problems arising from port activities regarding bulk carriers and dry bulk loads in some Greek ports.

Table 6. Greek TEN-T ports' top ten environmental priorities [1].

Greek TEN-T Ports' Top Ten Environmental Priorities	Ranking
Environmental Contamination/Contingency Plans	1
Port waste	2
Energy consumption/renewable energy	3
Ship waste	4
Air quality	5
Vessel emissions	6
Relationship with the local community	7
Load leakage	8
Electricity supply on land/Cold-ironing	9
Dust	10

Source: Authors, 2021; [1] Top ten environmental priorities based on respondents' answers to our questionnaire.

4.1.5. Green Services to Shipping

In an effort to address their environmental priorities, ports aim to enable greener shipping. We have found that almost half of them (48%) already provide three key green services: Onshore Power Supply (OPS), Liquefied Natural Gas (LNG) bunkering facilities, and ship waste collection (Figure 1). An interesting finding is that, even though 52% of respondents do not provide such services, most of the surveyed SAs (66.6%) and Core TEN–T ports (80%) offer green services to their clients. There is, thus, a stark contrast between SAs and MPAs and between Core and Comprehensive TEN-T ports, since only three (3) MPAs (27%) out of eleven (11) and only seven (7) Comprehensive TEN-T ports (39%) out of eighteen (18) have taken action to provide green services to shipping.

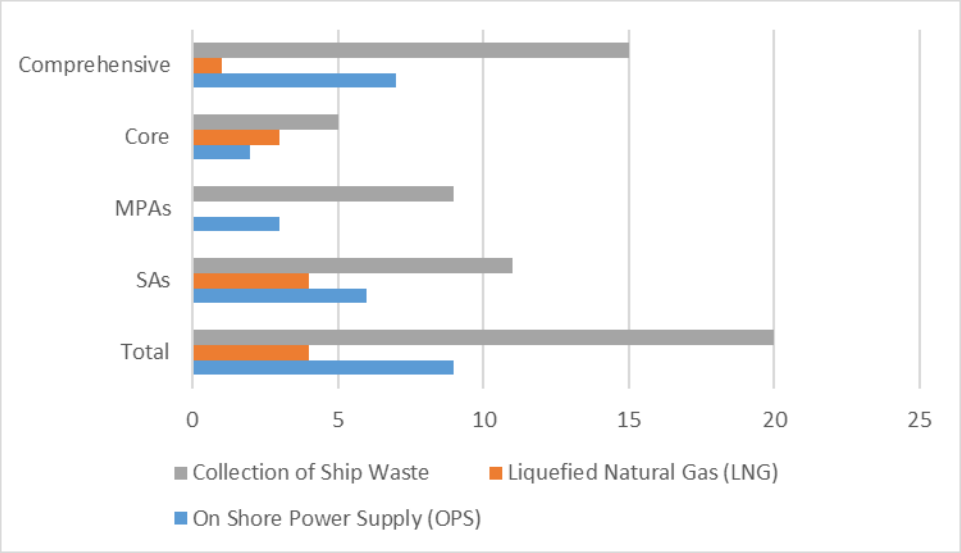

Figure 1. Green services to shipping by Greek TEN-T ports. Source: Authors, 2021.

4.1.6. Environmental Management Systems (EMS)

Based on the three main internationally recognized EMS standards, i.e., PERS, ISO 14001, and EMAS, Figure 2 shows how certified ports are distributed across the sample. ISO and PERS are the most popular standards in the sector. Some ports are certified with more than one standard, but only the Port Authority of Igoumenitsa (a Core TEN-T port) has been certified with all three standards. Out of the 67% of ports certified with ISO 14001 less than half are also PERS-certified (33%). Certified ports are mostly SAs (67% certified with ISO 14001 and 33% with PERS) and Core TEN-T ports (50% certified with ISO 14001 and 25% with PERS). Not a single MPA and only a few Comprehensive TEN-T ports have been certified under the abovementioned EMS standards (12.5% with ISO 14001 and 25% with PERS).

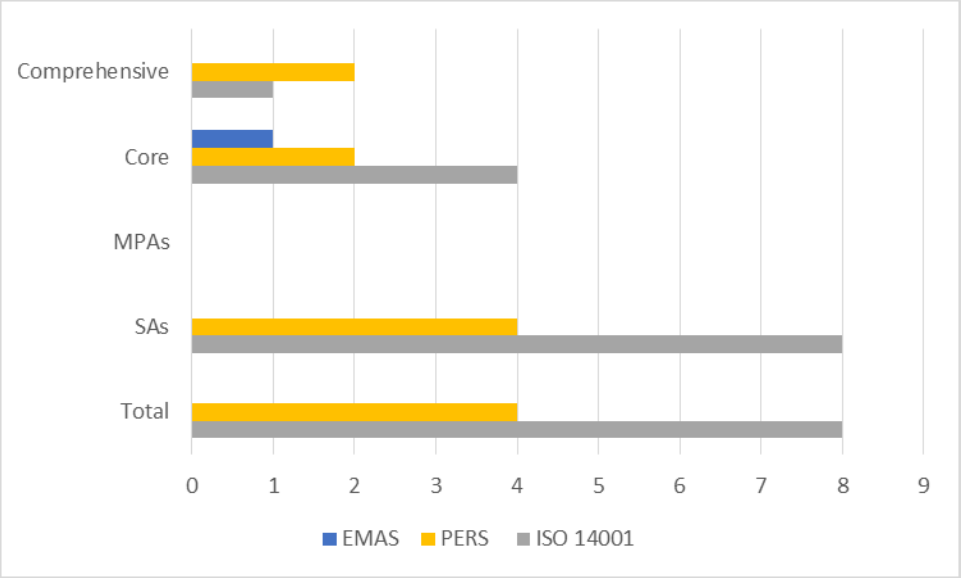

Figure 2. Greek TEN-T ports' Environmental Management Systems. Source: Authors, 2021.

Our survey finally posed the question as to whether respondents are considering participating in the EcoPorts network, as one of the port industry's flagship initiatives, integrated in the ESPO. Figure 3 shows that Greek ports are mainly neutral (8 out of 23 respondents, or 35%) toward the possibility of participating to the EcoPorts network, led by MPAs (55%) and followed by Comprehensive TEN-T ports (39%). It is somewhat encouraging that 13 out of 23 respondents are interested or fully interested in participating in the EcoPorts network, spearheaded by SAs (75%) and followed by Core TEN-T ports (60%).

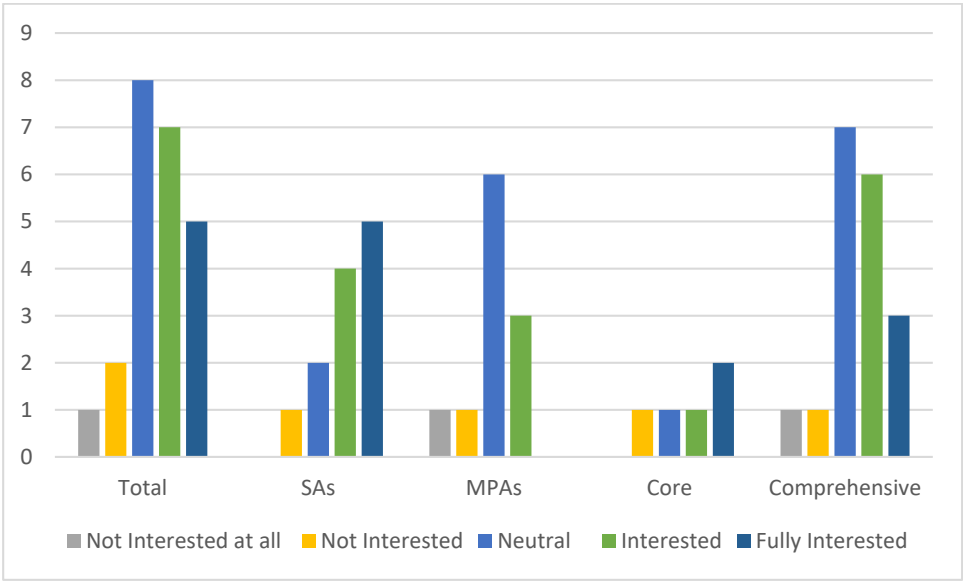

Figure 3. EcoPorts Network. Source: Authors, 2021.

4.2. A Comparison between Greek TEN-T Ports and ESPO Ports

A comparison of our respondents' environmental performance (based on how it is depicted in their answers to our questionnaire) with the relevant progress made by ESPO port members in 2021 (99 ports represented in the sample used in "ESPO Environmental Report–EcoPortsinSights 2021" [8]) has been deemed necessary in order for conclusions to be drawn beyond the domestic level.

4.2.1. Environmental Management Procedures and Indicators

Environmental management procedures and indicators refer to efforts undertaken to achieve a high level of environmental protection and promote sustainability. Concurrently, they reflect measures to handle the environmental impact of port activities and operations [9].

Table 7 presents positive responses (in percentage rates), prioritizing the 10 most important environmental management procedures/indicators that ports consistently report upon. Core TEN-T ports and SAs mainly drive the environmental performance of surveyed Greek TEN-T ports, whereas MPAs and Comprehensive TEN-T ports are seriously lagging behind, both at a domestic level and compared with ESPO ports. Exceptional scores obtained by responding SAs and Core TEN-T ports concern most of the environmental management procedures mentioned in our questionnaire, even well above the ESPO's respective percentages in key categories. Despite high scores, e.g., in environmental policy, EMS certification, and environmental monitoring, suggesting a good environmental performance, surveyed SAs and Core TEN-T ports do not seem to share the same level of environmental ambition as ESPO ports, as reflected, for example, in their answers regarding targets for environmental improvement (50% and 60%, respectively, compared with an ESPO average of 87%).

Table 7. Greek TEN-T ports' and ESPO 2021 environmental management procedures/indicators.

		Total (%)	SAs (%)	MPAs (%)	Core (%)	Comprehensive (%)	ESPO 2021 (%)
A.	EMS (ISO, EMAS, PERS)	39	75	0	80	25	75
B.	Environmental policy	39	75	0	100	20	93
C.	Environmental policy reference to ESPO guideline documents	13	25	0	40	5	39
D.	Environmental legislation	78	58	100	80	70	88
E.	Inventory of SEAs	13	25	0	40	5	92
F.	Targets for environmental improvement	30	50	9	60	20	87
G.	Environmental training	22	33	9	60	10	56
H.	Environmental monitoring	39	75	0	100	20	86
I.	Document environmental responsibilities of key personnel	13	25	0	40	5	82
J.	Publicly available environmental report	13	25	0	40	5	68

Sources: Authors, 2021 and ESPO, 2021.

Meanwhile, MPAs seem to be focused on legislative compliance, answering without exception (100%) that they keep an inventory of environmental legislation, far exceeding the ESPO's average of 88%. As for remaining categories, they recorded zero levels in seven out of ten categories and single-digit percentages for another two, namely environmental training and definition of targets for environmental improvement. It is thus clear that Greece's smaller TEN-T ports (MPAs in particular) have an enormous lag vis-à-vis ESPO ports and therefore need to take steps towards enhancing their environmental management performance, while Greece's major ports should beef up their environmental ambitions.

4.2.2. The Environmental Management Index (EMI)

An interesting comparison can be made by following the ESPO's methodology on calculating the Environmental Management Index (EMI) to look into Greek TEN-T ports' environmental performance. As explained in "ESPO Environmental Report—EcoPortsinSights 2021" [9] (p. 11), the EMI is "a measure of the overall environmental management performance of the port based on aggregation of the ten environmental indicators" that are of interest to ESPO Members according to their responses to the ESPO questionnaire, calculated using the following formula:

$$EMI = A * 1.5 + B * 1.25 + C * 0.75 + D * 1 + E * 1 + F * 1 + G * 0.75 + H * 1 + I * 1 + J * 0.75 \quad (1)$$

Drawing from ESPO's approach to the EMI, the ten environmental indicators relevant to Greek TEN-T ports are presented in the above Table 7. The worst EMI score is rated 0 (no environmental management), while the best is rated 10 (excellent environmental management). Relevant scores for Greek TEN-T ports, their subgroups, and the respective average for ESPO Members are depicted in Figure 4. The main finding is that the Environmental Management Indexes (EMIs) of Core TEN–T ports and SAs are closer to the ESPO 2021 EMI, whereas the EMIs of Greek MPAs and Comprehensive TEN–T ports lag significantly behind the ESPO 2021 EMI (Figure 4).

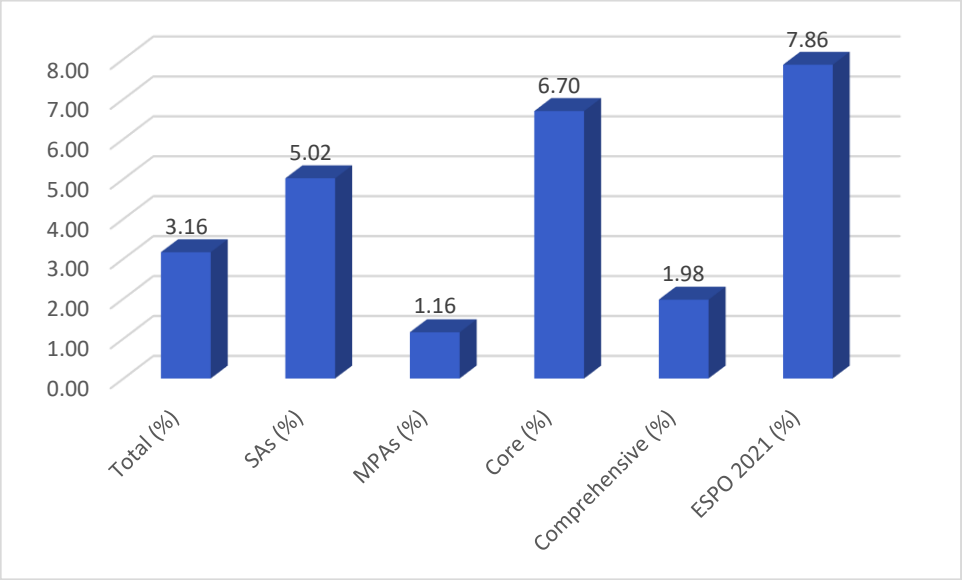

Figure 4. Environmental Management Indexes (EMI) for Greek TEN-T ports and ESPO 2021; Source: Authors, 2021.

As shown in Table 8, almost half the environmental monitoring indicators for SAs and Core TEN-T ports (i.e., port waste, energy efficiency, water quality, water consumption, and noise and air quality) largely converge with ESPO ones. On the other hand, there is a strong divergence between ESPO environmental monitoring indicators and the indicators of MPAs and Comprehensive TEN-T ports. Moreover, environmental monitoring indicators that have been found in our survey to be of low importance to Greek TEN-T ports, such as sediment quality, carbon footprint, marine ecosystems, soil quality, and terrestrial habitats, show a clearly visible divergence from ESPO ports' corresponding indicators.

Table 8. Greek TEN-T ports and ESPO 2021 environmental monitoring indicators.

	Total (%)	SAs (%)	MPAs (%)	Core (%)	Comprehensive (%)	ESPO 2021 (%)
Port waste	52	58	45	75	40	80
Energy efficiency	48	75	18	100	30	77
Water quality	39	50	27	100	20	71
Water consumption	52	75	27	100	35	70
Noise	30	58	0	75	15	70
Air quality	26	42	9	75	10	64
Sediment quality	4	8	0	20	0	60
Carbon footprint	4	8	0	20	0	59
Marine ecosystems	4	8	0	20	0	46
Soil quality	13	25	0	40	5	40
Terrestrial habitats	9	17	0	20	5	40

Sources: Authors, 2021 and ESPO, 2021.

4.2.3. Top Ten Environmental Priorities

It is relevant to show a comparison between the ten most significant issues in respect of environmental performance for Greek TEN-T ports and ESPO Members in order to identify any similarities and/or differences in their approach to environmental mainstreaming and the issues that matter most to them.

Table 9 presents a comparison between the top ten environmental priorities of Greek TEN-T and ESPO ports. There are four (4) priorities that coincide: port waste, ship waste, air quality, and relationship with the local community. The Greek TEN-T ports' environmental priorities of energy consumption/renewable energy and electricity supply on land/cold-ironing may be considered akin to energy efficiency, as one of the environmental priorities stated in [8]. These priorities reflect the need for more effective and efficient management of energy reserves. Moreover, vessel emissions and dust are priorities generally related to air quality and thus signal an interest on the part of Greek ports in air pollution, especially ports that are located in urban areas. This could be linked to the prioritization of ports' relationship with the local community, given that most Greek ports (like European ones) are located in or close to urban areas and therefore have a stake in cultivating a harmonious relationship with locals over the longer term.

Table 9. Greek TEN-T ports' and ESPO 2021 members' top ten environmental priorities.

Greek TEN-T Ports' Top Ten Environmental Priorities [1]	#	ESPO Ports' Top Ten Environmental Priorities	#
Environmental Contamination/Emergency Plans	1	Air quality	1
Port waste	2	Climate change	2
Energy consumption/Renewable energy	3	Energy efficiency	3
Ship waste	4	Noise	4
Air quality	5	Relationship with the local community	5
Vessel emissions	6	Water quality	6
Relationship with the local community	7	Ship waste	7
Load leakage	8	Dredging operations	8
Electricity supply on land/Cold-ironing	9	Port Development (land related)	9
Dust	10	Garbage/Port waste	10

Sources: Authors, 2021 and ESPO, 2021; [1] Based on respondents' answers to our questionnaire.

4.2.4. Green Services to Shipping

Green services to shipping are already emerging as a catalytic parameter for the port industry. By providing such services, ports improve their environmental footprint and sustainability performance. Concurrently, they become a component of competitive pressures with the potential to influence customer decisions on which port to use. As a result, green services are widely expected to play a decisive role in port operation and development as a major element of future business strategies.

Table 10 presents the three key green services that Greek TEN-T ports provide with a view to greener shipping compared with only two on the ESPO side, given that ship waste collection falls under ESPO's 2021 analysis on environmentally differentiated port fees. Ship waste collection is, nonetheless, one of the key supporting services offered by Greek TEN-T ports in light of the overwhelming number of positive responses.

Table 10. Greek TEN-T ports' and ESPO 2021 green services to shipping.

	Total (%)	SAs (%)	MPAs (%)	Core (%)	Comprehensive (%)	ESPO 2021 (%)
Onshore Power Supply (OPS)	39	50	27	40	35	57
Liquefied Natural Gas (LNG)	17	33	0	60	5	31
Ship waste collection	87	92	82	80	80	n/a

Sources: Authors, 2021 and ESPO, 2021.

Regarding onshore power supply, the percentages of surveyed Greek SAs and Core TEN-T ports are lower than, but close to, the ESPO average of 57%, at 50% and 40%, respectively, with comprehensive TEN-T ports and MPAs trailing behind, at 35% and 27%. These percentages are expected to rise further in coming years under the impact of the EU Directive on the deployment of alternative fuels infrastructure and a stronger emphasis on using onshore power supply across European ports.

As far as LNG is concerned, there is significant deviation among Greek TEN-T ports: Core TEN-T ports at 60% far outweigh the ESPO average of 31%, and SAs are slightly higher at 33%, whereas Comprehensive TEN-T ports (5%) and MPAs (0%) still have a considerable distance to catch up. Of course, LNG bunkering is not necessary for each and every port, especially taking into account port size, traffic, and specialization.

5. Discussion

5.1. Environmental Dimension in Ports and the Port Industry

Environmental mainstreaming and sustainability have become reference points for any contemporary approach in development planning and efforts in the EU [35–38]. The environmental dimension is thus not only becoming pivotal in port policy and governance but also increasingly emerges as a key choice for port authority corporate strategies and an essential element of port planning [39]. Ports make considerations for environmental concerns and pursue greener solutions and choices, as also indicated in the case of Greece by the results of our analysis and in the case of ESPO members in relevant reports [8,9,40] and recent academic research [34]. This starts from the premise that environmental pressures, challenges, and risks should be addressed effectively, and—perhaps even more so—that society and the economy should move towards sustainable development by introducing more sustainable models and rational behaviors, within the true limits of the natural environment, replacing existing models and behaviors associated with environmental damage, depletion, or destruction of natural resources, and continuing or reproduced trends that are harmful to the environment.

In this context, Greek TEN-T ports are called upon to plan and implement their development over the coming years taking into account problems, challenges, and risks [41], but also future requirements, capabilities, and opportunities [10,39], and, furthermore, to determine their strategy and take business decisions, to organize their efforts and choices, and seek fruitful solutions and ways in which to achieve their goals [41–45]. Certainly, initiatives undertaken and European policy elements create a framework and provide an impetus for Greek ports to pursue environmental goals and achieve tangible greener results. They exert pressures and create opportunities for ports in a field which, for all its inherent features, is open and strongly influenced by the international environment, also bearing in mind the national system's intrinsic connection with, and inferiority to, the European Union system.

5.2. The EU Framework

Despite the now broadly recognized significance of ports for the European economy [46–48], a clearly and explicitly laid out European policy for ports is still lacking. This had already been highlighted by Chlomoudis and Pallis in the early 2000s [49,50] and remains so today, although a crucial regulatory intervention in the sector has taken place in 2017 by means of Regulation (EU) 2017/352 of the European Parliament and the Council establishing a framework for the provision of port services and common rules on the financial transparency of ports [51]. Nonetheless, various initiatives are taken within the framework of, or in connection with, transport policy, significantly impacting European ports. Some of the central pillars of initiatives taken so far are TEN-T and Motorways of the Sea, Blue Growth, Maritime Spatial Planning, and Directive (EU) 2019/883 on port reception facilities for the delivery of waste from ships [52]. The institutional framework and key reference documents for all the above directly or indirectly promote environmental mainstreaming. Like the pieces of a complicated

jigsaw puzzle, they are put together as different efforts progress and individual parts evolve, concurrently promoting the environmental dimension.

More specifically, the TEN-T design and implementation must meet environmental requirements that continuously multiply as the system evolves [53]. For instance, the obligation of EU Member States to draw up national frameworks for the development of alternative fuel infrastructures under Directive 2014/94/EU dovetails with the TEN-T's development and the obligation to deploy an appropriate number of refueling points for LNG at Core TEN-T ports by 2025 [54]. Available financing (e.g., provided through the European Climate, Infrastructure, and Environment Executive Agency—CINEA, the successor organization of the Innovation and Networks Executive Agency—INEA) furthers and increasingly enhances support for ports' choices [55]. Moreover, in the context of Blue Growth and Maritime Spatial Planning, whereby environmental protection and sound environmental management are default policy and governance issues [56], the environment is of primary concern, and advanced solutions are sought on green growth and effective spatial planning in maritime and coastal areas. Ports, as key facilitators of Blue Growth and the Blue Economy [57,58], must address ensuing environmental pressures, challenges, and risks and promote sustainable operation and development. Furthermore, the regulatory framework on maritime spatial planning established by means of Directive 2014/89/EU [59] provides a powerful multi-purpose tool in order to rationalize and optimize port organization, operation, and development, also in terms of environmental performance and sustainability [60]. Last but not least, the abovementioned Directive on port reception facilities for the delivery of waste from ships is obviously particularly aimed to benefit the environment, as it helps shape a system that is capable to contribute to a clean maritime environment [61].

At the same time, the terms of financing of EU call for the creation of incentives to integrate the environmental dimension in any choices made by ports. This benefits the environment and ultimately improves the system's environmental performance. Nevertheless, as soft approaches, financing and 'new' environmental policy instruments will not yield desired outcomes—both in terms of results per se and in terms of a more rapid pace of environmental performance improvement—a recourse to hard regulatory interventions is considered probable. It is, however, reasonable to expect a combination of approaches and an effective instrument mix [62,63], continuously searching for a point of balance among them, which will be determined by the interaction of many different factors.

The prevailing trend and positive political momentum in the EU are extremely favorable to promoting the environment's pivotal role in port operation and development. In particular, the debate on sustainable development in the context of the sustainability paradigm and environmental mainstreaming, the EU's new Strategic Agenda for 2019–2024, the European Green Deal, measures to address climate change, the 8th Environment Action Program, interlocking of policy priorities and visionary initiatives with funding under the 2021–2027 Multiannual Financial Framework, and the new European recovery instrument NextGenerationEU (NGEU) [64] suggest that the jigsaw pieces aimed at achieving environmental targets fit together. In line with all the above, environmental considerations are mainstreamed into initiatives in virtually every policy field, including ports.

5.3. European Green Deal and Ports

The European Green Deal adds momentum for port policy and the port industry and contributes to the trend of mainstreaming environmental concerns and targets in the design and implementation of port activities and development [65]. By advancing environmental targeting, it bolsters green growth of ports and suggests integrating the principle of sustainability in port organization, operation, and development. Within the framework of the European Green Deal's implementation, efforts need to be based on the EU acquis and all the achievements obtained with regard to environmental protection but also be geared towards the environment and sustainability as key concerns of ports and the (trans)port industry. Consequently, large-scale and widespread changes in ports are needed,

not least to decisively influence port service providers and users and play a catalytic role in the transport corridors and logistics chains to which they belong [66,67].

There is ample room not only for environmental improvement in ports, i.e., integrating environmental targets, organizing port production in an environment-friendly manner, and greening ports and their activities, but also for achieving their sustainable development. This applies to both traditional activities and new promising initiatives such as Blue Growth and the Blue Economy, for which ports are expected to play a central role. Taking advantage of the available room for improvement of course greatly depends on the real capabilities and willingness of ports to bring about structural changes. This is a function of their perceived benefits against the expected costs, as well as the pressures on ports to mainstream the environmental dimension.

5.4. The Response of Greek Ports

Greek ports respond to European policy demands in a rather satisfactory manner in terms of compliance with environmental legislative requirement. Things differ when it comes to addressing the challenges brought about by recent EU initiatives, given that ports (even major ones) generally lack a proactive stance. Most of them try to keep up with the majority of Europe's ports in terms of integrating and pursuing key environmental objectives but usually lag behind those ports that promote more advanced environmental solutions. They also fall short in terms of their environmental performance, environmental programs, and their identified priorities against the backdrop of major European initiatives established or under way. As in the case of all other ports in the EU, even those that excel in terms of their environmental performance, Greek ports are far from achieving sustainable operation and development.

Greek ports, like the port industry in general, have a lot of room for improvement. It remains to be seen whether they will undergo significant changes and improvements with the potential to considerably enhance their environmental performance and lay down the proper foundations for green development. The biggest and more dynamic ports, despite any adversities and weaknesses, may conditionally keep in line with the EU's policies and high standards at least in terms of environmental protection and management, improve their environmental performance, and make the transition towards green growth. We generally expect that financial support for interventions in the environmental field may encourage ports and make it much easier for them to pursue environmental targets. However, financing is not necessarily a strong incentive in the face of opposing currents or if additional impetus is lacking.

In light of all the above, Greek ports are required to:

- Examine their needs and shortcomings in terms of environmental protection and management and recognize the challenges arising from their operation and future development, but also seek ways to take on board environmental issues adequately and improve their environmental performance;
- Prioritize environmental issues and environmental protection and management and explore sustainable solutions, particularly in relation to the prospects and opportunities that are opening up, e.g., in the context of TEN-T or the Blue Economy, as well as in relation to traditional activities and fields of port operation;
- Capitalize on the means and tools at their disposal on various levels, for instance, port master plans, maritime and land-based spatial planning, strategic environmental assessments and environmental impact assessments, environmental certification of ports and their activities based on certain standards, etc.;
- Identify indispensable and valuable projects that benefit the environment and search for available resources to implement them, potentially within the framework of broader projects and consortia with the use of EU funding;
- Create networks for exchanging knowledge, information, and best practices, establish broad consultations with all stakeholders, port service providers and users, academia

and expert groups, authorities and lobbies, civil society, and any interested parties, and even try to influence EU processes and outcomes.

Ports can and will meet these requirements to a greater or lesser extent in coming years. However, port responses and performance so far show divergence in terms of willingness and forebode varying levels of success. The road ahead is in any event long and significant efforts are needed by ports, stakeholders, and state authorities alike. For its part, the Greek State was until very recently rather reluctant to develop a comprehensive strategy on port environmental matters. A certain optimism for a new dynamic in the sector emerges through the Revised National Strategy for Ports officially announced to be subject to consultation (not launched as yet) and the recently adopted Greek Law 4832/2021 [68] regarding, inter alia, the Integrated Maritime Policy for Islands with a strong emphasis on sustainability.

6. Conclusions

Greek TEN-T ports are today faced with formidable environmental challenges and pressures. Mainstreaming environmental concerns in their operation and development is thus essential, along with creating prospects for a green transition and development. For the most part, they have approached environmental concerns in a largely defensive manner, mainly opting for minimum compliance with environmental requirements, whilst leaving several environmental problems unaddressed. Nonetheless, it appears in our survey that Greek TEN-T ports increasingly undertake initiatives and put in place measures to tackle environmental issues and challenges, adopt environmental standards, and participate in networks aimed at achieving environmental targets. In particular, we found that the performance of Greece's major ports that participated in our survey (i.e., SAs and Core TEN-T ports) often converges with that of ESPO members, although there are still significant differences. Bigger ports show enhanced environmental awareness and a more active stance, but they still lack environmental ambition. However, the willingness and strategic approach of port authorities, as well as tangible outcomes, greatly depend on ports' real capabilities to meet their obligations and take greener initiatives. Therefore, it is more probable that bigger and more dynamic Greek TEN-T ports, starting from a better position, will promote more advanced solutions.

Cautious optimism is thus warranted regarding future steps and achievements. Of course, this does not guarantee positive developments and progress for Greece's major ports, nor does it preclude the smaller ones from successful outcomes. Indeed, some MPAs and Comprehensive TEN-T ports have already signaled a partial change in their approach to certain environmental issues, although they have a lot of work to do. In any event, given the path taken so far and in light of individual port characteristics, the main impetus for change is expected to be top-down and outside-in, i.e., coming from the EU system and the policy choices shaped at European level, as well as from EU financing support.

While the paper examines environmental mainstreaming in Greek TEN-T ports and provides useful insights on the issue, it may be complemented by future research, e.g., shedding light on the different segments of environmental mainstreaming in this very complex industry and adding useful knowledge about ports and the port communities around them. Since data on Greek ports and their analysis are not sufficiently developed so far, the adopted methodology will also remain relevant for future work. Despite some constraints such as responders' potentially subjective answers, field data, i.e., input from ports, are essential for any quantitative or qualitative analysis. Beyond environmental mainstreaming, a deeper and better understanding of environmental implications for ports and the port industry is necessary in order to better identify the environmental pillar of the sustainability debate in their regard. Research in the field of public policy and port governance and management could provide further meaningful contributions with practical results and eventually have a significant impact towards sustainability.

Author Contributions: Conceptualization, all authors; methodology, C.C. and P.P.; software, P.P.; validation, C.C. and P.P.; formal analysis, all authors; investigation, C.C. and P.P.; resources, P.P.; data curation, P.P.; writing—original draft preparation, C.P. and P.P.; writing—review and editing, all authors.; visualization, P.P. and C.P.; supervision, C.C.; project administration, C.P.; funding acquisition, P.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the "Hellenic Foundation of Research and Innovation", Grant No. 173, 2nd Postdoc Call.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available upon request from the corresponding author.

Acknowledgments: The authors would like to express their gratitude to the chairperson of each of the 23 Greek TEN-T port authorities who responded to the questionnaire used for the purposes of the survey, as well as to the Ministry of Maritime Affairs and Insular Policy of the Hellenic Republic and especially to the General Secretariat of Ports, Port Policy and Maritime Investments for encouraging the port authorities concerned to participate in the survey.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

1. OECD. *Environmental Impacts of International Shipping: The Role of Ports*; OECD Publishing: Paris, France, 2011. Available online: https://read.oecd-ilibrary.org/environment/environmental-impacts-of-international-shipping_9789264097339-en (accessed on 7 December 2021).
2. Trozzi, C.; Vaccaro, R. Environmental Impact of Port Activities. In *Maritime Engineering and Ports II*; Brebbia, C.A., Olivella, J., Eds.; WITPress: Southampton, UK, 2000; pp. 151–161.
3. Puig, M.; Wooldridge, C.; Michail, A.; Darbra, R.M. Current status and trends of the environmental performance in European ports. *Environ. Sci. Policy* **2015**, *48*, 57–66. [CrossRef]
4. Lim, S.; Pettit, S.; Abouarghoub, W.; Beresford, A. Port sustainability and performance: A systematic literature review. *Transp. Res. Part D Transp. Environ.* **2019**, *72*, 47–64. [CrossRef]
5. Özispa, N.; Arabelen, G. Sustainability issues in ports: Content analysis and review of the literature (1987–2017). *SHS Web Conf.* **2018**, *58*, 01022. [CrossRef]
6. Davarzani, H.; Fahimnia, B.; Bell, M.; Sarkis, J. Greening ports and maritime logistics: A review. *Transp. Res. Part D Transp. Environ.* **2016**, *48*, 473–487. [CrossRef]
7. Styliadis, T.; Angelopoulos, J.; Leonardou, P.; Pallis, P. Promoting Sustainability through the assessment and measurement of Ports' Externalities: A Systematic Literature Review and future research paths. In Proceedings of the IAME 2021, 29th Conference of the International Association of Maritime Economists, Rotterdam, The Netherlands, 29 June–2 July 2021.
8. ESPO. *ESPO Green Guide 2021. A Manual for European Ports towards a Green Future*; ESPO: Brussels, Belgium, 2021. Available online: https://www.espo.be/media/ESPO%20Green%20Guide%202021%20-%20FINAL.pdf (accessed on 7 December 2021).
9. ESPO. *ESPO Environmental Report EcoPortsinSights 2021*; ESPO: Brussels, Belgium, 2021. Available online: https://www.espo.be/media/ESP-2844%20(Sustainability%20Report%202021)_WEB.pdf (accessed on 7 December 2021).
10. WPSP. World Ports Sustainability Report 2020. *World Ports Sustainability Program*. 2020. Available online: https://sustainableworldports.org/wp-content/uploads/WORLD-PORTS-SUSTAINABILITY-REPORT-2020-FIN.pdf (accessed on 7 December 2021).
11. Alamoush, A.S.; Ballini, F.; Ölçer, A.I. Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs). *J. Shipp. Trade* **2021**, *6*, 1–40. [CrossRef]
12. Hossain, T.; Adams, M.; Walker, T.R. Role of sustainability in global seaports. *Ocean Coast. Manag.* **2021**, *202*, 105435. [CrossRef]
13. Acciaro, M.; Vanelslander, T.; Sys, C.; Ferrari, C.; Roumboutsos, A.; Giuliano, G.; Lam, J.S.L.; Kapros, S. Environmental sustainability in seaports: A framework for successful innovation. *Marit. Policy Manag.* **2014**, *41*, 480–500. [CrossRef]
14. Argyriou, I.; Sifakis, N.; Tsoutsos, T. Ranking measures to improve the sustainability of Mediterranean ports based on multicriteria decision analysis: A case study of Souda port, Chania, Crete. *Environ. Dev. Sustain.* **2021**, 1–18. [CrossRef]
15. Dupont, C.; Jordan, A. Policy Integration. In *Environmental Policy in the EU: Actors, Institutions and Processes*; Jordan, A., Gravey, A., Eds.; Routledge: Abingdon, UK; New York, NY, USA, 2021; pp. 203–219.
16. Persson, Å.; Runhaar, H.; Karlsson-Vinkhuyzen, S.; Mullally, G.; Russel, D.; Widmer, A. Editorial: Environmental Policy Integration: Taking stock of policy practice in different contexts. *Environ. Sci. Policy* **2018**, *85*, 113–115. [CrossRef]
17. Notteboom, T.; Lam, J.S.L. The Greening of Terminal Concessions in Seaports. *Sustainability* **2018**, *10*, 3318. [CrossRef]
18. Notteboom, T.; Van Der Lugt, L.; Van Saase, N.; Sel, S.; Neyens, K. The Role of Seaports in Green Supply Chain Management: Initiatives, Attitudes, and Perspectives in Rotterdam, Antwerp, North Sea Port, and Zeebrugge. *Sustainability* **2020**, *12*, 1688. [CrossRef]

19. Poulsen, R.T.; Ponte, S.; Sornn-Friese, H. Environmental upgrading in global value chains: The potential and limitations of ports in the greening of maritime transport. *Geoforum* **2018**, *89*, 83–95. [CrossRef]
20. Russo, F.; Musolino, G. Case Studies and Theoretical Approaches in Port Competition and Cooperation. In *Computational Science and Its Applications—ICCSA 2021*; Gervasi, O., Murgante, B., Misra, S., Garau, C., Blečić, I., Taniar, D., Apduhan, B.O., Rocha, A.M.A.C., Tarantino, E., Torre, C.M., Eds.; Springer International Publishing: Cham, Switzerland, 2021; pp. 198–212.
21. Russo, F.; Musolino, G. Quantitative characteristics for port generations: The italian case study. *Int. J. Transp. Dev. Integr.* **2020**, *4*, 103–112. [CrossRef]
22. European Union. Regulation (EU) No. 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union Guidelines for the Development of the Trans-European Transport Network and Repealing Decision No. 661/2010/EU, OJ L 348, 20.12.2013. pp. 1–128. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L:2013:348:FULL&from=EN (accessed on 12 December 2021).
23. Government of the Hellenic Republic. Joint Ministerial Decision No. 8315.2/02/07 (GG Issue B 202/16-02-2007). Available online: https://www.eyath.gr/misc/FEK202B_2007.pdf (accessed on 12 December 2021).
24. Pallis, A.; Vaggelas, G. *GREPORT Report on Greek Ports*; Ports & Shipping Advisory: Piraeus, Greece, 2021.
25. Ministry of Shipping and the Aegean. *National Strategic Port Plan and Financing Possibilities through the NSRF and Resources of the New Programming Period—Action Provision of Services and Coverage of Expenses of EYSED-YNA for the Programming Period 2007–2013 (MIS 440979)*; Rogan & Partners S.A.: Athens, Greece, 2013.
26. Churchill, G.A.; Iacobucci, D. *Marketing Research: Methodological Foundations*; Harcourt College Publishers: London, UK, 2002.
27. Phillips, L.W. Assessing Measurement Error in Key Informant Reports: A Methodological Note on Organizational Analysis in Marketing. *J. Mark. Res.* **1981**, *18*, 395–415. [CrossRef]
28. Kumar, N.; Stern, L.W.; Anderson, J.C. Conducting Interorganizational Research Using Key Informants. *Acad. Manag. J.* **1993**, *36*, 1633–1651.
29. Hooley, G.J.; Lynch, J.E.; Shepherd, J. The Marketing Concept: Putting the Theory into Practice. *Eur. J. Mark.* **1990**, *24*, 7–24. [CrossRef]
30. Kohli, A.K.; Jaworski, B.J. Market Orientation: The Construct, Research Propositions, and Managerial Implications. *J. Mark.* **1990**, *54*, 1–18. [CrossRef]
31. Narver, J.C.; Slater, S.F. The Effect of a Market Orientation on Business Profitability. *J. Mark.* **1990**, *54*, 20–35. [CrossRef]
32. Ruekert, R.W. Developing a market orientation: An organizational strategy perspective. *Int. J. Res. Mark.* **1992**, *9*, 225–245. [CrossRef]
33. Kinnear, T.C.; Taylor, J.R. *Marketing Research: An Applied Approach*, 5th ed.; McGraw-Hill: New York, NY, USA, 1996.
34. Puig, M.; Azarkamand, S.; Wooldridge, C.; Selén, V.; Darbra, R. Insights on the environmental management system of the European port sector. *Sci. Total Environ.* **2022**, *806*, 150550. [CrossRef]
35. Delreux, T.; Happerts, S. *Environmental Policy and Politics in the European Union*; Palgrave Macmillan: London, UK; New York, NY, USA, 2016.
36. Tsaltas, G.I.; Platias, C. *European Union and Environment. Anatomy of a Common European Policy*; I. Sideris Publishing: Athens, Greece, 2010. (In Greek)
37. Platias, C. *Policy and Governance Issues of EU Environmental Policy and Sustainable Development*; I. Sideris Publishing: Athens, Greece, 2020. (In Greek)
38. Domorenok, E. *Governing Sustainability in the EU*; Routledge: Oxfordshire, UK, 2018.
39. Chlomoudis, C. *Port Planning in the Modern Port Industry*; J and J Hellas Publications: Athens, Greece, 2005.
40. Deloitte; ESPO. Europe's Ports at the Crossroads of Transitions. A Deloitte and ESPO Study. 2021. Available online: https://www.espo.be/media/Deloitte-ESPO%20study%20-%20Europe%E2%80%99s%20ports%20at%20the%20crossroads%20of%20transitions_1.pdf (accessed on 14 December 2021).
41. Chlomoudis, C.; Kostagiolas, P.; Pallis, P. An Analysis of Formal Risk Assessments for Safety and Security in Ports: Empirical Evidence from Container Terminals in Greece. *J. Shipp. Ocean Eng.* **2012**, *2*, 45–54.
42. Geerlings, H.; Vellinga, T. Sustainability. In *Ports and Networks*; Routledge: Abingdon, UK; New York, NY, USA, 2017; pp. 296–314.
43. Puig, M.; Darbra, R.M. The Role of Ports in a Global Economy, Issues of Relevance and Environmental Initiatives. In *World Seas: An Environmental Evaluation*; Elsevier: Amsterdam, The Netherlands, 2018; Volume 3, pp. 593–611.
44. Puig, M.; Wooldridge, C.; Darbra, R.M. Identification and selection of Environmental Performance Indicators for sustainable port development. *Mar. Pollut. Bull.* **2014**, *81*, 124–130. [CrossRef]
45. Pallis, A.A.; Vaggelas, G.K. Cruise Shipping and Green Ports. In *Green Ports. Inland and Seaside Sustainable Transportation Strategies*; Bergqvist, R., Monios, J., Eds.; Elsevier: Amsterdam, The Netherlands, 2019; pp. 255–273.
46. European Commission. Communication COM(2013) 295 Final from the Commission "Ports: An Engine for Growth" (23.5.2013). Available online: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM%3A2013%3A0295%3AFIN%3AEN%3APDF (accessed on 12 December 2021).
47. European Commission. White Paper COM(2011) 144 Final from the Commission "Roadmap to a Single European Transport Area—Towards a Competitive and Resource Efficient Transport System" (28.3.2011). Available online: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:en:PDF (accessed on 12 December 2021).
48. European Commission. Communication COM(2007) 616 Final from the Commission "Communication on a European Ports Policy" (18.10.2007). Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0616&from=EN (accessed on 12 December 2021).
49. Chlomoudis, C.I.; Pallis, A.A. *European Union Port Policy*; Edward Elgar Publishing: Northampton, MA, USA, 2002.
50. Chlomoudis, C.I.; Pallis, A.A. The EU Port Policy in a Historical Perspective. *Eur. Res. Stud.* **2005**, *8*, 21–42.

51. European Union. Regulation (EU) 2017/352 of the European Parliament and of the Council of 15 February 2017 Establishing a Framework for the Provision of Port Services and Common Rules on the Financial Transparency of Ports, OJ L 57, 3.3.2017. pp. 1–18. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0352&from=en (accessed on 12 December 2021).
52. European Union. Directive (EU) 2019/883 of the European Parliament and of the Council of 17 April 2019 on Port Reception Facilities for the Delivery of Waste from Ships, Amending Directive 2010/65/EU and Repealing Directive 2000/59/EC, OJ L 151, 7.6.2019. pp. 116–142. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0883&from=en (accessed on 12 December 2021).
53. Panagakos, G. Green Corridors and Network Design. In *Green Transportation Logistics. The Quest for Win-Win Solutions*; Psaraftis, H.N., Ed.; Springer: Cham, Switzerland, 2016; pp. 123–160.
54. European Union. Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the Deployment of Alternative Fuels Infrastructure, OJ L 307, 28.10.2014. pp. 1–20. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0094&from=en (accessed on 12 December 2021).
55. European Commission. Commission Decision C(2021) 4750 Final and Annex to the Commission Decision Approving the Work Programme 2021 of the European Climate, Infrastructure and Environment Executive Agency (1.7.2021). Available online: https://cinea.ec.europa.eu/system/files/2021-07/AWP2021DecisionC20214750%20Annex.pdf.pdf (accessed on 12 December 2021).
56. Schultz-Zehden, A.; Weig, B.; Lukic, I. Maritime Spatial Planning and the EU's Blue Growth Policy: Past, Present and Future Perspectives. In *Maritime Spatial Planning*; Springer Science and Business Media LLC.: Berlin/Heidelberg, Germany, 2019; pp. 121–149.
57. Ecorys; Deltares; Océanic Développement. *Blue Growth—Scenarios and Drivers for Sustainable Growth from the Oceans, Seas and Coasts. Final Report. Commissioned by DG. MARE*; Ecorys: Rotterdam, The Netherlands; Brussels, Belgium, 2012. Available online: https://maritime-spatial-planning.ec.europa.eu/sites/default/files/blue_growth_final_report_130920122.pdf (accessed on 12 December 2021).
58. European Commission. *The EU Blue Economy Report*; Publications Office of the European Union: Luxembourg, 2021.
59. European Commission. Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 Establishing a Framework for Maritime Spatial Planning, OJ L 257, 28.8.2014. pp. 135–145. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0089&from=EN (accessed on 12 December 2021).
60. Platias, C. Maritime Spatial Planning and Ports: Seeking Sustainable Solutions. In *Maritime Spatial Planning*; Serraos, K., Melissas, D., Eds.; Sakkoulas Publishing: Athens, Greece; Thessaloniki, Greece, 2018; pp. 103–124. (In Greek)
61. Pallis, A.; Papachristou, A.A.; Platias, C. Environmental Policies and Practices in Cruise Ports: Waste Reception Facilities in the Med. *Spoud. J. Econ. Bus.* **2017**, *67*, 54–70.
62. Wurzel, R.; Zito, A.; Jordan, A. Smart (and Not-So-Smart) Mixes of New Environmental Policy Instruments. In *Smart Mixes for Transboundary Environmental Harm*; van Erp, J., Faure, M., Nollkaemper, A., Philipsen, N., Eds.; Cambridge University Press: Cambridge, UK, 2019; pp. 69–94.
63. Moore, B.; Benson, D.; Jordan, A.; Wurzel, R.K.; Zito, A. Governing with multiple policy instruments? In *Environmental Policy in the EU*; Routledge: Abingdon, UK; New York, NY, USA, 2021; pp. 299–316.
64. European Commission. 2021-2027 Long-Term EU Budget & NextGenerationEU. Available online: https://ec.europa.eu/info/strategy/eu-budget/long-term-eu-budget/2021-2027_en (accessed on 17 December 2021).
65. European Commission. Communication COM(2019) 640 Final from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "The European Green Deal" (11.12.2019). Available online: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF (accessed on 12 December 2021).
66. European Commission. Communication COM(2020) 789 Final from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Sustainable and Smart Mobility Strategy—Putting European Transport on Track for the Future". Available online: https://eur-lex.europa.eu/resource.html?uri=cellar:5e601657-3b06-11eb-b27b-01aa75ed71a1.0001.02/DOC_1&format=PDF (accessed on 12 December 2021).
67. European Commission. Commission Staff Working Document SWD(2020) 331 Final Accompanying the Document Communication COM(2020) 789 Final from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Sustainable and Smart Mobility Strategy—Putting European Transport on Track for the Future". Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0331&from=EN (accessed on 12 December 2021).
68. Government of the Hellenic Republic. Greek Law 4832/2021 "Adoption of a Code of Legislation for the Integrated Maritime Policy for the Islands and on the Implementation Mechanism, State Aid and Supervision and General Conditions for Implementation of the Transport Equivalent" (GG Issue A 172/25-09-2021). Available online: http://www.et.gr/idocs-nph/search/pdfViewerForm.html?args=5C7QrtC22wEzH9d6xfVpRXdtvSoClrL8i2n7ZC8E30l5MXD0LzQTLWPU9yLzB8V68knBzLCmTXKaO6fpVZ6Lx3UnKl3nP8NxdnJ5r9cmWyJWelDvWS_18kAEhATUkJb0x1LIdQ163nV9K--td6SIuejD6cZNvQw17XMV6uHDseXp6awKFW_iZc1kEH-R3xtt (accessed on 12 December 2021).