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Seaports participation in enhancing the sustainable development goals

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ABSTRACT

The Sustainable Development Goals (SDGs) agenda encourages and establishes initiatives that are important to society. In this sense, it is vital and valuable to adapt these initiatives on a sectoral basis. Therefore, this study aims to handle sustainability issues at ports within the United Nations Sustainable Development Goals (UNSDG) framework. Two targets were set. The first target is addressing the attention of European ports' sustainability disclosures to SDGs. The second target is to develop a comprehensive framework of port related sustainability initiatives to support the achievement of SDG targets. This paper is based upon a qualitative content analysis study. To consolidate the best practices, European Ports were selected as the research area. First, this study contributes to the extension of the UNSDG and Global Reporting Initiative (GRI) indicator framework with port specific aspects. Therefore, it provides a comprehensive picture of port-related actions linked to each SDG goal. Secondly, it provides evidence of how European ports are aligned with SDGs. The results revealed that the port industry has the potential to contribute mainly to SDGs 8 Decent Work and Economic Growth; 9 Industry, Innovation and Infrastructure; 11 Sustainable Cities and Communities, 12 Responsible Consumption and Production, 13 Climate Action, and 17 Partnership.

1. Introduction

The 17 Sustainable Development Goals (SDGs) approved by the United Nations General Assembly in September 2015 represent today's most commonly acknowledged sustainable development agenda (Assembly, 2015). It is the first global set of goals addressing all three pillars of sustainability. It provides a legal framework within which governments, civil society, and corporations can plan, measure, and explain their contributions to sustainable development (Griggs et al., 2013). International Maritime Organization (IMO) has been emphasizing the importance of the shipping industry in achieving all SDGs by revealing its leading role in promoting worldwide trade and supporting global economic growth (Sciberras and Silva, 2018). As a part of the shipping industry, the port sector has a unique role in fostering sustainability. Over 80 percent of global merchandise trade by volume is carried out by ships (UNCTAD/RMT, 2020). There are numerous stops at ports along the way for these ships all around the world. The point where global trade and economy have reached today means we rely on ships and ports to transport goods from one point to another. Given their unique position in the shipping supply chain between different transportation modes, seaports are economic engines and gateways to trade (Hossain et al., 2019). This dependence and reliance on global shipping increase both the contribution and the externalities of the industry to sustainability on a local and global scale. Firstly, despite their economic importance, ports adversely impact the environment. The port industry is one of the fastest growing sectors causing environmental pollution (UNCTAD RMT, 2019; EPA, 2020). Secondly, some specifications such as the intensity of the workforce, contribution to economic growth, the connection, and relationship with cities yield a different degree in social and economic sustainability compared to other industries. Society increasingly expects ports to balance economic growth with social and environmental effects. Because the domain of a port economy is quite broad, it includes environmental management, land usage, emission and wastage management, energy resources, human resources, natural life, transportation and connections, education and knowledge sharing, local impacts, and port-city integration. Therefore, parallel with stakeholder theory (Freeman and Reed, 1983), ports have enormous potential to create value for their owners and multiple industries, groups, actors, and individuals.

However, although there are current studies examining shipping sustainability in the context of UNSDG (Sciberras and Silva, 2018; Wang et al., 2020, 2021), it is clear that there is a gap in port studies. Academic interest in port sustainability has different approaches with different viewpoints. Generally, the studies focus on only one pillar of sustainability: Environment (see Lam and Li, 2019; Hossain et al., 2019; Twrdy and Zanne, 2020; Schrobback and Meath, 2020). Although the studies

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dealing with the social dimension (see Bjerkan and Ryghaug, 2021) are more than those examining the economic dimension, the dominance is in the environmental dimension. There are, of course, plenty of studies that adopt the triple bottom line approach (See Lim et al., 2019; Ignaccolo et al., 2020; Kong and Liu, 2021; D'amico et al., 2021) in port sustainability. Nevertheless, there is still an absence of a comprehensive study taking the sustainability issue in the port industry based on Sustainable SDGs. Also, incorporating SDGs into companies' strategic management is critical to achieving sustainable progress; therefore, it is essential to offer sectoral-based internal actions (Tsalis et al., 2020). To fill this knowledge gap, this study aims to offer a simple and holistic sustainable seaport management practices framework compatible with the UNSDGs.

This study firstly addresses the attention of European ports' sustainability disclosures to SDGs. Secondly, it develops a comprehensive framework port related sustainability actions that can be implemented to support the achievement of SDG targets. This study is important because the active participation of various industries and business players is essential to achieve SDGs. There are two contributions of this study:

(1) It provides evidence of how European ports are aligned with SDGs.
(2) It provides a comprehensive picture of port-related actions linked to each SDG goal.

This paper is based upon a qualitative content analysis study. To consolidate the best practices, European Ports were selected as the research area. Because European ports are already integrating sustainable actions into their management strategies, investments, and operations. European Commission clearly expressed and put in practice (European Green Deal) the aim of mainstream sustainability in all policy fields with a specific focus on climate neutrality by 2050, circular economy, sustainable food systems, and biodiversity. Therefore, as in other fields, significant changes have also been required in how European ports (not only EU ports) operate, produce, market, consume, and trade. Regarding this, European Sea Ports Organization introduced a roadmap to implement European Green Deal objectives in ports (ESPO, 2020).

The remainder of this paper is structured as follows: Section 2 reviews the literature regarding sustainability in the port industry and enlists the research gap and contribution of this study. Section 3 discusses the research process followed in this study including sampling and qualitative data analysis. Section 4 presents the findings of each application carried out for the research targets. Section 5 puts forward the conclusions and implications.

2. Literature review

2.1. Sustainability: concept, definition, and application in port management

Elkington (1998) defines sustainability as a strategic consideration and attention of economic performance (profit) together with environmental effect (planet) and social impact (people), which is mainly referred to as the triple bottom line. United Nations Brundtland Commission famously defines sustainable development as '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (Our Common Future, 1987). In terms of definition and scope, sustainability goes beyond environmental care to also embrace the social initiatives for the well-being of employees, local communities, and society as well as financial performance (Vadakkepatt et al., 2021). The 17 goals comprise the SDG framework forming a transformative action plan to help nations achieve a more sustainable future by balancing their environmental, social, and economic development (Aly et al., 2022). The SDGs can provide an indication and measure of progress towards the main objective of sustainable development (Barbier and Burgess, 2017) and represent a shared expression of stakeholder needs at a global level and foster organizational operationalization and integration of sustainability (Fonseca and Carvalho, 2019; Fonseca et al., 2020). SDGs agenda encourages and establishes initiatives that are important to society. In this sense, it is vital and valuable to comply with the requirement of sustainable development for the business community (Tsalis et al., 2020).

Changing supply chain structures, dependence on shipping, and the growing volume of cargoes handled in ports rolled out a new wave of investments across the world (Notteboom, 2006; Chinemerem and Ogochukwu, 2018). Ports are not only economic hubs and engines for regional and global economies. Port surroundings also became an increasingly prominent factor in achieving sustainable growth (Sislian et al., 2016). Historically, economic goals such as cargo handling growth and profits have been the main focus of seaports. However, ports are increasingly tackling sustainability goals as complementary rather than competing goals. For example, the ports are evolving to digital nodes whereby the restriction of the physical document flow would positively impact the environment and lead to even higher energy. The Covid-19 pandemic also contributed to the acceleration of the digitalization process in ports. For example, the focus of companies in creating a new kind of operational performance and minimizing risks by improving their operations' resilience, emphasizing more on reliable and close than cheap suppliers, and ensuring high visibility and supply chain process improvements while accelerating end-to-end digital transformation (Fonseca et al., 2020). Another example, modal shift, increases the accessibility and reachability of the port area while reducing the lorry traffic on the city's main roads and the external impacts on climate.

Port management aims to achieve profits, profitable returns on investment, and growth, to maximize the performance and efficiency in the port operations, a value generated productivity, high-quality business services within the economic sustainability (UNCTAD, 2019; Lim et al., 2019; Ignaccolo et al., 2020). Social sustainability scope embraces the efforts of creating a healthy and dignified working environment, contributing to knowledge development and education, and the public's well-being in the port surrounding (Narula, 2014; Sislian et al., 2016). The environmental dimension of sustainability for port management implies reducing the emissions, noise, dust, waste, and dredging disposals, protecting the marine environment, greening the port facilities and equipment, reducing the energy consumption, and increasing the generation and use of renewable energy (Hossain et al., 2019; Twrdy and Zanne, 2020).

Researches in port sustainability have different approaches with different viewpoints. Ignaccolo et al. (2020) developed and tested an avoid-shift-improve framework to foster port economic, environmental and social sustainable development. Lim et al. (2019) used a systematic literature review to identify trends, measurement methods, and mechanisms for the implementation of strategy and policy in port sustainability area. Kong and Liu (2021) established an interaction model to associate port and city and proposed an index system including economic, environmental and social indicators. Schrobback and Meath (2020) conceptually developed a sustainability governance framework for ports and assessed the level of adoption of multiple sustainable strategy components by port in Australia and New Zealand.

Academic interest in port sustainability has not preferred much to address initiatives. For example, Molina-Serrano et al. (2020) harmonized and associated the main targets of four sustainability dimensions in the port industry. The authors used the targets (such as minimizing negative environmental impacts of port activity) instead of real applications (such as noise limitation measures). However, this trend is not specific to the port studies. According to Aly et al. (2022), most studies focused on policy changes and targets to achieve SDGs. Hence, this study focuses on the initiatives, activities, and actions applied to achieve the sustainability objectives of ports. For the objectives, this study uses the UNSDGs as a baseline.

In addition, in the literature, a significant interest has been devoted to environmental indicators and the environmental performance of ports (e.g. Hossain et al., 2019, Peris-Mora et al., 2005; Asgari et al., 2015; Twrdy and Zanne, 2020) in the port sustainability area. Indicators are much more quantitative to make them able to measure performance. However, quantitative analyses restrict the capability of expanding the sustainability applications. For example, both studies of Zhao et al. (2021) and Kong and Liu (2021) have considered all three pillars of sustainability. However, the sustainability factors they add to the analysis model are not comprehensive and sufficient, as they make quantitative analysis and need actual representative data. For instance, Zhao et al. (2021) applied the simulation method, and for economic sustainability, the research used only the efficiency of the customs clearance process while considering the quality of port infrastructure as a social dimension. Also, Kong and Liu (2021) handled container and cargo throughput, berth, crane, land, labor, and energy measures as sustainability factors. Therefore, the qualitative content of this study has a strong potential to contribute significantly to the literature. Although the current study does not present a measurable and comparable numerical analysis, it will contribute to the literature and the port industry with its comprehensive sustainability practices, projects, and strategies.

2.2. Port industry engagement with the SDGs

The SDGs agenda encourages and establishes important initiatives for society (Department of Economic and Social Affairs, 2020). The accomplishment of the SDGs is appraised at the national level; however, the private industry serves as a vital player in achieving the SDGs (Pizzi et al., 2020). Private industry can be an impetus or a handicap in achieving SDGs because it has the power to admit business and to impact society (Rauter et al., 2017). Therefore, the objectives of SDGs cannot be achieved without the collaboration of firms in terms of their externalities and contributions produced by their activities (Calabrese et al., 2021). The shipping industry plays a crucial role in fostering sustainable development. It is linked to each SDG since it supports global trade and facilitates the global economy. First of all, as stated by both IMO and academics, the maritime sector makes the most significant contribution to SDG 14, which concentrates on protecting and sustainable use of oceans, seas, and marine resources (IMO, 2018; Kronfeld-Goharani, 2018; Virto, 2018). Wang et al. (2020) investigated possible maritime industry fields that could contribute to the 17 SDGs. They analyzed the content of sustainability reports of shipping lines and terminal operators. The results revealed that the main contribution of the maritime industry is to SDG 8, followed by SDG 9 and SDG 11. Relatively small contributions are determined on SDG 13, SDG 16, SDG 12, and SDG 14. In addition, they determined the less relevant goals of SDGs (1-2-3-4-5-6-10-15) to the maritime industry, which reports devoted less than 3% of the contents. With ATM analysis, they found SDGs 8, 9, 12, and 14 most aligned with the core business of the maritime industry. Aside from SDGs strongly matched with the core business, the authors identified SDGs 2, 7, 13, and 16 that the maritime industry might help to succeed. Despite its considerable contribution potential, it is widely believed that IMO's actions and initiatives are insufficient compared to other UN Bodies (i.e., ILO, FAO) in terms of harmonization with sustainable development goals for the maritime sector (Sciberras and Silva, 2018).

For now, the literature does not present any academic research on the connection between port activities and SDGs. However, the port industry has practically started adopting the SDGs in its sustainability strategies. For example, the Port of Antwerp (the leading 13th container port in the world, UNCTAD RMT, 2020) built its sustainability policy and business plan around SDGs 3, 8, 9, 11, and 13 (health & welfare, work & economic growth, innovation, sustainable cities & communities, and climate action). World Sustainability Program, which was initiated in 2018 by the International Association for Ports and Harbours (IAPH), provides a growing portfolio of best sustainability practices by 71 ports worldwide. The Program introduced five sustainability themes for the port industry and absorbed the SDGs they relate to. The themes are Resilient infrastructure (SDGs 8, 9, 13, 14), climate and energy (SDGs 7, 9, 12, 13), community outreach & port city dialogue (SDGs 3, 6, 11, 14, 15), safety and security (SDGs 3, 4, 8, 16), and governance and ethics (SDGs 1, 2, 4, 5, 10, 16). Accordingly, ports have the highest level of activity on community outreach and port-city dialogue, followed by climate and energy and resilient infrastructure.

Today, it is the duty of all nations to achieve sustainable development goals globally. Failure of a single link in this global chain or not giving the critical importance will cause the desired goal not to be accomplished on a global scale. In this case, it is obvious that geographical location differences and the countries' level of development cause some advantages and disadvantages in achieving the desired goals (Kücükgül et al., 2022). For example, financial abilities, technological systems, and infrastructure capabilities play vital roles in achieving the SDGs, and developed countries have comparative advantages (Biglari et al., 2022). Seaports significantly impact economic, social, and regional balanced development in the coastal areas and hinterlands (Dwarakish and Salim, 2015). Therefore, the importance of ports and their potential contributions to the SDGs in leveraging the advantages of geographical location and eliminating the gaps in geographical disadvantages should be investigated more deeply.

2.3. Theoretical background

The above review put forward that ports, being the modal point of global supply chains, have the potential to create intense value not only for themselves but also for the micro and macro environment they are in, with the actors they interact with directly and indirectly (Caliskan and Esmer, 2020). Therefore, this paper utilized the stakeholder theory perspective to highlight the broader implications of achieving sustainability in the port industry. Stakeholder theory focuses on the relationship between an organization and the environment in which it operates (Freeman and Reed, 1983; Schrobback and Meath, 2020). According to the theory, the company's specific purpose should be to create value for the stakeholders by adjusting the interests of different stakeholders to create mutual benefits instead of weighting conflict of interest (Freeman, 2010). Hence, achieving sustainability in the port industry requires strengthening the sustainability interests of stakeholders, generating mutual sustainability interests, and acting together for sustainable development (Hörisch et al., 2014). Both the achievement of sustainability and its influence of it can not be thought of without the stakeholders of a port, such as; transport operators, forwarders, agencies, industrial companies, civil society organizations, community groups, press, legislation and public policy stakeholder, public, employees, shareholders and board members (Notteboom and Winkelmans, 2002).

3. Methodology

This study employs a content analysis method for collecting and analyzing the content of documentation (Lawrence, 2007). It is a technique to be used "*to provide knowledge and understanding of the phenomenon under study*" (Downe-Wamboldt, 1992). The analysis process is divided into two groups: Qualitative and quantitative. The qualitative content analysis classifies a large amount of data into an efficient number of categories (Weber, 1990). The quantitative content analysis uses a deductive approach to quantitatively measure the data (Scheufele, 2008). It is generally used to retest the existing hypothesis or theory in the literature (Elo and Kyngäs, 2008). In this study qualitative content analysis method was performed which deals with the meanings of the content and words rather than numbers (Elo et al., 2014).

Content analysis is a useful technique for seeing how the current order is and its harmony with the expected. It is a mostly applied method, especially for those declared in corporate reports. For the

subject of SDGs it is also preferred to encompass content analysis on companies' sustainability disclosures (Silva, 2021). For example, Fonseca and Carvalho (2019) applied a content analysis method to map the present level of engagement of Portuguese organizations with Quality, Environmental, and Occupational Health and Safety (QEOHS)-certified management systems in contributing and reporting to the 17 SDGs. Calabrese et al. (2021) also applied content analysis to reduce the number SDG indicators, including only the companies' internally actionable ones.

3.1. Sample

This study used secondary data to perform content analysis and finally to create a holistic UNSDG based sustainability framework in the port industry. In this regard, the Top 28 main European ports with TEU handling volume (Eurostat, 2021a) and the Top 33 main European ports with gross weight handling volume (Eurostat, 2021b) in 2019 were put together, and a total of 42 European ports became the sample of the study (Table 1). The table was constructed with the main ports which record annual handling of more than one million tons of cargo. Port of Bergen, Constanta, Gioia Tauro, Immingham, La Havre, Marseille, and Tees & Hartlepool do not have any sustainability disclosures. Port of Algeciras and Bilbao have sustainability disclosures but in their languages. Therefore 9 ports out of 42 were not included in the research. Thirty-three ports' sustainability disclosures were reached through their sustainability reports, environmental reports, corporate social responsibility reports, annual reports, and websites. To create the UNSDG basis, UNSDG Business Reporting, and World Ports Sustainability Report 2020 (WPSR, 2020) were used (see Fig. 1).

Table 1
Sample of the study.

Top Port Authorities (volume in TEU and gross weight)	Country	Top 28 European ports 2019 handling volume in TEU (.000) (rank)	Top 33 European ports 2019 handling volume in gross weight (.000) (rank)	Source of sustainability disclosure [a]	Pages
Algeciras	Spain	5125 (6)	89,905 (5)	SR 2016[b]	–
Aliaga	Turkey		64,922 (10)	CSR 2017	24
Ambarli	Turkey	3105 (10)	33,285 (27)	SR 2017–2018	108
Amsterdam	Netherlands		103,913 (4)	SR 2017	33
Antwerpen	Belgium	11,676 (2)	214,030 (2)	SR 2019	67
Barcelona	Spain	3313 (9)	54,709 (15)	SR 2018	181
Bergen	Norway		44,173 (21)	–	–
Bilbao	Spain	628 (26)		ER 2018[b]	–
Botas	Turkey		66,945 (8)	Website	8
Bremerhaven	Germany	4850 (7)	47,586 (19)	SR 2016 + ER 2018	243
Constanta	Romania	665 (25)	42,195 (23)	–	–
Dunkerque	France		42,558 (22)	ER 2016	16
Felixstowe	United Kingdom	3838 (8)		ER 2018–2019	16
Gdansk	Poland	1800 (16)	45,522 (20)	CSR 2017	30
Genova	Italy	2176 (13)	49,695 (18)	Website	5
Gioia Tauro	Italy	2982 (11)		–	–
Gothenburg	Sweden	763 (24)	38,891 (25)	SR 2017	62
Hamburg	Germany	9282 (3)	117,152 (3)	SR 2017–2018	123
Immingham	United Kingdom		54,081 (16)	–	–
Kocaeli/Izmit	Turkey	1715 (18)	71,359 (7)	Website	7
Iskenderun	Turkey		61,895 (11)	Website	2
La Havre	France	2763 (12)	60,172 (13)	–	–
La Spezia	Italy	1659 (19)		SR 2017	62
Las Palmas	Spain	1007 (22)		Website	14
Liverpool	United Kingdom	885 (23)		SR 2016	12
London	United Kingdom	1731 (17)	54,035 (17)	ER 2018	21
Marseille	France	1455 (20)	74,051 (6)	–	–
Medway	United Kingdom	113 (28)		SR 2016	12
Mersin	Turkey	1854 (15)		Website	2
Milford Haven	United Kingdom		34,951 (26)	ER 2019	50
Piraeus	Greece	5646 (4)	56,825 (14)	SR 2016	48
Riga	Latvia		30,625 (29)	Website	5
Rotterdam	Netherlands	13,493 (1)	439,631 (1)	AR 2017	22
Sines	Portugal	1423 (21)	38,907 (24)	SR 2015	111
Southampton	United Kingdom	1880 (14)	33,151 (28)	SR 2019	82
Tallinn	Estonia		19,635 (32)	AR 2019	134
Taranto	Italy		17,609 (33)	AR 2019	2
Tees&Hartlepool	United Kingdom		28,156 (31)	–	–
Trieste	Italy		60,333 (12)	Website	1
Valencia	Spain	5421 (5)	65,308 (9)	SR 2017	77
Wilhelmshaven	Germany		28,867 (30	SR 2019	68
Zeebrugge	Belgium	477 (27)		Website	1

[a] SR: Sustainability report; ER: Environmental report; CSR: Corporate social responsibility report; AR: Annual report.
[b] Spanish.
Source: Eurostat 2021a; Eurostat 2021b.

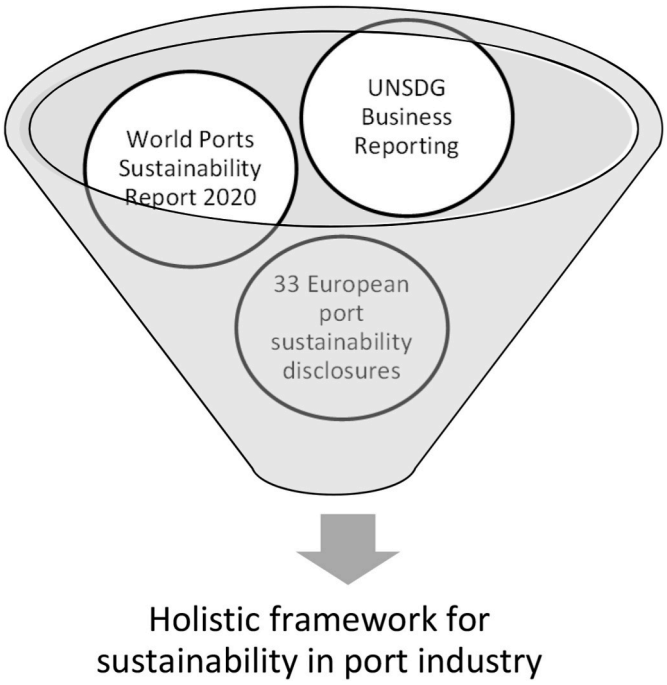

Fig. 1. Unit of analysis.

3.2. Initial coding

Because this study aims to develop a framework regarding sustainability in the port industry based on UNSDGs, a directed content analysis method was conducted as a first step of the research. Therefore, an initial set of nodes were constructed according to the UNDSDGs. "UNSDG Business Reporting" guide developed by GRI and United Nations Global Compact was used to extract the main themes, targets, actions, and concepts under the 17 sustainable development goals. It is a guide to assist businesses in integrating SDGs into their existing corporate responsibility and sustainability reporting programs. Therefore, it is an excellent resource to extract priorities and actions regarding sustainable development within the basis of commercial business. The document with 223 pages was analyzed manually, and 372 keywords and phrases relevant to 17 goals were coded via NVivo 11 Plus software (see Appendix A). 17 goals were coded as the main nodes, and keywords and phrases were coded as the sub-nodes.

After the initial coding process, a compatibility examination of ports' sustainability disclosures towards SDGs was performed. A text search query was applied for each word and phrase to discover if they are available in ports' sustainability reports. Frequency analysis was not conducted because some text around the searched word or phrase was unrelated to the SDG. For example, while searching the "food" sub-node under "SDG2 zero hunger", one of the resources contained the food word 17 times. 11 out of 17 were used in the tables and explanations of cargo handling part of the report, and 3 were used ecologically to define the foods of sea and land animals. Therefore, only the rest of the 3 was coded on the existing zero hunger sub-node. "Food" defining the food of land and sea animals was coded under "SDG14 Life Below Water" and "SDG15 Life on Land". Proper allocation of searched nodes within the reports of ports was achieved through references and word tree options of the NVivo software.

3.3. Open coding

After the initial coding process of content analysis and exploration of compatibility of ports towards SDGs, it was time to discover port related sustainability actions that can be coded as new sub-nodes under the main SDG nodes. Therefore, as the first step of open coding, the port related applications of the 17 UNSDGs of the World Ports Sustainability Report 2020 (WPSR, 2020) were coded directly under the main nodes as they are in the report. After, the sustainability disclosures of European ports were read line-by-line, and sustainability related all items were coded on the system. The coding action was carried out on NVivo software by highlighting the key items to capture the key actions and strategies (Hsieh and Shannon, 2005). 1121 nodes were identified within the disclosures.

3.4. Axial coding

The axial coding step of content analysis contains drawing connections between the codes determined in the open coding process. In this process, codes are read over, grouped, and abstracted under the SDG categories. The importance of axial coding is merging codes that closely resemble one another and/or eliminating meaningless ones. 1121 codes determined in the open coding phase were reduced to 783 codes in the axial coding phase by categorizing them under the relevant SDG.

3.5. Reliability

The content analysis was conducted by two coders (one independent coder) to reduce subjectivity, minimize different interpretations, and enhance the credibility of the study results. This process, called intercoder reliability (also known as interrater), is a must in content analysis to enable the reliability of the analysis. Accordingly, the reliability assessment process of this study consists of three stages (Burla et al., 2008):

- Development of the coding scheme which includes the name of codes, the definitions of codes, the example unit of analysis, and rules of coding procedure. The coding scheme was discussed firstly and then coded independently by two experts.
- Assessment of intercoder reliability by calculating the coders' agreement rates (see Table 2).
- Final review of codes and coding.

The original kappa formula introduced by Cohen (1960) was used to assess intercoder reliability.

A total of 783 codes were identified. Intercoder reliability was founded as k = 0.779725 which represents a substantial agreement between two coders according to Cohen' Kappa formula as indicated below:

$$k = (Pr(a) - Pr(e)) / (1 - Pr(e))$$

- P (a) represents the relative observed agreement among coders (142 + 582)/783 = 92, 46%
- P (e) the hypothetical probability of chance agreement (21,71 * 22,09) + (78,28 * 77,90) = 65,77%
- k= (0,9246–0,6577)/(1–0,6577) = 0.779725 = 77,97%

Table 2
Results of intercoder reliability.

CODER A					
CODER B		**0**	**1**		
	0	142	31	173	22,09%
	1	28	582	610	77,90%
		170	613	783	
		21,71%	78,28%		

4. Findings

4.1. Target 1: the attention of European ports to SDGs

With the raw data gathered through the initial coding process compatibility examination of ports' sustainability disclosures towards SDGs was performed. A text search query was applied for each word and phrase to discover if they are available in ports' sustainability reports. According to the content analysis results applied to 33 ports' sustainability disclosures, only 6 European ports directly referenced SDG goals. These ports are Ambarli, Antwerp, Barcelona, London, Hamburg, and Wilhelmshaven. So, it can be said that only 14% of European ports showed commitment to the SDGs through either explicit statements about the goals or implicit actions that support them. However, just because a port is not yet communicating on the SDGs, does not mean they are not focused on sustainability. Instead, the rest of the European ports only mentioned content relevant to the SDGs by not communicating their commitment to the SDGs.

Fig. 2 vertically shows which and how many ports have mentioned each sustainability goal individually. Industry, innovation, and infrastructure (SDG9), responsible consumption and production (SDG 12), and Climate Action (SDG 13) are the most disclosed goals respectively by the European ports. Therefore, it can be said that the port industry leads on the commitment to SDG 9, 12, and 13. The least mentioned SDGs are Gender equality (SDG 5), Zero Hunger (SDG 2), and No poverty (SDG 1), respectively. Overall, some SDGs have visibility in more sustainability disclosures due to legal requirements in the maritime industry to address these issues (specifically, Responsible Production and Climate Action). Others receive less visibility due to industry differences (specifically, Zero Hunger and No Poverty). Commitment to other SDGs (i.e. well-being, quality education, clean water, life on land) is widely seen but overshadowed by other SDGs. The figure also horizontally exhibits which sustainability goals ports are mentioning. Ambarli Port, Port of Barcelona, Port of Bremen, and Port of London highlight a strong commitment to SDGs by mentioning all the SDG related targets in their sustainability disclosures. To compare the extent of SDG commitment of ports a scale (1–6 goals = low, 7–12 goals = medium; 13–17 goals = high) was developed by summing 17 SDGs. Ports of Zeebrugge, MIP, Iskenderun, Trieste, Dunkerque, Taranto, Genoa, and Riga are low performers in terms of SDG compliance. Ports of Botas, Felixtowe, Kocaeli, La Spezia, Las Palmas, Liverpool, Medway, Rotterdam, and Southampton are medium performers. Ports of Aliaga, Ambarli, Amsterdam, Antwerp, Barcelona, Bremen, Gdansk, Gothenburg, Hamburg, London, Milford, Pireus, Sines, Tallinn, Valencia, and Wilhelmshaven are high performers in SDG compliance.

4.2. Target 2: SDG based port related sustainability actions

The content analysis results reveal a very heterogeneous distribution of port activities along the SDGs as well as a significant correlation between the goals that ports frequently address together. In the axial coding process, totally 783 codes (port sustainability actions) were determined. The number of actions in Table 3 is not the same for each SDG. SDG12 (responsible production and consumption) and SDG8 (decent work and economic growth) include the largest number of port specific sustainability actions, for a total of 98 and 97 actions, respectively.

In this part, the general UNSDG based sustainability framework for ports is displayed in Tables 4 and 5. These tables involve the headers of each sustainability action. The details about each SDG and each header are explained related to port industry.

1. *No poverty:* The goal includes targets to reduce the proportion of poverty worldwide. The contribution of the port industry to the goal of reducing poverty is realized in various and different ways. One way is adapting a fair-trade policy which requires fair payment for services and transparency. The aim is to achieve a sustainable and equitable trade relationship. Helping and advancing the development of ports in emerging countries includes practices on coaching on sustainable development methods, improving efficiency, supporting the infrastructure, and providing the necessary help for training. Corporate social responsibility efforts

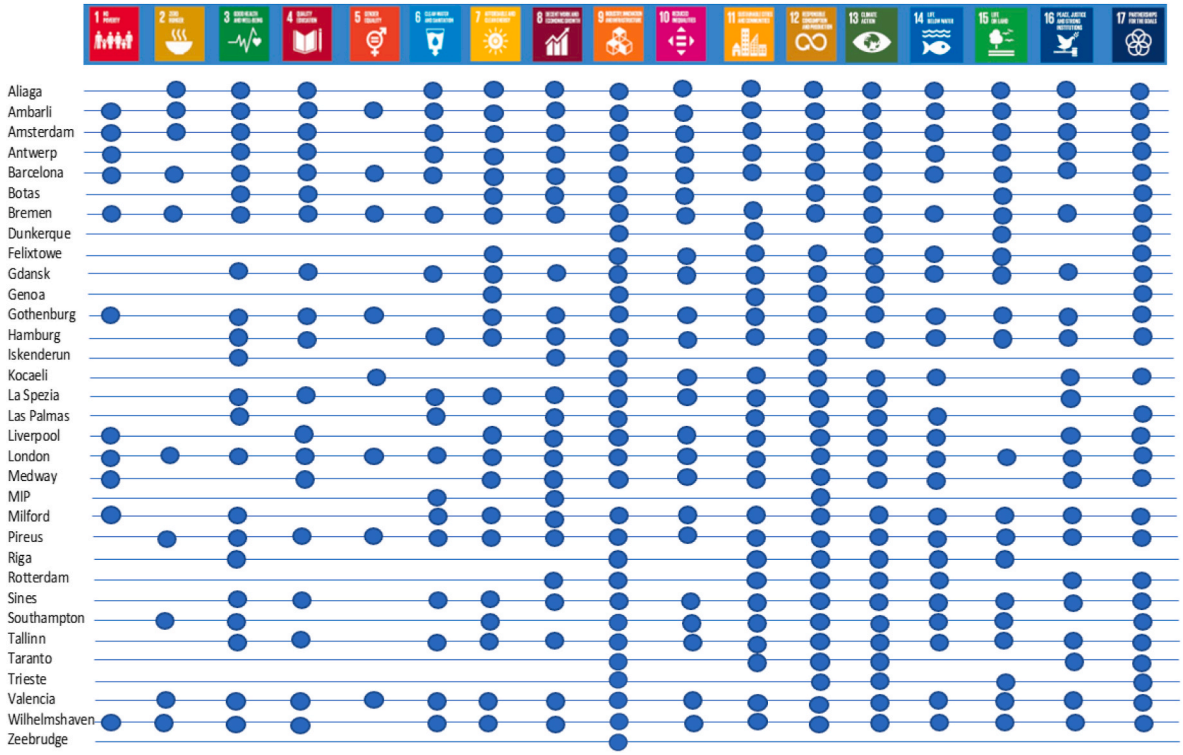

Fig. 2. SDG targets mentioned in ports' disclosures.

Table 3
Number of Port Sustainability Actions for each SDGs.

SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9
32	11	48	20	9	21	47	97	60
SDG10	**SDG11**	**SDG12**	**SDG13**	**SDG14**	**SDG15**	**SDG16**	**SDG17**	**Total**
37	65	98	70	29	34	19	75	783

Table 4
Port sustainability actions within the SDG framework.

SDG 1 No poverty	SDG 2 Zero hunger	SDG 3 Good health and well being	SDG 4 Quality education	SDG 5 Gender equality	SDG 6 Clean water and sanitation
Fairtrade policy	Foodbank activities	Corporate social responsibility	Cooperation with educational entities	The attractive working environment for women	Clean sanitation facilities
Advancing the development of emerging ports	Food security	Enhancing port safety and security	Apprenticeship	Gender balanced positions	Collectors and pumping stations for port water sanitation
Corporate social responsibility	Sourcing Fairtrade food products	Hygiene at work	Competence and talent policy for port employees	Gender-neutral hiring	Control of pollution through all activities
Decent work	Supporting the trade of agricultural products for charity purposes	Improving health and safety awareness	Life-long learning for port employees	Gender-neutral salary	Dredging as a last resort
Job creation	Sustainable agriculture	Minimizing environmental externalities	Financial sponsorship for educational activities		Drinking water supply
		Occupational safety and health protection	Helping companies to align their training needs with curricula designed and taught at training centers.		Harvesting rainwater for port use
		Promoting a culture of healthy living at work	Personnel development		Protecting freshwater resources
		Quick access to medical services at work			Protecting water-related ecosystems
		Reconciliation of family and working life			Reducing water consumption
		Restoring and protecting ecosystems			

Table 5
Port sustainability actions within SDG framework (*cont.*).

SDG 7 Affordable and clean energy	SDG 8 Decent work and economic growth	SDG 9 Industry innovation and infrastructure	SDG 10 Reduced Inequalities	SDG 11 Sustainable cities and communities	SDG 12 Responsible consumption and production
Climate change adaption plan	Achieving economic growth	Balanced modal split	Corporate social responsibility	Corporate social responsibility	Balanced modal split
Encouraging third parties for clean energy initiatives	Being a driver of economic development	Ensuring customer satisfaction	Equal career opportunities	Decent working conditions	Environment monitoring
Energy saving	Compliance with legal requirements	Investment in port infrastructure	Equal money for equal work	Minimize environmental externalities	Environmental management
Providing cleaner fuels	Enhance the competitiveness of the port	Investment in port processes	Equal treatment of people	Minimize nuisance	Optimizing freight traffic to and from the port
Renewable energy	Events	Optimizing freight traffic to and from the port	Ethical working place	More accessible port for society	Reduce consumption
	Inclusive employment	Public and private investment	Inclusive employment	Port security	Renewable energy
	Occupational safety and health protection	Renewable energy		Protecting nature reserves	Responsible procurement
	Responsible procurement	Sustainable port development projects		Reduce port related traffic congestion	Transition to a circular economy
	Rights granted to employees	Transition to a circular economy		Responsible procurement	Waste management
	Secure port			Short sea shipping	
	Services for crews			Sustainable mobility	
	Working conditions at the port				

differ in themselves. It involves donations to foundations, no port fee for outgoing or incoming charitable cargo, and financial and logistical support for NGOs, museums, orphanages, and schools. Having an anti-bribery policy and anti-modern slavery statement and a living wage scale are the decent work factors advancing the no poverty goal. Lastly, the port industry's most vital contribution to the SDGs' first goal is the direct and indirect job employment it creates.

2. *Zero hunger:* Zero hunger related activities of ports, especially in terms of the ports' activities, functions, direct contributions are somewhat limited. They are mostly social responsibility projects. Foodbank activities include food donation, logistical support (i.

Table 6
Port sustainability actions within SDG framework (*cont.*).

SDG 13 Climate Action	SDG 14 Life below water	SDG 15 Life on land	SDG 16 Peace justice and strong institutions	SDG 17 Partnership for the goals
Balanced modal split	Clean-up actions	Compensatory areas	Cyber security measures	Charitable initiatives
Climate change plans	Dredging with care	Habitat management	Anti-bribery policy	Cooperation with educational entities
Emission reduction technologies	Protecting water ecosystem	Minimize environmental externalities	Anti-modern slavery statement	Cooperation with other ports
Encouraging third parties for clean energy initiatives	Supporting researches on sustainable marine resources	Minimize nuisance	Anti-corruption and compliance	Development of sustainable strategy with stakeholders
Energy saving in operations	Water pollution prevention	Nature and environmental education programs to employees	Codes of ethics	Host activities organized by other organizations
Optimizing freight traffic to and from the port	Encouraging green shipping with incentives	Nature conversation	Commitment to zero tolerance	International sectoral initiatives
Reducing consumption		Nature improvement	Constructive dialogue with employees	Joint job training programs
Renewable energy		Port area development in balance with ecosystems	Customer privacy and claims handling	Joint research and development projects
The signing of and adherence to voluntary agreements on climate change		Wildlife protection	Good governance	Participation in international projects
			Maintaining relationships with local residents	Partnering with other parties in the logistics chain
			Open dialogue and collaboration with all stakeholders	Partnerships with NGOs
			Peace initiatives	Partnerships with local communities
			Supplier code of conduct	Presence in fairs
			Transparent internal and external communication	Public private partnership
				Sponsorships and donations
				Stakeholder communication platforms

e., food collection, food distribution, food storage), and encouraging the transfer of food surpluses out of the warehouses. The other contributions are achieving food security, sourcing fair trade food products for own catering, supporting the trade of agricultural products for charity purposes, and supporting sustainable agriculture.

3. *Good health and well-being:* Corporate social responsibility activities such as donating hygiene products to charitable organizations can be applied. Enhancing port safety and security and minimizing risks involves for example certified occupational hazard prevention management systems, measures for reducing job accidents, and employment of port police. The other activity is improving port employees' and local communities' health and safety awareness through training and transparent communications. Minimizing environmental externalities, for example, preventing air and water pollution, limiting the noise through noise maps, and adapting and generating a balanced modal split is the basic sustainability action of ports that directly impact the good health and well-being goal of the UN. Promoting a culture of healthy living at work includes actions such as mental health first aid training, drugs, and alcohol policy for staff and operators, raising awareness and actions against the use of addictive substances (e.g. tobacco, alcohol, drugs). Quick access to medical services at work involves ambulance service, boosted access to automated external defibrillators, Medical Emergencies System (SEM). Reconciliation of family and working life is a vital policy for improving port employees' good health and well-being through operationalizing the policies regarding childcare, maternity leave, parental leave, teleworking, and working time models. Restoring and protecting ecosystems also directly impact the well-being by greening the port area and protecting habitats and biodiversity in and around the port.
4. *Quality education:* Apprenticeship programs, competence and talent policy for port employees, cooperation with educational entities for example with schools, universities, and research centers by offering them educational programs, funding, internships, port visits, school excursion, participating in port research projects and development projects and enhancing life-long learning for the employees through continuous training. The other activities are financial sponsorship for educational activities and helping companies align their training needs with curricula designed and taught at training centers. Personnel development is another sustainability concept that the ports emphasize. They can offer interdisciplinary courses, new leadership skills, and training to port professionals through dedicated institutions, professional qualifications, and professional technical courses.
5. *Gender equality:* Crane operator, leveling the female-male ratio of port employees for operational and managerial positions, minimizing gender pay gap, training and promoting women for leadership roles, managerial positions and operational positions, gender-neutral hiring, gender-neutral salary, and attractive working environment for women which includes family-friendly HR policy, flexible working conditions, and separate toilets.
6. *Clean water and sanitation:* Harvesting rainwater for port use, protecting water-related ecosystems such as estuaries, mangroves, and wetlands, protecting freshwater resources by stormwater treatment and wastewater treatment, investing and managing the collectors and pumping stations for port water sanitation, dredging as a last resort, controlling pollution through all activities, supplying drinking water for port employees, crew, and truck drivers, and providing clean sanitation facilities. Reducing water consumption through a drip irrigation system, irrigation system with counters, plants with few irrigation requirements, wastewater treatment, and water efficiency measures.
7. *Affordable and clean energy:* Renewable energy includes biogas, biomass, hydrogen, generation of renewable sources of energy,

intelligent management of supply and demand for renewable energy, producing and recovering energy from industrial waste streams, providing onshore power supply from renewable sources, renewable energy storage systems, reuse residual heat, solar power, supporting research and development on clean energy technology, wind energy. Energy-saving aim involves several categories. The first one is energy saving in lighting. The reports of European ports show that they achieve this saving through demand-oriented lighting, modernization of the public lighting network, movement sensors, and new lighting technologies (intelligent lighting, LED, LEP). The second one is energy-saving in operations. Energy savings in port operations can be achieved in various ways. For example, purchasing and using energy-efficient port equipment, increasing the energy efficiency of ACs in buildings, optimizing port services, reducing heating consumption, and training for energy efficiency. The third one is reducing fuel consumption through incentives for ships and bonus systems for cleaner ships, mobility with electric vehicles, promotion of gasification by LNG and CNG supply station, using natural gas as a mobility fuel, and transformation of port equipment to natural gas. The last action is encouraging third parties for clean energy initiatives by offering ESI discounts, granting environmental discounts, promoting LNG as an alternative fuel, providing services to reduce greenhouse gas emissions such as LNG bunkering and shore power, and by rewarding clean shipping. In addition, this goal includes providing safe and efficient cleaner (marine)fuels, and a climate change adaptation plan.

8. *Decent work and economic growth:* Decent work and economic growth goals are one of the UN goals the port industry is most likely to contribute. Under the head of achieving economic growth, the ports promote short sea shipping, generate a sustainable model for cruise tourism, and achieve sustainable economic growth, including environmental and social growth. The ports also should be the primary driver of the economic development of the maritime cluster, non-maritime cluster, industry, and the region. This can be achieved by attracting more manufacturing companies and industry, increasing the share of city and country in foreign maritime trade, strengthening the local cargo volume, tracking and announcing the growth rate of goods handling, and shipping traffic, analyzing the economic impact, direct and indirect added value, GDP and GVA, and employment. Carrying out an inclusive employment policy is another contribution of ports to the 8th goal. Employment of disadvantaged groups, older people, people with disabilities, poorly educated individuals, younger people, and intercultural openness are the elements of inclusive employment the ports mentioned. Creating decent working conditions for employees is an issue that concerns ports as well as any workplace. Working conditions at the port should be ergonomic, healthy, family-friendly, and ethical. Besides, it should include a good work-life balance, respect for human rights, improve the accessibility of port for employees, and have a channel to address complaints about non-compliance with labor regulations. The ports must provide useful facilities and services not only for the port workers, but also for the ship crews calling at the port, such as accommodation, financial aid and free tickets, information, publications, maps of the city and the port, legal consultancy service, medical service, religious materials, and priest visiting, sports organizations, telephone, the club for seafarers with a bar, games, an Internet connection, telephones, a currency exchange, a chapel, a library, and a bazaar., transport service to the city free of charge, and Wi-fi. The events to be organized throughout the port will also have the power to motivate and integrate both port workers, visitors, and locals. Port festivals, “Health Days”, “Family Days”, religious celebrations, Seafarers events, “The IMO’s Day of the Seafarer” are some examples of these events. Apart from legal obligations, the port’s granting of privileged rights for its employees is also of the nature to take decent working conditions to the next level. Rights granted to employees are abstaining from the salary deduction for those who are on maternity leave, chocolates during religious festivals and holy days, gift vouchers or special gifts for special days, granting more annual leave than the legal minimum, life insurance, private health insurance with family coverage, and seniority rewards, financial contributions upon marriage, births, and deaths. Occupational safety and health protection, a legal obligation, also serves the UN’s 8th goal. Within this training on occupational safety, analyzing causes of accidents, preventive medical check-ups, and safe work environments such as minimized occupational accidents, safety managers, and zero fatalities) are the actions the ports apply. In addition to safety, it is also vital to provide a secure port for the employees, the people of the region, and the country and the region. The secure port requires the control of criminal and suspicious cases such as drug smuggling, human traffic, illegal transport, and loading theft, disaster recovery planning, ISPS Code, safe access to public spaces, security network (customs, disaster coordinators, police, security officers), the security of goods and passengers. Responsible procurement also serves economic growth, including purchasing criteria such as environmental, social, or sustainable, and focuses on local suppliers. Enhancing competitiveness is important to ensure economic growth positively impacts local communities. The last one is to comply with and fulfill the legal obligations of decision-makers, executives, and controllers (i.e. IMO and ILO).
9. *Industry, innovation, and infrastructure:* Enabling a modal split action is about giving importance to alternative transportation modes other than the road. Firstly, it focuses on promoting the use of alternative inland navigation (water, pipeline, rail) to and from the port. To be an incentive in this regard, ports need to make some investments. Developing a corridor system for inland waterway and greater river use, investment in railway infrastructure, superstructure, improving rail links, modernizing and railway signaling, and taking over the management of part of the pipeline network are some actions that ports can implement to promote inland navigation with other modes. To achieve industry development the ports also need to ensure customer satisfaction through an exceptional customer service department, reliability in operations and vessel services, and transparency. Investment in port infrastructure involves improving the capacities of the container, gate, storage, terminal, and warehouse as well as the port connections. Of course, infrastructure investment alone is not enough. Service investment, which is the main product of the port industry, is as important as infrastructure. Investment in port processes includes industry 4.0 applications such as autonomous vehicles, blockchain technology, knowledge database, and data sharing platforms like e-commerce platforms for all stakeholders, digitally optimized infrastructure and port operations, processes, and services, drones, IoT, and smart inspections. It also includes integrated logistics activities and investment in research and development.
10. *Reduced inequalities:* The actions are basically divided into two categories. Employment-related actions and social responsibility-related actions. The first one interests in supporting socially sensitive groups by adapting inclusive and diverse employment policy, equal treatment in terms of salary and career opportunities, and prevention of discrimination. Social responsibility includes social projects including supports for children, schools, NGOs, and orphanages targeting sustainable growth of communities.
11. *Sustainable cities and communities:* According to the IMO’s statement, the maritime industry’s contribution to achieving sustainable cities and communities is to create secure supply chains.

However, since ports operate intertwined with cities, their role in this goal is much greater than shipping. Declarations of ports concerning this goal are; ensuring port security through risk management, ISPS Code, and other threat transferring methods; taking role in social responsibility projects with donations, financial and logistical support to NGOs, museums, orphanages, and schools, minimizing environmental externalities such as air pollution, land consumption, discharges, and water pollution; protecting nature reserves; minimizing nuisance to the local area for example dust, light, and noise by operationalizing the noise map, investing in electric vehicles, and applying audibly fewer projects. In addition, engaging in activities that will interest the region's people, in short being a more accessible port for society, appears as a way to achieve this goal. Community engagement programs and initiatives, cultural uses, recreational uses, and tourist uses are examples of the ports concerning this issue. Furthermore, reducing port-related traffic congestion, adapting responsible procurement, promoting short sea shipping, and providing sustainable mobility opportunities for both passengers and employees are among activities that can be carried out specific to the port that contributes to this goal.

12. *Responsible consumption and production:* Although the ship, ship recycling, ship construction sides of the maritime industry is more of a concern, the contribution of ports in achieving this goal cannot be ignored. The activities compiled as a result of content analysis to achieve the 12th goal are pretty comprehensive. As a service facility, the primary task of ports is to act as a link between transportation modes. Therefore, providing a balanced modal split infrastructure of a port that adopts the philosophy of responsible production directly serves this purpose. Examples include developing a corridor system for inland waterways, investing in railway structures, promoting the use of inland navigation, and taking over the management of part of the pipeline network. In addition, optimizing freight traffic to and from the port by enabling cooperation between carriers to prevent empty truck trips, new access connections to the port, night logistics, and up-to-date information on the alternative routes to the port. Environment monitoring of greenhouse gases (BTX analyzer, eco calculator, ozone analyzer, sensors for PM10 and PM2,5), habitats, flora, fauna, land consumption, noise, port lighting, sediment quality, and water quality; having an environmental management system includes independent external auditor, PERS, and sustainability management staff. Reducing consumption is one of the most basic targets of this goal. What has already been done to reduce consumption in the port can be classified as follows: (1)Energy-saving in lighting, (2)Energy-saving operations, (3) Reducing fuel consumption, (4) Reducing water consumption. Energy saving in lighting is achieved through demand-oriented lighting, modernization of lighting networks, movement sensors, and new lighting technologies such as intelligent lighting systems, LED, and LEP. Energy-efficient port equipment and buildings, optimizing port services, reducing heating consumption, and training for energy efficiency are the actions applied for energy saving in operations. Reducing fuel consumption activities take place in two legs. The first is in the port area by providing mobility through electric vehicles and transforming port equipment into natural gas. The second is for ships by giving incentives and bonus systems for cleaner ships and providing LNG and CNG supply stations to promote gasification. Reducing water consumption activities involve drip irrigation systems, irrigation systems with counters, wastewater treatment, and water efficiency measures. The other significant contribution of ports is to use renewable energy, such as biogas, biomass, hydrogen, solar power, and wind energy. In addition, providing onshore power supply from renewable sources, renewable energy storage systems, reuse of residual heat, generation of renewable sources of energy, intelligent management of supply and demand for renewable energy, and support research and development of clean energy technology. Responsible procurement includes procurement according to the environmental, social, and sustainable criteria and local suppliers. Transition to a circular economy includes being a recycling hub, exchanging industrial (residual) flows, reusing the wastes by other companies, and sharing logistics facilities. Waste management includes disposal of own waste, increasing the amount of recycled waste, reducing total waste production, ship-generated waste management, waste separation, and working in partnership with other waste treatment companies.
13. *Climate action:* Climate action plans and activities of ports coincide with the activities of other SDGs (such as Goal 12). The specific target of ports for this goal is to become climate-neutral by 2050. Therefore, ports focus on energy transition, balanced modal split, circular economy, greening the shipping, onshore power supply, and digitalization are to contribute to Goal 13.
14. *Life below water:* This goal interests conserving and sustainably using the oceans, seas, and marine resources for sustainable development. Ports' contribution to this goal is all related to the port area. For example, ports perform clean-up actions such as collecting floating waste-litter with collectors, remote systems, and/or artificial intelligence, oil spill clearance and sorting industrial, maritime, and inland wastes. Specifically, port specific action is dredging with care through dredging management systems by applying biological mapping and reducing the dredging volumes. The other contribution might be protecting the water ecosystem by using biocide-free underwater paints for the port fleet, control of the introduction of invasive species, minimizing the underwater noise for marine mammals, and promoting sustainable fishing activities such as preventing fishing for litter. Ports also do have the responsibility to prevent water pollution. Collectors and pumping stations for port water sanitation, control of risky operations for water quality, monitoring sediment quality, water quality, and embodying port reception and wastewater treatment facilities are actions of ports to protect water quality. Particular efforts are also made to encourage green shipping and support research on sustainable marine resources.
15. *Life on land:* This goal is about protecting, restoring, and promoting sustainable use of terrestrial ecosystems, forests, combating desertification, and halt and reversing land degradation, and halting biodiversity loss. Although it is limited, ports also have some contributions to this goal because they are located on the land area. The indirect contributions come from the activities achieved for minimizing environmental externalities such as preventing air and water pollution, as discussed in detail above. The direct contributions stem from nature conservation activities, for example, protecting flora and fauna in the vicinity of ports, recovering and protecting nature and biodiversity in the port surroundings, renaturation of special habitats, and restoration of biodiversity. Port area development in balance with ecosystems is another direct contribution. There are also specific activities ports might perform under corporate responsibility projects such as improving the tidal natural habitat, reintroducing the peregrine falcon, remediation actions, and supporting local projects regarding nature development and biodiversity.
16 *Peace, Justice, and Strong Institutions:* Appropriate port governance has the potential to promote just, peaceful and inclusive societies. However, the actions achieved in this goal are not totally related to port specific context. It can also be generalized to other industries and corporations. Anti-bribery policies, anti-modern slavery statements, codes of ethics, commitment to zero tolerance, cyber security measures, and supplier code of conduct are some generic examples. In addition, maintaining relationships with residents through direct contact, publications, social media

channels, themed information events, and websites and having a transparent internal and external communication system are the applications of ports to achieve Goal 16.

17 *Partnership for the goals:* This goal is used to achieve partnership strategies for specific goals that are intended to achieve. The content analysis results revealed that the port industry tends to collaborate with many stakeholders towards the achievement of the 16 goals, in addition, to striving to become a member of agreements and conventions in this regard. Ports can achieve much more when they work in partnership with their partners who operate in and out of the port, and with the broader city. They dialogue with and bring together city councils, country councils, freight companies, international organizations, educational entities, NGOs, and people.

5. Conclusions

It is highly emphasized that the private sector has an essential role in achieving the SDGs. Therefore, each study focusing on one sector is highly valuable because offering an implementation path by relying upon the core business activities to engage with SDGs at the corporate level. This study introduces port specific sustainability actions related to each 17 SDGs. The initial, open, and axial coding processes have revealed the activities ports can implement within the framework of UNSDG. The resulting content can be used in the sustainability reporting and communications of ports. It is a valuable outcome since it is challenging for companies to use current guides to obtain the highest benefits for fulfilling corporate sustainability targets and provide valuable reporting on these for its stakeholders (Kücükgül et al., 2022). The ports can improve their contribution to SDGs by following various actions presented in this study and catching new synergies. However, at this point, it is also vital to understand the nature of interdependencies among the SDGs because some goals can reinforce each other. In addition, this study has an explorative nature. In the future, the studies may investigate the business priorities of ports regarding UNSDG by focusing on impacts and opportunities. A study may be conducted to measure the most significant impacts of port functions on each SDG. In addition, an engagement survey might be implemented.

6. Discussion

In this study, the contributions of the port industry to all SDGs are synthesized. After a detailed content analysis on both UNSDG documents and the sustainability discourses of ports, it has become possible to draw a series of inferences for the issue of sustainability in the port industry based on SDGs. Firstly, although it is stated that (IMO, 2018; Virto, 2018) the primary contribution of the entire maritime industry is for the SDG 14 (Life below water), it can be deduced from this study that this is not the primary contribution of the port sector due to its unique characteristics. As a result of the first analysis to figure out the attention of European ports to SDGs, the primary contribution of the port industry is to SDGs 9, 12, and 13. However, the second detailed content analysis revealed that in terms of their capabilities to achieve special to the port policy, management, and operations, the port industry has the potential to contribute mostly to SDGs 8 (decent work and economic growth), 9 (industry), 11 (sustainable cities), 12 (responsible production), 13 (climate action) and 17 (partnership). Secondly, since ports are connected with cities, every activity carried out within the scope of sustainability (social, environmental, or economic) directly or indirectly serves the Sustainable Cities and Communities (SDG 11) goal of the United Nations. Third, ports can potentially contribute to sustainability on a large scale. For example, enhancement of intermobility (a balanced modal split), encouraging third parties for clean energy initiatives (rewarding clean shipping, promotion of alternative fuels, etc.), transition to a circular economy (e.g. being a recycling hub, sharing logistics facilities, reusing the wastes of other parties) are actions currently applied by European ports which extent the impact of sustainability to the local and global supply chains. Improved port sustainability trickles down to every part of the global supply chain since ports are binding sites of linkage where cargo is moved between ships, trains, and trucks.

In addition, it is also vital to point out that port industry related sustainability actions are related to each other at some point. In other words, some SDGs are intertwined. For example, energy reduction initiatives (e.g. energy saving in lighting and operations, reducing fuel consumption), using and generating renewable energy (Biogas, biomass, hydrogen, solar power, wind energy, etc.) concern SDG 12 (Responsible consumption and production), SDG 13 (Climate Action), SDG 7 (Affordable and clean energy), SDG 9 (Industry, innovation, and infrastructure), and SDG 11. In addition, employment and working conditions related sustainability actions (e.g. training, lifelong learning, job creation, occupational safety and health protection, inclusive employment, rights granted to employees, equal payment, equal career opportunities, ethical standards, work-life balance, gender balanced positions, etc.) are of interest to SDG 1 (No poverty), SDG 3 (Good health and well-being), SDG 4 (Quality education), SDG 5 (Gender Equality), SDG 8 (Decent work and economic growth), SDG 10 (Reduced inequalities), SDG 11, and SDG 16 (Peace, Justice and strong institutions). This finding also contributes to the late literature where synergetic relationships among the 17 SDGs have been discussed (see Zhu et al., 2022; Fonseca et al., 2020).

If the presented sustainability actions of ports are evaluated it in terms of UNSDG compliance and contribution, we can deduce that ports can basically engage in 3 types of activities. The first one is adapting and implementing sustainability actions within the port area and port operations (e.g. using environmentally friendly fuel in port equipment). The second is partnering with third parties to enhance sustainability within and outside the port area (e.g. sharing logistics facilities). The third is the sustainability activities carried out under the corporate social responsibility projects, independently and separately from the port location and services (e.g. donations to foundations).

A few other issues stand out by making a difference in this study, which was prepared specifically for the port sector. The academics (Le Blanc, 2015; Szennay et al., 2019; Calabrese et al., 2021) have a common view that the private sector cannot directly contribute to the climate action goal (SDG 13) through activities realized within their value chains. However, the results of this study show that the port industry has the capability to serve climate action goal due to its unique characteristics and multi-stakeholder field of activity.

This study also offers a comparison chance with other sectoral SDG studies. For example, the results of providing more information about the actions that contribute to the SDG 9 and SDG 13 are similar to the study of Tsalis et al. (2020) where the authors examine the sustainability disclosures of Greek finance companies. Both studies are in common in revealing that both ports' and finance companies' reports fail to inform about corporate policies of disposing of corruption incidents and action to protect human rights (SDG 16). In addition, the ports have the capability to make major contribution to achieving the SDG 8 and SDG 12. This result is consistent with Calabrese et al., (2021) conclusion that the companies' achievement of SDG 8 and SDG 12 exceeds that of other SDGs.

CRediT authorship contribution statement

Aylin Caliskan: (single author), Writing – review & editing, Visualization, Resources, Formal analysis, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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