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Overview of status and priorities for sustainable management of European seaports

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ABSTRACT

In the past decade a strong commitment in terms of environmental protection and sustainable development in port sector is noted. In order to achieve and maintain the environmental performance of port it is necessary to establish guidelines and priorities. This paper presents status and priorities which are marked within the European port sector through ESPO's Ecoports environmental reports for the period 2013-2018. The change of environmental priorities in the port sector over the years has been noticed and therefore potential reasons for priority changes are addressed in this paper. The general aim of set priorities is to provide information about the high priority environmental issues and thus set the framework for guidance and initiatives that influence the environmental performance of the port. The analysis indicates that most of European ports actively work to protect the environment and thus guarantee sustainable development. From 2016 to 2018 the top 3 priorities have been the same (air quality, noise and energy efficiency), while air quality has remained the number one priority of the European ports since 2013. It is interesting to highlight that climate change priority which has been introduced in 2017 has been rapidly climbing the ranks and went up by 3 places in 2018.

1. Introduction.

In recent years, in all industries and thus in the transport and port sector, the sustainability has been the core of development. It is commonly said that there is no prosperity without business and that there is no business without transport. Hence, in terms of sustainability and the impact of transport on the environment, as an environmentally friendly mode of transport, maritime transport plays a decisive role. According to the most recent report from UNCTAD (2019), in 2018 world seaborne trade gathered momentum with total volumes of 11 billion tons (UNCTAD, 2019). In the world seaborne trade, ports precisely, have a crucial role and good organization of the port system is the key to guarantee a smooth exchange of goods. In further development, greening of transport and transport infrastructure will be one of the key drivers which can be achieved by transport efficiency improvement and reduction of transport infrastructures and modalities footprint (PIANC, 2014). There are diverse environmental concerns that can arise from maritime activities in seaports, such as air pollution from port operations, loss or degradation of wetlands, destruction of fishery and endangered species, wastewater and stormwater discharges, severe traffic congestion, noise and light pollution, loss of cultural resources, contamination of soil and water from leaking storage tanks, air releases from chemical storage or fumigation activities, solid and hazardous waste generation, soil runoff and erosion (American Association of Port Authorities, 2019). In general, the impact on the port environment can be divided into the following categories: problems caused by port activities; problems caused by ship sailings; emissions from intermodal transport network which is in the function of serving the port hinterland. Namely, the fact is that the busiest port has higher risks of suffering from pollution (Badurina, 2017). The key com-

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ponent of the management of port development activities is to minimize the harmful impact of port operations on the environment (Badurina, 2017),(Beškovnik, 2014). New challenges for the development of ports which address environmental issues and raise environmental awareness have already been incorporated into international and national legislation. Furthermore, to achieve and maintain environmental performance of port it is necessary to underline priorities and follow guidelines which are set through directives and regulatory framework. This paper aims to analyze priorities and guidelines that are marked within European port sector through ESPO's Ecoports environmental reports for period 2013-2018, monitor their change over the years and try to address the potential reasons for priority changes (European Sea Ports Organisation, 2016), (European Sea Ports Organisation, 2017), (European Sea Ports Organisation, 2018).

2. European environmental priorities for port sector.

Ports all around the world have been demonstrating an increasing commitment to achieve a green status in port operations through a variety of actions, mandates, and initiatives. The main idea underlined in the term green port is directly connected with eco-friendly solutions in port operations (energy efficiency, collecting and recycling rainwater and waste on board, "zero emissions" policies) (Longo, 2015). In the long-term, minimized environmental impact and sustainable operations are the main basis in achieving port sustainability. The mutual dependence of the concept of a "green" and sustainable development is notable. There are various definition of sustainable port, the PIANC in 'Sustainable Ports' A Guide for Port Authorities Report from 2014 defines a sustainable port *as one in which the port authority together with port users, proactively and responsibly develops and operates, based on an economic green growth strategy, on the working with nature philosophy and on stakeholder participation, starting from a long-term vision on the area in which it is located and from its privileged position within the logistic chain, thus assuring development that anticipates the needs of future generations, for their own benefit and the prosperity of the region that it serves* (PIANC, 2014). In the European context, there are many legal interventions related to environmental problems regarding seaport industry (EU, 2019), (EU,2016), (EU, 2015), (EU, 2014), (EU,2012), (EU, 2009), (EU,2005), (EU, 2002). Also, there are numerous initiatives in terms of sustainability achievement, and fast developing regions (like South-East Europe) will have to start developing green technologies and solutions for transport infrastructure (Beškovnik, 2010).

Within European Sea Ports Organization - ESPO, EcoPorts represent a major initiative which relates to achievement of environmental sustainability in the seaport. The ESPO (ESPO, 2012) Green Guide upgrades European Commission efforts regarding environmental challenges and introduces measures for dealing with content like noise, water management, air quality, and climate change.

According to ESPO's EcoPorts environmental review which followed the environmental priorities in the European port sector through regular surveys of their members since 1996 (Figure 1), it can be noted that priority areas ranked differently over time. For example, in the early beginning of monitoring (2004), air quality was ranked in 6^{th} place. A few years after air quality went up in second place, and from 2013 is the top 1 monitored priority.

When analyzing table 1, it can be noted that in the first years of tracking port environmental priorities were generally connected with port development plans and dredging operations and disposal. From 2009, results reveal completely different factors affecting port's development management, such as noise, air quality, and garbage waste. Since 2013, energy consumption represents the top 3 issues for EU ports. One of the reasons for the high ranking of this priority could be direct connection between energy consumption and the carbon footprint of the ports and climate change. The European Union's efforts for reduction of carbon footprint and energy consumption are stated in (EU, 2015), (EU, 2014), (EU,2012), (EU, 2012). When observing period 2017-2018, it is interesting to highlight that climate change priority from the last position in 2017 has been rapidly climbing the ranks and went up by 3 places in 2018. It can be inferred that contributing ports are starting to act in order to adapt to climate change effects and to fulfill the objectives of the Paris Agreement.

Furthermore, from 2016 to 2018 the top 3 priorities have been the same, while air quality has remained the number one priority of the European ports since 2013 (ESPO, 2018). The fact is that ports are major sources of air pollutants that affect not only the health of people living in nearby communities but also contribute to regional air pollution problems. The major air pollutants related to port activities are diesel exhaust, particulate matter (PM), volatile organic compounds (VOCs), nitrogen oxides (NOx), ozone, and sulfur oxides (SOx) (Bailey et al., 2004). The ranking of air quality is in line with the European policies and efforts to enforce the existing legislation on air quality and other national initiatives which aim to comply with the EU limits and targets. Furthermore, a separate pieces of legislation such as the implementation of the Sulphur Directive, the new National Emission Ceiling Directive, the introduction of the global 0.5% sulphur cap on marine fuels in 2020 and the IMO NOx requirements for vessels built from 01/01/2021 onwards operating in the North and the Baltic sea (NECAs) have been introduced (ESPO, 2018).

Noise remains the third priority and its importance has also grown since 2004. The general aim of Directive 2002/49/EC is to define a common approach intended to avoid, prevent or reduce the harmful effects due to exposure to environmental noise. Both priorities, noise and air quality are directly connected with the number four priority that is relationship with the local community.

It is interesting to observe that the priority ship waste was introduced in 2013, and since then has been on the top 10 list of priorities. Comparing 2017-2018, it can be noted that ship waste went on higher position probably due to the introduction and adoption of the new EU Directive on Port Reception Facilities for ship waste (EU, 2016). This Directive aims to protect the marine environment against the negative effects of

Table 1: Overview of ESPO top 10 environmental priorities over the years [8].

	1996	2004	2009	2013	2016	2017	2018
1	**Port development (water)**	**Garbage/ Port waste**	**Noise**	**Air quality**	**Air quality**	**Air quality**	**Air quality**
2	Water quality	Dredging operations	Air quality	Garbage/Port waste	Energy consumption	Energy consumption	Energy consumption
3	Dredging disposal	Dredging disposal	Garbage/Port waste	Energy consumption	Noise	Noise	Noise
4	Dredging operations	Dust	Dredging operations	Noise	Relationship with community	Water quality	Relationship with the community
5	Dust	Noise	Dredging disposal	Ship waste	Garbage/Port waste	Dredging operations	Ship waste
6	Port development (land)	Air quality	Relationship with the community	Relationship whit the community	Ship waste	Garbage/Port waste	Port development (land)
7	Contaminated land	Hazardous cargo	Energy consumption	Dredging operations	Port development (land)	Port development (land)	Climate change
8	Habitat loss/degradation	Bunkering	Dust	Dust	Water quality	Relationship with the community	Water quality
9	Traffic volume	Port development (land)	Port development (water)	Port development (land)	Dust	Ship waste	Dredging operations
10	Industrial effluent	Ship discharge	Port development (land)	Water quality	Dredging operations	Climate change	Garbage/Port waste

Source: Made by authors using ESPO reports for 2018.

discharges of ship waste by using ports located in the Union and by improving the availability and use of adequate port reception facilities and delivery of waste to those facilities. Furthermore, it is important to highlight that waste has been reported as the highest priority monitoring issue by ports since 2013 (Figure 4), which shows that ports are ready to take a further step in dealing with marine litter.

Also, it can be noted that in a 20-year long period, the dredging operations and port development (land-related) are issues which have been included in all top 10 rankings. Furthermore, some priorities have been on top 10 lists in 1996 and 2004 but are not present longer, such as contaminated land, habitat loss/degradation, traffic volume, hazardous cargo, bunkering, and ship discharge. By its nature, the port sector is subject to continuous development and changes so the top 10 priority ranking changes over time (due to introduction of new legislation, the significance of topics for local port development, etc.). Ranked issues are rarely discrete subjects in themselves but are often linked with other priorities. For example, air quality, dust and noise may all be considered significant in terms of local community relations. Following the same argumentation, issues related to contaminated land and habitat loss may be subsumed under the issue of port development (Puig et al., 2015).

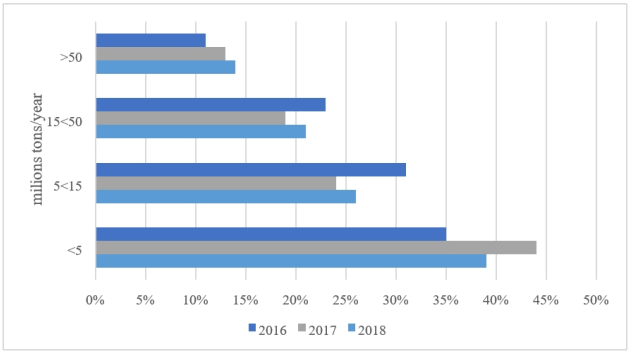
3. Overview of European ports environmental performance in period 2013-2018.

In taking initiatives for addressing potential challenges and protecting the environment European ports are in the frontline (ESPO 2018). The passive role of ports against environmental challenges has changed drastically over the years (Mellin et al., 2011) As it has been already mentioned, within the port sector the air quality, noise, and energy efficiency are already top 3 environmental priorities since 2016. EcoPorts conduct research regarding port environmental performance through Self Diagnosis Method – SDM. SDM represents a comprehensive checklist for identifying environmental risk and establishing priorities in order to take action. This section will present and analyze obtained results within SDM for 2016, 2017, 2018. Also, the presented results will give insights about the environmental management performance of European ports and environmental monitoring programmes. The results will be compared mutually.

In 2016, 91 ports across 20 EU Member States participated in the research. In 2017, 91 ports in

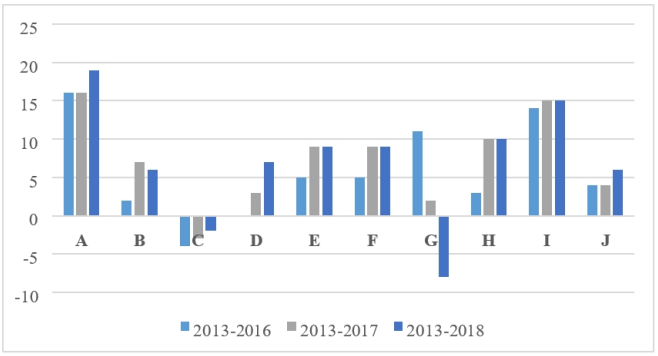
21 countries were involved in the research. Ninety (90) ports from 19 EU Member States and Norway participated in 2018 study. Spain and the United Kingdom are countries with the most participants in the research, followed by France, where 10 ports participated in the research (ESPO, 2016), (ESPO, 2017), (ESPO, 2018).

Figure 1: Tonnage characteristics of the contributing ports.



Source: Made by authors using ESPO reports for 2016, 2017, 2018.

Figure 2: Overview of application and changes of environmental management indicators for period 2013-2018.



Source: Made by authors using ESPO reports for 2016, 2017, 2018.

It is interesting to point out the results on the annual tonnage of goods handled in ports for observed period. Figure 1 shows that most of the ports are in the category of small and medium ports (less than 15 million tons per year).

3.1. Environmental management performance indicators.

There are 10 key indicators of environmental management in European ports that have been monitored from 2013. The indicators are:

A. Existence of a Certified Environmental Management System – EMS (ISO, EMAS, PERS)
B. Existence of an Environmental Policy
C. Environmental Policy refers to ESPO's guideline documents
D. Existence of an inventory of relevant environmental legislation
E. Existence of an inventory of Significant Environmental Aspects (SEA)
F. Definition of objectives and targets for environmental improvement
G. Existence of an environmental training programme for port employees
H. Existence of an environmental monitoring programme
I. Environmental responsibilities of key personnel are documented
J. Publicly available environmental report

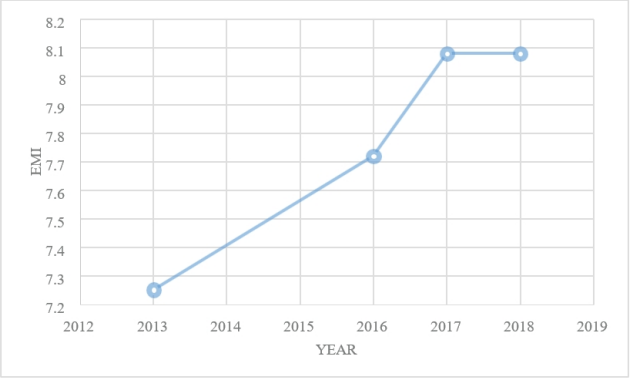
These indicators provide information about the management efforts that influence the environmental performance of the port.

Figure 2 shows the application of each of these 10 indicators in the 2013, 2016, 2017 and 2018. Also, comparisons are made between the changes in percentages for 2013 and each subsequent year (2013-2016, 2013-2017, and 2013-2018).

It can be noted from Figure 2, for 2018 that the existence of an inventory of relevant environmental legislation (a requirement of all major quality EMS standards) is the indicator that has the highest percentage of positive response (97%). Furthermore, the existence of an Environmental Policy is the second-highest-rated priority whose introduction represents a significant step towards the achievement of a certified Environmental Management System (EMS). It is important to emphasize that from 2013 the number of ports with a certified EMS has increased for 19 % (73% in 2018) which suggests the readiness of ports for the establishment of a good system to deal with environmental issues. By comparing years from 2013 to 2018, it can be noted that 8 of 10 indicators showed positive trends, especially in cases of documentation of environmental responsibilities of the key personnel (+15%) and the existence of an environmental monitoring program (+10%). The indicator regarding the compliance of Environmental Policy to ESPO's guideline documents declines 2%, while the existence of an environmental training program for port employees declines by 8% (ESPO, 2018). The biggest challenge for port management and port stakeholders in the implementation of environmental sustainability refers to the involvement of employees at all organizational levels, i.e. to empower workers and make them aware of the importance of strategies and policies adopted. The decisive role in the application of sustainability issues (concerning all three sustainable pillars: economic, environmental and social) lies in management system standards (ISO 9001, ISO 14001, ISO 50001, UNE 166002, and OHSAS 18001). The two opposite objectives, economic and environmental are respected thorough different certification standards. The economic pillar is covered through ISO 9001 and UNE 166002, while ISO 14001 and ISO 50001 are connected with environmental performance, commitment, and responsibility. The third, social pillar is guaranteed by ISO 9001, UNE 166002, and OHSAS 18001 [24].

Also, these ten indicators can be displayed in one number, the so-called Environmental Management Index - EMI. The specific weight is attributed to each of the 10 indicators of the Index, which reflects its relative importance for environmental management. EMI is calculated by multiplying the weights as-

Figure 3: Changes of Environmental Management Index for period 2013-2018.



Source: Made by authors using ESPO reports for 2016, 2017, 2018.

sociated with each environmental management indicator with a percentage of positive responses, which is illustrated by the formula (ESPO, 2018):

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.

3.2. Environmental monitoring indicators.

Environmental monitoring is crucial for the port and therefore it is important to explore the components of environmental monitoring programmes in the European ports. Figure 2 in the previous section showed that in period 2013-2018, 10% growth has been marked for indicator regarding existence of a system for environmental monitoring.

Figure 4 shows main components of the monitoring programme and application of each of these 10 monitored issues for the 2013, 2016, 2017 and 2018. Also, comparisons are made between the changes of 2013 and each subsequent year (2013-2016, 2013-2017, and 2013-2018).

When analyzing Figure 4, it can be noted that from 2013 waste represents a top priority monitored issue. The following issues for 2018 are energy consumption (80%), water quality (76%) and water consumption (72%) [17]. Also, it should be noted that the percentage of ports that monitor waste has increased significantly between 2013 and 2018 (17%). More than half of the analyzed ports also include noise (67%), air quality (67%), and sediment (58%) in its monitoring programme. Trends concerning calculating and tracking carbon footprint remain stable since nearly half of the surveyed ports (47%) are devoted to this issue.

Besides mentioned priorities, in order to improve the environmental performance "5E" framework with following actions has been introduced: exemplifying (setting the good example in the port community when managing own operations); enabling (providing conditions for facilitating port users and improving environmental performance within the port area); encouraging (providing incentives to greener port users); engaging (sharing knowledge, means and skills between port users and/or competent authorities); enforcing (using mechanisms to enforce effective environmental practices by port users and ensuring compliance) (ESPO, 2012).

Conclusions.

Green ports will indisputably become the cornerstone of the development of the port sector in the future. Nowadays, the main goal of the development of (environmental) port is to reconcile the two opposite objectives: high economic efficiency and excellent ecological performance of ports. Efficient use of resources, reduction of negative impact on the environment, improvement of environmental management and quality of the port natural environment are prerequisite for sustainable development of the port. To achieve this goal, it is necessary to ensure the use of renewable resources and the implementation of sustainable practices (such as recycling) in the port activities. The port authorities should be constantly encouraged to act and think in a greener way. Their activities should be directed to sustainable development and continuous improvement in environmental protection. It is necessary to identify the best practices and processes that can help port authorities to achieve higher levels of sustainability and thus to reduce the level of pollution affecting water, air, and noise. In this overview of the status of European ports it can be noted that EU ports are constantly working on the improvement of their environmental performance. Ports are prepared to respond to all changes and issues that have been addressed through a regulatory framework (such as waste, air quality and climate change).

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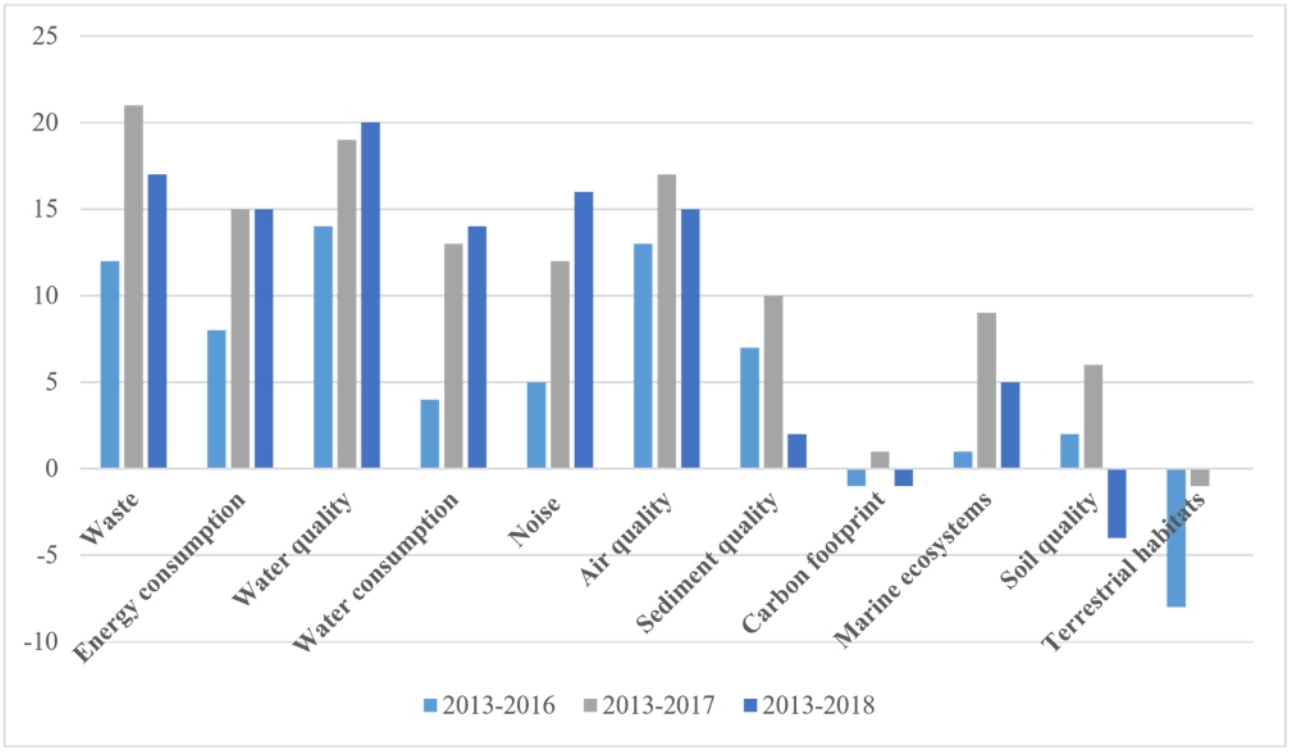
Figure 4: Overview of application and changes of environmental monitoring indicators for period 2013-2018.



Source: Made by authors using ESPO reports for 2016, 2017, 2018.

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