

The environmental management of small ports – challenges and options

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Abstract

It is widely acknowledged that small ports (including small-island ports) play a vital role in the supply chain, in general transport connectivity, and in the day-to-day life of their communities. Sometimes classified as being typically less than 1 million tonnes throughput per year, nevertheless they are highly significant in terms of the socio-economic well-being of the neighbourhoods and societies that they serve.

In terms of environmental impacts, such ports often face the same legal liabilities and responsibilities as experienced by major ports of the global sector. The scale of operations may be smaller but the activities, products and services involved may well have profound actual or potential effects on the environment. The port area may also be exposed to the cross-boundary impacts from adjacent towns and hinterland links, and stakeholder expectations are increasing with demands for evidence of good practice and demonstration of sustainability.

In order to respond to the range of challenges involved, it may reasonably be stated that small ports are often disadvantaged relative to large ports in lacking the human and financial resources necessary to develop, implement and maintain a practicable and effective Environmental Management System (EMS). The costs of collecting, analysing and reporting relevant data on environmental performance indicators may put a burden on profit, and the expense of operating a comprehensive EMS may appear prohibitive. The degree of autonomy and staff-time available may also inhibit an effective response.

The paper examines both the problems encountered and the positive options available to small ports to assist their endeavours to demonstrate compliance, reduce their environmental risks and to work towards sustainable development. Networked collaboration throughout the sector can assist with the exchange of knowledge and experience to mutual advantage. However, it is not all one-way traffic. Small ports themselves can also demonstrate good practice and innovation in terms of how the port sector may liaise and interact with local communities.

1. Introduction

The definition of a port by size may be a complex exercise in itself and ideally would take a multifaceted approach as demonstrated by Feng and Notteboom (2011) when Small and Medium-sized ports were defined on the basis of a seven-dimension method which took into account the port's competitive position in its port cluster region with the position reflecting the seven aspects of i) volume/market share, ii) international connectivity, iii) relative cluster position, iv) hinterland capture area, v) Gross Domestic Product of the port city, vi) GDP of the hinterland and vii) Logistics and distribution function. The range of characteristics that may be taken into account in the classification of ports by size and type is also discussed by Roa et al (2013). However, for the purposes of this paper, a somewhat pragmatic approach is taken where the definition applied is simply that of a single variable of the total cargo throughput (volume) below the threshold value of 5 million tonnes although it is acknowledged that this is not a measure of their significance (the figure has been used by ESPO and research associated with EcoPorts). In many cases they underpin the local economy, provide the basis of employment and are critically important players in terms of regeneration and the growth of a green recovery. As key players in terms of socio-economic benefits, transport and logistics

they are under considerable pressure to be demonstrably efficient in terms of management and operations, and to answer to an increasingly widening and ever-more demanding group of stakeholders.

The reality is that in many cases, small ports have limited human and financial resources and yet are required to comply with environmental legislation and regulation the same as large ports. It is widely acknowledged that the cost of such compliance can be disproportionately high. It may be argued that in terms of representation and awareness, small ports lack visibility in terms of their role in the logistics chain and overall sectoral policy, have limited capacity to bring influence to bear with regard to planning and regulation, and restricted opportunities for funding.

If the impact of Covid-19 pandemic is added to the environmental liabilities and responsibilities of small ports then the challenges confronting the functional organization necessary to deliver compliance, cost- and risk-reduction, and sustainability are as profound as for larger ports that have more resources. Compliance is, of course, non-negotiable, and yet the processes and procedures involved in developing, implementing and operating a time- and cost-effective Environmental Management System (EMS) through a dedicated Environmental Management Program can be considerable in terms of expertise and funding (Iraldo et al, 2011).

The imperative of managing the fulfilment of compliance obligations, the achievement of environmental objectives, and the enhancement of environmental performance through continuous improvement is the basis of any, credible EMS (Erauskin-Tolosa et al, 2019). Regardless of size, port environmental management requires efforts to be made to control the port's environmental aspects, that is, those activities, products and services that may impact directly or indirectly on the environment. In many circumstances, the port authority may indeed have fixed liabilities and responsibilities, in other instances it may be deemed to be in a position to bring influence to bear *e.g.*, on the environmental performance of tenants and operators.

The fundamental components of any convincing EMS require the port to develop a policy statement, compile registers of aspects and legal requirements, identify its responsibilities and resources, carry out a conformity review (it is not possible to manage what is not measured) and finally to report on its environmental performance (Barrow, 2005). Many small and medium size ports (SMPs) have worked on such programs being pro-active in their approach, responsive to stakeholder expectations, and keen to demonstrate their competence and sustainability credentials. Others lack awareness or resources, and initiatives are still required to encourage and enable good practices in terms of the environmental management of day-to-day activities and operations throughout the port area and its environs. Throughout the global sector there has been a range of responses and if the generally agreed concept that 'each port is unique' (in terms of commercial profile, geography, hydrography *etc.*) then it is no surprise that the various strengths, weaknesses, opportunities and threats characteristic of SMPs profiles are significant in terms of developing and implementing a reliable EMS. The following table provides a useful summary of key considerations:

Table 1. Present and future features of Small and Medium Ports (*This research and 'small and medium sized ports as hubs for smart growth and sustainable connectivity, interreg4a-2mers.eu, 2 Seas Magazine, November 2014'*).

<p>Strengths</p> <ul style="list-style-type: none"> • existing reliable links • opportunity to serve more isolated communities • port versatility and adaptability to structural transformation • agility to specialise in niche markets • some unutilised space due to concentration on major economic development areas • knowledge of the sea • knowledge of maritime logistics • proximity to major EU metropolitan areas • long-established links with local community • well-established knowledge of history, culture and 	<p>Weaknesses</p> <ul style="list-style-type: none"> • infrastructure in need of optimisation/adaptation • need for innovation to improve intra-port/extra-port multimodal accessibility and connectivity (port-to-port, port-to-hinterland, port-to-end users) e.g., more sustainable transport links, greener inner port transport/handling equipment, novelty technologies to improve operations • lack of human and financial resources to optimise existing port operations and/or infrastructure • need for innovative financing methods and partnerships to compensate for reduced port funding and financial support • competition from better accessible/connected but congested bigger ports • sometimes little room for port expansion • lack of technical expertise and knowledge on new technologies or emerging sectors' requirements (infrastructure & skills) • lack of awareness of importance of SMPs for their regions' connectivity and economy • lack of visibility and lobbying power
<p>Opportunities</p> <ul style="list-style-type: none"> • identification of niche markets, specialisation and/or investment in non-traditional activities/sectors (e.g., energy, eco-innovation) and develop related better connectivity for emerging industries • innovative shared marketing between connected ports • cross border sharing of information and best practices for resource and time saving • use of land space for businesses to generate revenue 	<p>Threats</p> <ul style="list-style-type: none"> • lack of policy support • loss of competitive power • closure and/or loss of employment • pressures posed by ecological and social factors • pressures of real estate developers to sell assets for residential or recreational uses • possible negative (cost) effects posed on ports by legislative or policy changes and regulations (especially when introduced by policy makers)

<ul style="list-style-type: none"> temporarily serve as support facilities for primary ports in case of slowdowns and/or stoppage due to natural or man-made events, thus providing a more resilient transport network relieve pressure and congestion when other nearby larger ports approach capacity limits opportunity to access new technologies that can enhance infrastructural/operational connectivity, improve energy efficiency and reduce emissions development of long-term strategies that take into account inter-dependency of ports across the sea investments (e.g., larger berth) to mitigate effects of Sulphur Directive 	<p>without in-depth maritime knowledge or expertise)</p> <ul style="list-style-type: none"> impacts of climate change NIMBYism, i.e., opposition to port development plans from some local communities pressures of new incoming residents and 2nd house holders without sufficient knowledge of the sea and port operations
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2. Addressing the issues

Reference is made again to the fact that generally speaking, legislation and regulation is aimed at the sector whether at international or national scale, and yet, the individual port has to address the site-specific detail of its own location. Generalizations by size of port show that the priority issues that need to be managed change with time (depending on commercial profile, changes in legislation, emergencies and incidents *etc.*) and there is substantial evidence to show that there are differences in perceived topics and their relative importance depending on the size of port.

Table 2. Top ten environmental priorities by size. Source: EcoPorts, 2020.

	<5 million tonnes	5<15 million tonnes	25-50 million tonnes	50 – 100 million tonnes
1	Energy efficiency	Climate change	Air quality	Air quality
2	Air quality	Air quality	Climate change	Climate change
3	Climate change	Energy efficiency	Energy efficiency	Energy efficiency
4	Ship waste	Noise	Noise	Ship exhaust
5	Noise	Dredging disposal	Dredging operations	Noise
6	Water quality	Ship waste	Local community	Garbage/Port waste
7	Local community	Garbage/Port waste	Conservation areas	Local community
8	Garbage/Port waste	Development (Land)	Sediment contamination	Water quality
9	Development (Land)	Water quality	Dust	Port development (Land)
10	Dust	Local community	Ship waste	Dredging operations

Opinion may be divided but it is suggested that there is a general consensus that each port is unique when the sum total of its commercial, cultural and physical characteristics is taken into account; and yet, there is a strong case for a sectoral approach being taken on many issues such as legislation, regulation, planning and environment. Each port inevitably has its own mix of activities, products and services that impact on the environment, and each port will have its own perceived priority issues in terms of opportunities and challenges regarding a range of management issues. Table 2 demonstrates that at the sectoral scale, there are differences between the size classifications on the basis of significant issues identified and their respective

priority ranking. Small ports share many of the challenges faced by larger ports and it demonstrates the scope for two-way collaboration on several key issues such as air quality, climate change and energy efficiency, for example. Such issues may manifest themselves in different ways and to different degrees depending on the port's overall profile – and small ports must rise to the challenge often encumbered by the restraints outlined above.

3. Challenges and experience

In order to better understand the situation of small ports and their current challenges, it should be acknowledged that there does not exist a universally accepted definition of their overall characteristics. The most common approach is to use measurements based on annual volume of goods handled by the ports, either by cargo or shipping tonnage handled. However, small ports should not be regarded only in relation to the amount of traffic they handle as they are valid contributors to the economy and the community life of their region, not to mention the small islands. In this sense, regional differentiation influences the concept of small ports and what might be small in a coastal region, e.g., in the Mediterranean, might be referred to as medium-size in the Baltic Sea or elsewhere, and vice versa. For example, in Greece, as referred to in the Hellenic Port Strategy (2012) there are about 900 ports and port facilities of different size, administrative organization, uses and importance for the national and local community and economy from which, according to Ports Classification (2007), the 58 are considered as of international, national, and regional significance, and the rest ones (over 800!) as of local significance.

Today, several factors influence the way in which small ports are managed and organized, as well as financed, including mainly the market economy of the country, the location of the port (island, urban region, isolated area), and the types of cargoes handled (general cargo, fishing activities, etc.). These factors are also linked with the type of the provision of the services (public, mixed), the ownership of the infrastructure and necessary equipment, and the status of the dock labour. In particular, it is possible to identify a municipal model of small ports, such as those in North Europe (e.g., Belgium), a state model, such as those used mainly in South Europe, in which central governments control and finance all main ports, and a mixed model. Additionally, it should be noted that in some cases small ports are grouped on a regional scale together and are managed by one body, while in other cases, small ports, are part of the management of larger ports, mainly for logistics and competitive reasons. For instance, in Greece, almost all small ports, depending on their location, are subject to a management body, called "Port Fund", which is administered by the local municipal or prefectural authority, being also responsible for the management and financing of its ports. There are also 10 Port Funds that are managed directly by the state. Cooperation between ports on such a scale is not a reality, but the process that creates large scale companies that run ports all over the world has started.

Whichever definition for small ports is considered, the main challenge for them is to be sustainable in both management and operations. This means carrying out their activities (e.g., commercial operations, industrial interests, transport and chain links, managing port assets, environmental protection) effectively and adequately at low cost and minimised environmental impact, with reliable infrastructure and skilled personnel. Nevertheless, it may reasonably be argued that small are often disadvantaged through lack of acknowledgement and recognition of their economic and social function, and their role in the logistics chain. There are many instances of low integration into supply chains and freight volumes, limited smart solutions, inadequate cooperation from stakeholders, outdated infrastructure, lack of expertise and investments, and limited environmental awareness.

With regard to environmental management, it is reasonable to suggest that small ports still need to progress, adapt and reinvent themselves as they face ever tougher environmental legislation, and increasing pressure from local communities and a widening range of

stakeholder pressure. The range of considerations and options for small ports are discussed by Kuznetsova et al (2015). However, meeting these requirements poses additional challenges on ports' resources with respect to, finances, personnel, port community and stakeholder management. Mere reduction of the environmental impact of ports and logistics is no longer enough. Issues related to social responsibility, control of significant environmental aspects and cost-effectiveness have to be taken into consideration at the same time in an integrated management approach. Thus, in order to face these new challenges and ensure their competitiveness and sustainability, small ports need to work with environmental legislation, gain from existing experience and, in parallel, apply good practices, methodologies and approaches.

Experience so far has shown that the response by small ports to these challenges is best achieved in a collaborative and step-by-step-manner. This process of improvement starts with the creation of awareness of the environmental imperative as part of the business plan by the port authority and the development and application of a credible and effective port Environmental Management System (EMS) so that the port may demonstrate its competence and ability to comply with relevant legislation and responsibilities through certification to an International Quality Standard of EMS such as EcoPorts PERS, for example (www.ecoport.com and www.ecoslc.be).

This phased approach has been tested successfully in various European small ports, not only by showing that it makes the ports aware of the need and the effects of environmental management, but also by assisting them in the introduction of sustainable port management. For example, the ports of Volos in Greece and Melilla in Spain may be regarded as typical small ports, which after following the Self Diagnosis Methodology of EcoPorts achieved PERS certification (and have also attained ISO 14001 development (Ecoports, 2021). On the occasion of the second recently achieved re-certification by the port of Volos, its CEO Mr. Socrates Anagnostou stated: "The protection of the environment is a top priority for the Administration of the port and obtaining this certificate, is a justification of our efforts and the goals we have set for sustainable development of the port" (Volos Port Authority, 2021). With the same sentiment, Mr Athanasios Porfiris, Chief Executive of the Port of Igoumenitsa's (recently re-certificated to EcoPorts PERS for the third time) stated during a recent interview (Roussos, 2020) that "...The standard also defines the planning for the identification, assessment and control of environmental hazards, as well as environmental programs for the definition and control of individual actions to improve the level" [5].

4. Importance and examples of positive links with local community

A useful indicator of the value of a collaborative approach to assist small ports was demonstrated at the 3rd Ports, Maritime Transport & Insularity" International Conference organized by the Aegean Energy & Environment Agency (AEGEA) and the Network of Sustainable Greek Islands DAFNI held in Piraeus, Greece, in April 2018 (<https://aegean-energy.gr>). The overall objective of the event was to highlight the vital role of ports and shipping in shaping a development strategy in the European and Mediterranean regions, exploiting the comparative advantages of the regions and improving the competitiveness of economic actors in the context of sustainable development. At the same time, the island's particular challenges regarding the design, management and operation of its port infrastructures in relation to sea connections (strengthening the connection between the islands and the mainland) was also presented. The approach was part of the European Commission's 'smart islands' strategy, which is part of the strategy for reducing greenhouse gas emissions.

The main conference presented the opportunity for the arrangement of a Parallel Workshop entitled "Small & Islands Ports Management - Roadmap to sustainability". Delegates included Local Authorities, Port Authorities and academia, and all participants contributed to the

compilation of a template for a SMART Roadmap specifically designed to assist Small and Island Ports to bridge the gap between policy - and practice.

Several key issues were highlighted during the presentations in order to assist and focus the discussion that followed. These included: i) Ways to retain local influence of the port, ii) Plans to enhance collaboration in port related areas, including the environment, iii) Methodologies to implement an effective Environmental Management System (EMS) within the port's capabilities, iv) Techniques to demonstrate improvement in management options, and v) Holistic approach to Sustainable Development of the port.

The Workshop focused on the critically important components of the ports' Environmental aspects (activities, products and services) and the considerations that need to be taken into account in managing their impacts.

The priority issues identified by 31 port managers are shown in the following table:

Priority	Issue
1	Port Infrastructure (land area)
2	Legal Procedures - Framework
3	EMS and Resources
4	Local community
5	Energy (renewable)
6	Waste management
7	Tourism & Shipping
8	Noise
9	Urban Traffic
10	Air Pollution

Table 3. Priority issues for local authorities and small port authorities, according the SMART Roadmap Workshop questionnaire.

Other issues raised during discussion included: the Logistics Chain, Fishing, Areas of Responsibility, Support Services, Ecosystems and Habitats, Cultural Heritage and Archeology, Water consumption, Good Practice Guidelines, Access to Funding, Establishing a product or service, and Accreditation/Certification of EMS.

In the discussion that followed, participants highlighted the priorities and the problems facing many small ports (in this particular instance, in Greece) and these overwhelmingly centered on Port Infrastructure *i.e.*, the unclear picture of the actual land area that these ports actually own and therefore can develop. The governmental system of allocating land to municipalities and local authorities seems to be so complex and perplexing, that any attempts to expand as a port, inevitably runs into a stalemate with the central government. Associated with this was the apparently insurmountable problem of the legal framework and associated procedures (Ranked 2nd in Top-10 priority).

Regarding Environmental Management Systems the main concern was the lack of specialized personnel and resources available, since most lack employees that can develop such systems. Finally, nearly all ports mentioned the difficulties posed by laws that protect cultural heritage and archeological sites, making it almost impossible to develop by gaining access to both land and marine areas. Last but not least, the lack of expertise and guidance by the central and local government in accessing funding, whether national or European, was pointed out by all participants.

There was consensus that the components of the SMART Roadmap should include: i) Priority issues and integrated activity plans based on these issues, and ii) Making sure that there is scope for collaboration and networking, either through existing or new networks or

organizations, which will agree upon a mutually acceptable framework of cooperation, including demonstration projects.

These projects must definitely include financial options, training and exchange of experience in order to increase the capacity of human resources and state support for local initiatives, based on a training, dissemination and local community approach. In this way all agreed that a “train-the-trainers” scheme could be developed, also acknowledging leadership at a regional and national level.

Further discussion led to the following suggestions that are believed to provide an opportunity for small port sustainable development: i) Enforcement of existing legislation & regulations (fair framework -prosecution of non-compliance), ii) Interaction with stakeholders, iii) rationalization of legislative procedures, iv) encouragement of private initiatives, and v) publication of Good Practice Guidelines.

Proposals for the SMART Roadmap concluded that the following two models or approaches involving the key players, could be helpful in supporting small ports in their efforts towards sustainable development. Systematic collaboration based on the following links using both formal and informal connections was deemed to be helpful (<https://aegean-energy.gr>).

a) AEGEA Model I: Local Government-Municipality / Port / University / Business- private initiatives

or

b) AEGEA Model II: Port "Model" based on its unique characteristics / Local Community / Leaders / Instructors / Dissemination of best practices

5. Summary and conclusions

There exist a set of tools that can be useful to assist small ports in their daily management and the implementation of an EMS. The EcoPorts Self Diagnosis Method (SDM) is one example of this. It is a tool that allows port managers to periodically assess the quality of the environmental management and the progress achieved through time in their ports. It also acts as a checklist of good practices; it identifies environmental risks and establishes priorities for action (Darbra et al. 2004). Completing SDM and applying for a confidential review provides an appropriate framework for a future PERS certification

The Port Environmental Review System (PERS) is the port sector's own, independently verified, international standard for EMS. SDM and PERS are available for European Ports through ESPO (www.espo.be) but also around the world through EcoSLC Foundation (www.ecoslc.eu).

In addition, there exist three other tools that can be used for ports free of charge: TEAP (The Tool for the identification and assessment of Environmental Aspects in Ports), TEIP (The Tool for the identification and implementation of Environmental Indicators in Ports) and Standardized tool to calculate Carbon Footprint in Ports. All of them are available at www.eports.cat.

To assist small ports with their responsibilities toward compliance and sustainability, a collaborative approach involving training workshops, joint projects, mechanisms for the exchange of knowledge and experience on-site and a strategic pathway involving large and small ports may be a cost- and time-effective option for all relevant stakeholders. The exchange of good practices between large and small ports would certainly not be one-way traffic as may be expected by the population at large. In many cases, small ports are well-

placed to demonstrate good environmental practice experience to the larger ports particularly with respect to local community relations and conservation projects, for example.

Just as the whole environmental imperative must be treated as a cross-boundary. No-limits issue, so must collaboration between ports, and ports and their stakeholders, be based on open links and the free exchange of knowledge and experience to mutual benefit of all players – and the environment itself.

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