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Management Control Systems in port waste management: Evidence from Italy

Assunta Di Vaio[a,*], Luisa Varriale[b], Lourdes Trujillo[c]

[a] Department of Law, University of Naples "Parthenope", via G. Parisi, no. 13 - 80132, Naples, Italy
[b] Department of Sport Sciences and Wellbeing, University of Naples "Parthenope", via Medina, no. 40 - 80133, Naples, Italy
[c] Department of Applied Economic Analysis, University of Las Palmas de Gran Canaria – Campus de Tafira, 35017, Las Palmas de Gran Canaria, Spain

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ABSTRACT

This study investigates Management Control Systems (MCS) in supporting Port Authority (PA) decision-making processes to prevent and reduce negative environmental effects from seaports. We focus on information management (data collecting, processing and reporting) in the inter-organisational relationships system established among the stakeholders involved in the arrival, mooring and departure of ships in port destinations, evidencing whether the control function exclusively consists of compliance with the MARPOL 73/78 convention and port regulations. Drawing on a deep review of the regulations and literature on environmental issues in seaports and MCS for environmental sustainability and energy efficiency in the port sector, we conducted semi-structured interviews with port users in one Italian seaport. The results show that more detailed information and reporting are needed to improve performance, especially during the mooring of the ships, as well as, MCS could support information for all players, especially the PA, in making developmental decisions about seaports. Key Performance Indicators (KPIs) are provided for measuring and controlling the effectiveness and efficiency of the waste management process in the port sector. Theoretical and managerial implications are discussed.

1. Introduction

Over the last thirty years, both researchers and practitioners have paid growing attention to the negative environmental impacts of port operations and development.

A system of environmental regulation, rules for compliance and rigid scrutiny are needed for the port industry considering the high price related to climate change and global warming deriving from port activities and operations. Indeed, ports must record high levels of environmental performance to meet societal expectations and community support if they plan to grow (ESPO, 2012; Lam and Notteboom, 2014; Acciaro, 2015). The environmental issues in the port industry are very challenging in terms of the need to modify logistics and minimise emissions from existing and future port activities.

Ports tend to assume environmentally sustainable and energy efficient behaviour, allowing some authors to introduce the concept of "green ports" as one of the first frameworks for aware and sustainable port strategies, where "a green port will lead to positive outcomes on [a] port's customer retention and economic performance" (Lam and Van de Voorde, 2012: 424). Green ports thus develop, implement and monitor practices for preventing and reducing their environmental impacts above the requirements for regulatory compliance (Acciaro, 2015).

Within green ports, social, economic and environmental dimensions can be considered (Elkington, 1997; Henriques and Richardson, 2004), encouraging voluntary environmental and sustainable practices beyond the regulations (Acciaro, 2015).

The literature on green ports and their strategies and duties is still scarce. In order to support the "green port decision-making processes" of Port Authorities (PAs), environmental regulations should specify instruments for measuring the effects of "green choices" and the effectiveness and efficiency of decision-making processes, such as those concerning waste management by ships. Normative rules must be adopted and respected through reporting activities, such as certifications and permissions, and encouraging a "green behaviour orientation". PAs and all port users could use measurement and control instruments to make investment choices that effectively and efficiently reduce the negative environmental impact (Straughan and Roberts, 1999; Lam and Notteboom, 2014; Acciaro, 2015; Barnes-Dabban et al., 2017; Di Vaio and Varriale, 2018a, 2018b; Di Vaio et al., 2018). Thus, Management Control Systems (MCS) are crucial for supporting the decision-making processes and operating activities of port users from

* Corresponding author.
E-mail address: susy.divaio@uniparthenope.it (A. Di Vaio).

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the perspective of sustainability. To maintain competitiveness in seaports, while responding to environmental needs, investment of resources is necessary.

In this study, the role of MCS and its instruments are investigated in terms of Port Authority (PA) decision-making process in terms of inter-organisational relationships among stakeholders. These include the main port service providers involved in the waste management processes from ships, as well as shipping agents that perform intermediating functions for the cruise companies and harbour offices. PAs have to pay more attention to regulatory requirements for the prevention and reduction of negative environmental effects of seaports. We analyse the processes for information and data collecting, processing and reporting, relative to the coordination system established among the players involved in the activities related to arrival, mooring and departure of ships in port destinations. This paper aims to verify the nature and content of the control function of PAs in the landlord port model to assess whether it consistently verifies compliance with the MARPOL convention and port regulations. We also consider whether the overall information and data management process can support the general environmental strategies of seaports.

We adopt a qualitative approach using a case study methodology. Two different phases can be distinguished in this research: First, there is a deep analysis of the regulations and review of the literature on MCS and information systems in inter-organisational relationships for environmental sustainability and energy efficiency applied in the port sector; second, for analysing and understanding the role played by MCS within the port industry in preventing and reducing the environmental impact of the main port operations, we conducted some semi-structured interviews with PAs and shipping agents that represent the cruise companies in an Italian seaport. The empirical study is focused on the waste management process within the cruise industry.

Several reasons justify the focus on the cruise segment. First, the cruise sector has been significantly increasing in the tourism, shipping and port industry, evidencing relevant economic, social and environmental impacts. Second, the cruise infrastructure presents high effects (i.e. ships, cruise passenger terminal facilities and berthing access requirements)by implying deep changes of the natural environment for enabling port destinations as cruise line destinations. Third, operational activities are impactful in terms of consumption of energy, water and also air quality pollution. Fourth, managing the increasing passenger flows requires environmental and sustainable carrying capacity of destinations and efficient landside transport connectivity. Finally, considering growing cruise ship sizes, the multiple departure ports and calling ports, diversified consumptions and behaviours, and the effects of a circular economy, there is high environmental impact including waste management onboard and onshore in ports (Johnson, 2002; Butt, 2007; Geng et al., 2009). Specifically, the main type of waste derived from cruise ships consists of organic material, domestic waste and oily rags, apart from recycling waste, that is aluminium, plastic, paper and glass.

The study is organised as follows. In the second section, a deep analysis of regulations and a review of the main contributions in the literature on the environmental impact of port operations and development provide a clear scenario about the phenomenon, highlighting the existing gap in the research. In the third section, MCS and its instruments for collecting, managing and reporting information and data about the environmental impact of port users are analysed. In the fourth section, details about the methodology adopted with the case study and semi-structured interviews are provided. The fifth section proposes a set of Key Performance Indicators (KPIs) developed thanks to the information and details collected through the entire study. The last section discusses the final considerations and limitations and suggests future research steps.

2. Regulatory and theoretical frameworks

Port and shipping regulatory frameworks and scholars have increasingly paid attention to environmental sustainability and energy efficiency for protecting both the coastal wildlife and port city destinations.

Recently, global warming and other modifications in atmospheric conditions are leading to important restructuring in many economic sectors, especially those with important environmental impact, such as the port industry. Most operators are aware of climate change and its worldwide effects and are trying to adopt variations in port destinations in order to face the great impact of larger, faster and more luxurious vessels or, for instance, the growing of cruise passenger flow (Murugesan, 2008; Nordhaus, 2008; Walker and King, 2008; Gibbs et al., 2014) giving higher importance to environmental groups and politics (Lin and Lin, 2006; Bows et al., 2009; Grech et al., 2013; Lam and Notteboom, 2014; Lu et al., 2014; Gibbs et al., 2014). The port industry is trying to set new aspirational emission targets (Johnson, 2002; Butt, 2007; Brida and Zapata, 2010; Eijgelaar et al., 2010; Howitt et al., 2010; Poplawski et al., 2011) as the whole industry is concerned with environmental and social impacts due to the important external effects (Dinwoodie et al., 2012; Acciaro, 2015).

Technical characteristics of ships are often considered as the main causes of environmental pollution. During the last three decades, regulations focused on environmental sustainability and energy efficiency for ports have been introduced at international, European and national level (Table 1).

Over the last decades the main international institutions, like the International Maritime Organisation (IMO) and the Marine Environment Protection Committee (MEPC), carried out continuous and deep interventions, consisting of amendments, regulations, standards and proposals of guidelines related to MARPOL 73/78/97. Several conventions have been introduced by the IMO (UN specialised agency with responsibility both for safety and security of shipping). The main convention, the “International Convention for the Prevention of Pollution from Ships”, was introduced in 1973 (MARPOL 73) amending the International Convention for the Prevention of Marine Oil Water (OILPOL 54). Subsequently, the same convention was amended by the 1978 Protocol, signed during the TSPP (Tanker Safety Pollution Prevention) Conference and planned as a result of environmental disasters caused by oil tankers in the late 1970s. The convention known as MARPOL 73/78 deals with the prevention of pollution of the marine environment by ships from operational or accidental causes, regulating the draining standards for used oil, sewage and waste materials. This convention is structured by six annexes which entered into force from 1983 to 2005. In more detail, the six Annexes consist of the specific features described below: prevention of pollution by oil and oily water (Annex I); control of pollution by noxious liquid substances in bulk (Annex II); prevention of pollution by harmful substances carried by sea in packaged form (Annex III); pollution by sewage from ships (Annex IV); pollution by garbage from ships (Annex V); and prevention of air pollution from ships (Annex VI).

Increasing attention has been paid to the ships' ballast water by the International Convention for the Control and Management of Ships' Ballast Water and Sediments and also the Ballast Water Management (BWM) regulations which address the reduction of the transmigration of aquatic microorganisms from one port to another through the ballast water produced by the ships. Indeed, they have a negative impact on the environment, human health, biodiversity and the different industries involved (e.g. fishing, agriculture, tourism). Consequently, the ships have to adopt a Ballast Water Management Plan according to the BWM standard and maintain a Ballast Water Record Book to record each operation related to the ballast water.

Seaport industry has been the focus of many legal interventions on environmental issues by the European Union (EU), supporting challenging international actions to prevent climate change and global

Table 1
International, European and National regulations on green ports.

Year	Geographic Competence		
	International	European	National
2001–2016	**IMO (International Maritime Organisation that is United Nations Agency with responsibility both for safety and security of shipping)** **2013**: The Marine Environment Protection Committee (MEPC), IMO's technical work, pushed forward with "energy efficiency" implementation. **2011**: Chapter for covering "mandatory technical and operational energy efficiency measures" addressed at decreasing "greenhouse gas emission" from vessels. **2009**: The Hong Kong International Convention for the safe and environmentally sound recycling of the ships. **2004**: The International Convention for the control and management of ships ballast water and sediments.	**European Union (EU)** **2016**: Directive 2016/802/EC (relating to a reduction in the sulphur content of certain liquid fuels). **2015**: EU Regulation no. 2015/575 concerns the monitoring, reporting and verification of CO_2 emissions from maritime transport. **2014**: Directive 2014/94/EC. **2012**: Directive 2012/33/EU; Directive 2012/27/EU **2012**: ESPO Green Guide (2012) **2011**: The Communication on an Energy Efficiency Plan 2011. **2009**: Directive 2009/28/EC. **2006**: Directive 2006/32/EC. **2005**: Directive 2005/33/EC, amendment of Directive 1999/32/CE, identifies some European zones as sulphur emission control areas (SECAs); Directive 2005/35/EC; Directive 2005/33/EC. **2004**: Directive 2004/8/EC. **2003**: Directive 2003/55/EC. **2002**: Directive 2002/49/EC. **2001**: Directive 2001/42/EC, well known as SEA Directive introduces the concept of "environmental assessment and reporting". **2000**: Directive 2000/59/EU.	**National Government (Italy)** **2016**: Reform of the port industry. (redesign of organisational asset of port industry) **2014**: Law 164/2014 (converting the Decree Law D.L. 133/2014 on September D.L. "Sblocca Italia"). **2012**: Ministerial Decree 56/2012. **2006**: Law 13/2006, Decree No. 152/2006 replaces D.Lgs. 22/1997 and D.Lgs. 152/1999 and the following amendments on "Environmental Regulations". **2004**: Decree January/2004. **2003**: Legislative Decree 182/2003 implements the Directive 2000/59/EU, introducing restrictions and rules for port facilities to manage ship-generated waste. **2001**: Law 51/2001 (measures for preventing the pollution by vessels).
1990–2000	**2000:** Protocol to the OPRC relating to hazardous and noxious substances (OPRC-HNS Protocol). **1997:** MARPOL 97 with amendments for MARPOL 73/78 specifically with the Annex (VI). **1996:** Protocol to the London Convention 1972 for regulating the use of the sea as a depositary for waste materials and finding a balance between the concentration of CO2 in the atmosphere and the marine environment to guarantee the new technology (Entry into force: 2006). **1990:** The International Convention on oil pollution preparedness response and Co-operation (OPRC) (Entry into force: May 1995).	**1999:** Directive 1999/32/EC (regulation of sulphur emissions by ships). **1995:** Directive 1995/21/EC (regulation of international standards for ship safety, pollution prevention and shipboard living and working conditions, called as port State control).	**1999:** Legislative Decree (D.Lgs. 152/1999) implements European directives, regarding specifically the different types of water pollution resulting from ships wastewater. **1997:** Legislative Decree (D.Lgs. 22/1997), named "Ronchi Decree" (waste pollution in general).
1969–1989	**1973:** MARPOL 73 **1972:** London Convention on the prevention of "marine pollution" by dumping of wastes and other matter.	**1969/1971:** Convention on the high seas in the event of accidents for oil pollution adopted in Brussels in 1969, the Convention on Civil Liability for Oil Pollution Damage adopted in Brussels always in 1969 subsequently amended, and the Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage from Ships in Brussels in 1971.	**1982:** Law 979/1982,concerning any forms of pollution and the protection of the sea and marine ecosystems. **1977:** Law 185/1977 ratified and implemented the three most important international conventions on the matter, that is the Convention on the high seas in the event of accidents for oil pollution adopted in Brussels in 1969, the Convention on Civil Liability for Oil Pollution Damage adopted in Brussels always in 1969 subsequently amended, and the Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage from Ships in Brussels in 1971.

warming. EU policies aim to guarantee environmental sustainability and energy efficiency in the seaport industry in order to promote environmentally aware and sustainable ports, reducing the utilisation of fossil fuel energy sources because of the increasing dependence on energy imports and their impact on climate change and global warming.

At the national level, Italian regulations, besides implementing international and European conventions and directives, introduced many obligations, limits and rules for the main actors in the seaport industry in compliance with the regulatory system on environmental pollution from ships. The existing Italian regulatory system does not explicitly introduce the sustainability and energy efficiency issues, only requiring a series of certifications. The National Strategic Plan of the Seaports and Logistics (MIT, 2014), adopted by Law 164/2014, finally included the concept of sustainability in seaport areas and for the full supply chain aiming to preserve and protect the environment and the development of the seaports system. This national strategic plan was conceived to improve the competitiveness of seaports and supply chain systems, stimulate and support their passenger and freight traffic, also considering the redesign of the port organisational assets, highlighting the green issue by adopting sustainable development models.

Besides the legal interventions on environmental issues in the seaport industry at different levels, scholars also tend to pay significant and growing attention to the topic. Past studies on the topic have addressed various aspects of environmental impacts generated by the seaport industry (Ng and Song, 2010). Scholars mostly distinguish the study of environmental risks related to the seaport industry into two main categories (Ng and Song, 2010): impact assessments and optimal solutions (Anderson and Lee, 2006; Nasiri et al., 2009) and environmental risk perception (Bohm and Pfister, 2005; El-Zein et al., 2006). The contributions in the literature focusing on the impacts generated by shipping and maritime activities following mostly a managerial and

economic perspective are still scarce (Ng and Song, 2010).

Our review demonstrates the different lenses through which scholars study environmental issues in the seaport industry: technical, managerial and economic, and legal viewpoints.

Adopting a technical perspective, some studies tend to seek and develop instruments aimed at reducing, for instance, the gas emissions or emissions for particulate matter and carbon monoxide; less attention is paid to the waste management process for the players, especially the shipping companies and port users (Lin and Lin, 2006; Buhaug et al., 2009; Howitt et al., 2010; Villalba and Gemechu, 2011; Contini et al., 2011; Poplawski et al., 2011; Jalkanen et al., 2012; Lu et al., 2014). Other researchers adopt a managerial and economic viewpoint related to energy efficiency and environmental sustainability, for instance, they develop and introduce effective policies for measuring and controlling the future cost scenarios for reduction of ship CO_2 emissions (Eide et al., 2011). Lastly, most studies analyse the implications deriving from the regulatory system (Lack et al., 2011; Cullinane and Cullinane, 2013; Sheng et al., 2017).

Adopting both technical and economic perspectives, the "resource" approach, or the so-called "damage cost" approach, represents the most significant and common approach that aims to estimate the opportunity costs related to damage occurring to natural resources or social welfare (Daniels and Adamowicz, 2000; INFRAS/IWW, 2000; Ng and Song, 2010). The "prevention" approach, different from previous techniques, focuses on estimating the damage costs, addressing estimation of the costs required for escaping the potential environmental impacts, especially climate change (Daniels and Adamowicz, 2000; INFRAS/IWW, 2000).

Etkin (2003) proposed a logical methodology to evaluate the oil spill impacts of shipping activities, but specific approaches and methodologies able to monitor, control, quantify and measure the environmental impacts of shipping activities in economic and monetary terms, specifically related to the waste management process, are still missing.

Recently, other authors developed economic evaluation models to assess the environmental impacts due to accidental oil spills. The main innovation of this model consists of the "service recovery function" concept with a wider definition of "environmental impact cost", including "natural environmental", "social-economic", "responding" and "research" costs (Liu and Wirtz, 2006). All the opportunity costs are summarised from natural damages and economic losses.

Other similar models have been introduced by scholars mostly considering "economic losses" and "response costs" due to accidental (rather than routine) maritime pollution adopting historically observed data analysis (Garza-Gil and Prada-Blanco, 2006). In short, models and mechanisms have been proposed in several studies for estimating and assessing the environmental impact within the maritime sector, mostly focusing on the impacts of routine shipping operations (INFRA/IWW, 2000; Etkin, 2003; IFAW, 2007), but mainly they had similar deficiencies related to their geographic restrictions and their focus on large-scale accidental pollution (Sirkar et al., 1997; Rawson et al., 1998; Garza-Gil and Prada-Blanco, 2006; Liu and Wirtz, 2006) and also, most models proposed do not pay relevant attention to the waste management process. For overcoming these deficiencies, different models have been proposed to assess small and large-scale accidental oil spills but always missing other maritime pollution sources, or any detailed evaluations of environmental impacts along coastal areas and waste areas (GESAMP, 2001; Bigano and Sheehan, 2006; Adler and Inbar, 2007). Hence, ethical concerns are still missing regarding a focus on the risks and negative effects of maritime accidents and waste management (Bohm and Pfister, 2005; El-Zein et al., 2006; Ng and Song, 2010). Lastly, most studies focused on environmental impacts of maritime and shipping industry, focused on natural damage entirely missing economic losses for the coastline, and considerations about environmental impacts by maritime industry, e.g. the impact of the waste management process, suggested by MARPOL 73/78/97.

3. Management Control Systems in inter-organisational systems for the waste management process in the seaport industry

Scholars have mainly recognised the adoption of software as the main factor in managing and supporting knowledge and information sharing because of the role played by the control. Adopting an integrated information system allows the coordination and control of activities among firms through the management and exchange of information (Choe, 2008).

Furthermore, the control in inter-organisational relationships plays a crucial role in stimulating the partners in assuming "performance oriented" behaviours and coordinating the input-output information process within the relationship (Dekker, 2004). Innovative IT tools have been adopted in the port industry for collecting and managing information traffic flows, or decision-making processes on environmental issues. Thanks to the management accounting and control systems all the organisational processes can be more effectively and efficiently managed and supported, especially the decision-making processes in the port community collecting and analysing information and data. In the last twenty years, the IT role in seaport systems has been studied by scholars recognising its crucial role (Lee-Partridge et al., 2000; Kia et al., 2000; Park et al., 2005). In the past, port users usually used paper-based methods, such as sending faxes or handing in documents directly for the delivery of cargo, and the documents were sent via e-mail thanks to the Internet. In this rudimentary system, information and data were retyped each time in the port's information systems, requiring more time and increasing the risks of mistakes (Keceli et al., 2008).

In this context, the technology introduced relevant advantages for port users especially considering the integrated information technologies useful for the MCS that plays a relevant role in supporting the business strategy to achieve a competitive advantage and high standards of performance (Kaplan and Norton, 1996; Langfield-Smith and Smith, 1997). Port users need to manage and share much information, both internal and external, in their complex decision-making processes. Thus, the processes within the inter-organisational relationships established between PAs and ships require increasing attention on information and data management and sharing regarding the environmental impact of their operations.

According to this perspective, considering MCS, we might create effective conditions for improving the relationships between PAs and ships on the waste phenomenon and, in general, between PAs and other port users involved in the processes of waste collection and management.

4. Methodology

Adopting a case study methodology, we analyse the experience of the port of Naples (Italy). It has been chosen because of specific criteria: its relevance to cruise traffic among the main ports in the Mediterranean region (CLIA Europe, 2016).

Taking into account the high complexity of the information management for the waste process and the overall regulations, we conducted semi-structured interviews. The interview structure was developed following Annex V of MARPOL 73/78/97, the Directive 2000/59/EC and its Legislative Decree 182/2003 transposing EC Directive in Italy, and the document for addressing the waste collection and management plan in seaports of the Campania Region (Regional Resolution no. 335/2012). This last document invites the port users involved in the waste management process to carefully collect data about the waste collection and garbage treatment as well as to closely assess all the data, e.g. including the notifications sent from ships or shipping agents.

In this study, for gathering information and data, we conducted two semi-structured interviews through face-to-face meetings with two key actors, one shipping agent during the month of April 2016 and the PA of Naples during the month of June. Each interview lasted about 3 h. A specific semi-structured questionnaire was adopted during the

interviews focusing on relevant issues related to the actions required during the arrival, mooring and departure of ships for waste management and also obligations for preventing and reducing the environmental impact of port operations. The questionnaire structure consists of three sections. Section 1 concerns general information on the interviewee, that is firm details, function and role of the interviewee. Section 2 focuses on the behavioural orientation adopted by the firm in terms of environmental sustainability, specifically the waste management process. For instance, the following open questions were submitted: How do you face the challenges concerning environmental sustainability according to the regulatory system? What kind of information do you collect and manage with regard to the waste management process? Do you have one person responsible for the waste management process? Do you have a specific garbage collecting plan? Did you introduce a quality management process? Do you require a certification for the environmental management system and specifically the waste management process?' Finally, Section 3 concerns the application of managerial accounting instruments, especially the MCS in managing the inter-organisational relationships established between public and private players for the waste management process. For example, major questions are about the application of the MCS for this specific issue and concerning the relationships between the firm interviewed and the port users, also about details for managing the garbage (e.g. Do you develop and apply key performance indicators for measuring the effectiveness and efficiency of the waste management? What kind of practices do you develop for managing garbage?).

4.1. Case study description

This study investigates the main inter-organisational relationships concerning information management related to waste processes between the PA and cruise companies. Following the legislative framework briefly described, it is clear that there is not a direct relationship between these two players. However, the PA has to carry out a control function on port activities as indicated by the art. 6 Law 84/94 and art. 7 of Legislative Decree no. 169 on 4 August 2016 that entered into force on 15 September 2016, for the reorganisation of the Italian seaports in the Authority of Seaport System.

In addition, for implementing Legislative Decree no. 182/2003 transposing Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, over ten years ago the PA called for tenders to entrust the waste activities to private specialised operators. The waste services were entrusted to Green Port, that is a temporary association of firms composed of six specialised firms addressing the implementation of the plan of waste collecting and management from ships and residues indicated in art. 5 by Legislative Decree 182/2003 and further defined by the Regional Resolution no. 335/2012.

The results of our interviews, especially the PA interviewed, that is the manager of the environmental department, highlight that, at present, Green Port is still not completely working because there are some administrative difficulties. Hence, considering that Green Port should provide a report on waste management (see Legislative Decree 24 June 2003, no. 182), the PA requires data from each firm that composes Green Port. There is no joint scheduling to collect data, but the data request depends on the needs of the PA. These data are included in Excel spreadsheets and, they are sent from each firm to the PA by e-mail or fax. The data regard the garbage quantity on board and deposited in port. According to the PA, the control activity is very relevant, but currently, much information is transferred from cruise companies or through their shipping agent to the Harbour Office (HO).

According to Directive 2000/59/EC (art. 5) and the Legislative Decree 182/2003, an appropriate waste reception and handling plan should be developed and implemented for each port following consultations with the relevant parties, especially with port users or their representatives. Besides, regarding the ports of the Campania region, Regional Resolution no. 335/2012 indicates that the plan for waste management has to be applied to all ships that are docked in the port or in the roadstead, which produce waste from the activities onboard the ship, used oils and oily residues, non-hazardous special waste, sewage. Regarding information management processes, the regulatory framework identified the relationship between ship, specifically the shipmaster or the shipping agent, and the Maritime Authority, which is the HO. In fact, the ship has to send the notification form that includes mainly the quantity and type of waste and residues to deliver and to keep on board ship. On this point, Regional Resolution no. 335/2012 suggested an analysis of information included in the notifications, such as: number of notifications with respect to the number of ships arriving in a specific period; recognition policy adopted in the port and the Maritime Authority's processes of computerisation; quantity of garbage specified in the notifications, and the information provided with respect to the total number of notifications examined; congruence between the storage capacity and the quantity transferred or to be transferred in the next port. These data should be summarised every year.

In our analysis, it has been possible to identify another relationship, that is between the ship and the shipping agent, and the latter and the HO. Additionally, in this second case, the relationship with the PA is indirect. In this relationship, the shipping agent works through its shipping agency (Marinter S.r.l.), which manages all the practices about the waste process derived from the ships in Naples port and performs a specific function that is “Garbage Declaration”. This activity concerns the collection, processing and reporting of all information and data about the waste management process for the ships. More specifically, the shipping agency, in managing all the processes, adopts an information system. Three different phases can be distinguished: before, during and at the end of mooring on the quay. In each step specific documents for the waste management process are required, in fact, the shipmaster has to fill specific schedules about the amount and nature of waste produced on the ship, specifying the intention to use the waste services in the port. These schedules filled for the port in Naples represent the “Garbage Declaration”. This document is necessary for making the shipping agency to require the intervention of PA and of the specialised organisation for certification about the environmental impact of shipping operations. In the collection and sharing of information and data, the shipping agency adopts a specific digital platform, called the Port Management Information System (PMIS), which allows access by external organisations for environmental management control and monitoring processes.

In the two inter-organisational indirect relationships investigated, we can observe relevant differences in terms of information systems adopted for managing the specific processes in order to make the control function from PA. In fact, a digital platform, which we can consider as an application of MCS is adopted between the shipping agent and HO, while in the relationship between ship and shipping agent there are no specific software or information systems that support the overall functions regarding the waste management process. Finally, the shipping agent has information about the waste delivered to the port and that remaining on board, but there is a system of indicators suggested by Regional Resolution no. 335/2012.

The results of the case study are summarised in Table 2.

5. Managerial accounting instruments for competitive green ports: a balanced scorecard for PA decision-making processes in waste management

In the scenario briefly described, we propose a set of KPIs following the internal processing perspective in the indirect relationships identified. The measurement and control of effectiveness and efficiency allow the PA to reorganise the port reception facilities required by MARPOL, Annex V.

In fact, according to Neely (1998), all the organisations make their performance control thanks to the quantification process named ‘performance measurement’. As a consequence, the performance goals, in

Table 2
Summary of results.

Case Study	Compliance To Marpol 73/78/97(Y/N)	Adoption Of Waste Collection And Management Plan (Y/N)	Adoption Of Integrated Waste Data Collecting System (Y/N)	Adoption Of Mcs For Waste Management (Y/N)	Adoption Of Digital Platform (Y/N)	Adoption Of MCS (Y/N)	Adoption Of Waste Reception And Handling Plan (Y/N)
PA of Naples	Y	Y	N	Y	N (PA/SA)	N	N
Shipping Agent (SA)	Y	-	N	N	Y (SA/HO); N (SA/SHIP)	Y	N

Direct Inter-Organisational Relationships: SA/HO = Shipping Agent and Harbour Office; SA/SHIP = Shipping Agent and Ship.
Indirect Inter-Organisational Relationships: PA/SA = Port Authority and Shipping Agent.

terms of effectiveness and efficiency criteria, can be achieved through the adoption of specific control systems (Hoffecker and Goldenberg, 1994). Several theoretical frameworks have been developed for measuring and controlling performance, and thus for addressing organisational asset management. The most popular and applied framework is the Balanced Scorecard (BSC), which was developed in the nineties by Kaplan and Norton (1996). The BSC was conceived as a multidimensional framework to describe, implement and manage strategies for overall organisational positions strongly linking objectives, initiatives and measures to the firm strategy in the functional perspective. The BSC provides details regarding the possible results obtained from the enterprise in terms of its overall performance. The BSC supplements the financial measures providing other KPIs according to some perspectives, such as financial, customer, internal business processes, and learning and organisational growth. More specifically, the financial perspective is about the profitability of the firms (i.e. the financial indicators ROI, EVA and so forth); the customer perspective includes measures of successful outcomes in the direction of firm strategy (i.e. customer satisfaction, customer retention, etc.); the internal business is based on the internal processes that affect customer satisfaction and thus the achievement of the financial organisational objectives; the learning and growth (or "innovation and learning") perspective including innovation issues, measures continuous improvements for existing products and processes, and also the launch of new products. Additionally, this last perspective can identify the fundamentals needed for building and managing long-term growth and competitive advantage in the organisation through people, systems and procedures. In each perspective, it is possible to identify sets of singular indicators that function as "dashboards". These sets provide knowledge factors supporting the monitoring processes for business strategies and the design of any organisational processes. Hence, Abran and Buglione (2003: 342) argue that "knowing the causal relationships across the indicators, the business executives must then, each time, figure out a consolidated assessment of current organisational performance".

However, on the one side, the BSC allows searching for solutions to support the implementation process for the strategy (Mintzberg, 1994; Kaplan and Norton, 1996); on the other side, because of the nature of the BSC, that is the adoption of the hierarchical top-down model, this strategic managerial tool could be arguable, bringing about criticisms and limits (Nørreklit, 2000). Otherwise, the BSC might be considered an effective tool for making decisions addressed at reducing costs and improving environmental performance, also increasing the level of "how" to carry out the processes by PAs, which tend to behave more similarly to private firms. Therefore, the BSC might represent a useful tool for justifying top-down control (Nørreklit, 2003: 612). The measures and performance drivers of outcomes represent the crucial key factor of the BSC following a cause and effect relationship (Kaplan and Norton, 1996). Otherwise, a cause and effect relationship between some of the suggested measurements areas does not always exist. For instance, Kaplan and Norton (1996) argue that the cause and effect relationship between customer satisfaction and loyalty, and between loyalty and financial results is still missing.

In the internal processes model, attention is paid to specific aspects, such as the risks related to the process and the consequent crisis management area, the performance evaluation systems and the review of strategic planning. Besides, according to Agostino and Arnaboldi (2012), two further main reasons justify the adoption of the BSC: the increasing attention paid to this tool by top and operational managers; the specific characteristics of the BSC, that is it is "concise and succinct" thanks to the development of adequate KPIs (Agostino and Arnaboldi, 2012: 332–333). In order to control the information about garbage, that is waste management (MARPOL 73/78/97, Annex V), during the mooring and departure phases, managerial instruments might be relevant for collecting, processing and reporting qualitative and quantitative data. Indeed, these operating processes concern the relationship systems among private (i.e. cruise companies) and public organisations

(i.e. PAs, maritime authorities), and the information and data regarding them are useful to support the PA's decision-making processes related to port environmental issues.

MCS and tools (e.g. BSC) use information to evaluate the performance of the resources employed in the business processes. An efficient MCS might support and improve the decision-making process, above all when the strategic choices of one firm impacts on the behaviour of other firms, in order to obtain a competitive advantage for both. Indeed, according to Anthony and Govindarajan (1998), and Horngren et al. (2005), management control is defined not only as the process by which managers influence other members of the organisation to implement organisational strategies, but it can also be conceived as an integrated technique concerning coordination, resource allocation and performance measurement (Di Vaio and Varriale, 2016).

This study develops and proposes some KPIs addressed at monitoring, controlling, assessing and measuring the decision-making processes of PAs in their relationships with a focus on information and data flows concerning related operating activities. Indeed, most authors tend to identify and propose 'environmental key performance indicators' (e-KPIs) paying attention mainly to technical aspects. For instance, Peris-Mora et al. (2005) developed strategic indicators for planning port management policy in the perspective of environmental performance where the specific conditions introduced by MARPOL 73/78/97 and all the other regulations were applied. The existing developed e-KPIs mostly consist of 'operative indicators' related to collection and management information in terms of fuel, oil or waste level of direct operations. Consequently, some indicators consider the negative environmental effects of port operations, or also others, consisting of "management port indicators", focus on delays in information management. For instance, some indicators concern direct and port activity licensed-distribution companies in terms of emission of greenhouse agents, atmospheric pollutant agencies or air quality. Our study proposes e-KPIs which can be considered as a useful instrument to monitor, control, assess and measure the effectiveness and efficiency of the decision-making process of PAs in the perspective of competitive green ports. These e-KPIs can help identify the causes of dysfunctions in the process within the inter-organisational relationships between the PAs, on the one side, and the cruise companies, on the other side. Hence, by identifying these KPIs we can improve the management control in the relationship investigated, adopting the BSC approach with a specific focus on the internal processes' perspective. However, it is relevant to identify and explain which factors can impact on the adoption of e-KPIs considering the PA's point of view, also investigating how information and data can be collected and managed. Besides, in order to develop e-KPIs, managers and, in general, private and public organisations with responsibility for the processes need to be clearly identified. E-KPIs have to consider the role of the PAs, their main tasks and responsibilities for environmental pollution, especially air pollution, mainly in their inter-organisational relationships established with shipping lines. Considering the "internal business processes" perspective, in Table 3 we identify the possible e-KPIs that the PAs could adopt in their management and control systems for environmental performance in their relationships with the shipping lines.

Table 3
PA in controlling functions for waste management from cruise ships.

e-KPIs
Effectiveness
[1a] No. meeting on waste issues attended by port users involved in the waste collecting and management/ No. meeting on waste issues promoted by PAs
[1b] No. hours spent listening to the cruise shipping lines by PAs linked to environmental topics
Efficiency
[2a] no. hours to check the notifications/total hours planned for PAs activities
[2b] no. waste deliveries/the tonnage of vessels
[2c] the quantitative of waste retained onboard/the waste to be delivered
[2d] no. notifications/no. hours spent for checking certifications-documents

Considering the potential causes of waste pollution from ships, we identify the indices to be integrated into the current MSC of PAs to comply with MARPOL 73/78/97, specifically Annexe V. These indices do not easily consider the technical and operating aspects outlined by the main regulations on environmental issues.

Table 3 shows six e-KPIs, including: effectiveness indices, that is [1a] no meeting on waste issues attended by port users involved in waste collection and management/no meeting on waste issues promoted by PAs. This indicator represents the real interest of the port users in the waste issues promoted by PAs. The index has to be equal to one and it measures the effectiveness of the promotion actions implemented by PAs in order to stimulate port users to adopt more and more managerial instruments capable of sharing information about the control of waste management onshore. The index [1b], number of hours spent by PAs listening to the shipping lines about environmental topics and the overall decisions needed to make for environmentally sustainable behaviour, refers to the level of attention paid by PAs to inform the users, such as shipping companies, about the environmental issues related to the port destination. A high value on this index means that more environmentally sustainable behaviours should be adopted.

Regarding the efficiency indices, Table 3 highlights four indicators: [2a] the number of hours spent checking the notifications in relation to the total of hours dedicated by PAs for their overall activities; [2b] the ratio between the number of checks of waste deliveries and the tonnage of vessels (capacity and weight of ships); [2c] the ratio between the amount of waste retained onboard and waste to be delivered; [2d] the number of notifications compared to the number of hours spent controlling all the documents. These indicators represent the efficiency of the check operations related to port waste management; that is, they reveal the relevance of reducing the investments of time and financial resources in waste management based on adequate strategic decisions including the Waste Management Plan.

These key indicators can support operations management to ensure higher levels of environmental performance of PAs and, consequently, the shipping companies. In this way PAs improve their management, measurement and control systems and they could give substance to the environmental strategy and policies, specifically to the overall green measurements which can be adopted in their relationships with port users, by translating the technical requirements introduced by the main regulations in the perspective of environmental performance which respects effectiveness and efficiency criteria. Besides, the data processed might support the decisions about the reorganisation of the port reception facilities indicated by Annex V, MARPOL.

Using the BSC, we can identify a strategy for environmental sustainability and energy efficiency in the port industry, which allows for defining effective and efficient solutions for PAs, filling the gap still existing in the regulatory systems and literature about the definition and implementation of managerial accounting tools for environmental performance, in general, competitive green ports. In detail, thanks to this instrument, PAs can prevent and manage the negative effects related to the activities and operations performed by PAs and shipping lines respecting specific perspectives addressed to guarantee efficient and effective processing. Indeed, operating on some aspects of port operations with a focus on shipping lines and PAs, e.g. the drafting and control of certifications in terms of hours spent to realise the activities, PAs can reduce any costs related to consequent air pollution, low performance, accidents and other risks to the environment.

Our analysis indicates that, besides respect for the overall regulations, codes and guidelines on the environment, all PAs and port users, also shipping lines, need to develop and adopt specific managerial tools to make effective and efficient decision-making processes, above all in terms of reducing negative external costs for the environment.

6. Conclusions, limitations and future perspectives

This study contributes to the existing literature by analysing the collecting, processing and reporting information and data about the environmental effects derived from ships in the port industry within the inter-relationships systems established between port users. We observe that port users still do not use advanced and specific information systems and, also, they do not share information, data and practices. Furthermore, the functions analysed in both the inter-relationships systems merely concern descriptions and documentation related to waste management.

This study highlights the need to respond to international, European and national regulations in terms of waste management, but, unfortunately, there is still a lack of an integrated MCS for sharing and managing information and data between all the players to manage the waste emissions in compliance with effectiveness and efficiency performance criteria. The waste management process is performed by other actors on the basis of elements of trust through reports not completely formalised and other players with high risks of conflict of interests, conflicting roles or opportunistic behaviours.

Thus, our on-going work can identify some relevant criticisms in the relationship between the port users analysed. In fact, the findings highlight that management controls, information systems and reporting are still missing crucial aspects related to the environmental issues, specifically port waste management, and the consequent activities in the port. Besides the several limitations of the study, such as its qualitative content and the analysis of only one case with only two interviews, it can be considered as an interesting research starting point in order to find new and more intriguing aspects to investigate, which can investigate and explain the different role and use of the management control information system and reporting tools in the seaport system with a focus on waste management.

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References

Abran, A., Buglione, L., 2003. A multidimensional performance model for consolidating balanced scorecards. Adv. Eng. Software 34 (6), 339–349. https://doi.org/10.1016/S0965-9978(03)00033-4.

Acciaro, M., 2015. Corporate responsibility and value creation in the port sector. International Journal of Logistics Research and Applications 18 (3), 291–311. https://doi.org/10.1080/13675567.2015.1027150.

Adler, E., Inbar, M., 2007. Shoreline sensitivity to oil spills, the Mediterranean coast of Israel: assessment and analysis. Ocean Coast Manag. 50 (1/2), 4–34. https://doi.org/10.1016/j.ocecoaman.2006.08.016.

Agostino, D., Arnaboldi, M., 2012. Design issues in Balanced Scorecards: the “what” and “how” of control. Eur. Manag. J. 30 (4), 327–339. https://doi.org/10.1016/j.emj.2012.02.001.

Anderson, J.W., Lee, R.F., 2006. Use of biomarkers in oil spill risk assessment in the marine environment. Hum. Ecol. Risk Assess. 12, 1192–1222. https://doi.org/10.1080/10807030600976600.

Anthony, R.N., Govindarajan, V., 1998. In: Management Control Systems, ninth ed. Irwin McGraw-Hill, Homewood.

Barnes-Dabban, H., van Tatenhove, J.P., van Koppen, K.C., Termeer, K.J., 2017. Institutionalizing environmental reform with sense-making: west and Central Africa ports and the ‘green port’phenomenon. Mar. Pol. 86, 111–120. https://doi.org/10.1016/j.marpol.2017.09.005.

Bigano, A., Sheehan, P., 2006. Assessing the Risk of Oil Spills in the Mediterranean: the Case of the Route from the Black Sea to Italy. Workingpaper. 32 Fondazione Eni Enrico Mattei, Milan.

Bohm, G., Pfister, H.R., 2005. Consequences, morality, and time in environmental risk evaluation. J. Risk Res. 8 (6), 461–479. https://doi.org/10.1080/13669870500064143.

Bows, A., Anderson, K., Peeters, P., 2009. Air transport, climate change and tourism. Tourism Hospit. Plann. Dev. 6 (1), 7–20. https://doi.org/10.1080/14790530902847012.

Brida, J.G., Zapata, S., 2010. Economic impacts of cruise tourism: the case of Costa Rica. Anatolia 21 (2), 322–338. https://doi.org/10.1080/13032917.2010.9687106.

Buhaug, O., Corbett, J.J., Endresen, O., Eyring, V., Faber, J., Hanayama, S., Lee, D.S., Lee, D., Lindstad, H., Markowska, A.Z., Mjelde, A., Nelissen, D., Nilsen, J., Palsson, C., Winebrake, J.J., Wu, W.Q., Yoshida, K., 2009. Second IMO GHG Study. International Maritime Organization (IMO), London, UK.

Butt, N., 2007. The impact of cruise ship generated waste on home ports and ports of call: a study of Southampton. Mar. Pol. 31 (5), 591–598. https://doi.org/10.1016/j.marpol.2007.03.002.

Choe, J.M., 2008. Inter-organizational relationships and the flow of information through value chains. Inf. Manag. 45, 444–450. https://doi.org/10.1016/j.im.2008.06.006.

CLIA Europe, 2016. Cruise industry. Contribute Contribution of cruise tourism to the economies of Europe. http://www.cliaeurope.eu/.

Contini, D., Gambaro, A., Belosi, F., De Pieri, S., Cairns, W.R.L., Donateo, A., Citron, M., 2011. The direct influence of ship traffic on atmospheric PM 2.5, PM 10 and PAH in Venice. J. Environ. Manag. 92 (9), 2119–2129. https://doi.org/10.1016/j.jenvman.2011.01.016.

Cullinane, K., Cullinane, S., 2013. Atmospheric emissions from shipping: the need for regulation and approaches to compliance. Transport Rev. 33 (4), 377–401.

Daniels, R.H.O.N.D.A., Adamowicz, V., 2000. Environmental Valuation. Handbook of Transport Modelling. Pergamon, Amsterdam.

Dekker, H.C., 2004. Control of inter-organizational relationships: evidence on appropriation concerns and coordination requirements. Account. Org. Soc. 29 (1), 27–49. https://doi.org/10.1016/S0361-3682(02)00056-9.

Di Vaio, A., Varriale, L., 2018a. Management innovation for environmental sustainability in seaports: managerial accounting instruments and training for competitive green ports beyond the regulations. Sustainability 10 (3), 783. https://doi.org/10.3390/su10030783.

Di Vaio, A., Varriale, L., 2018b. Management control systems in inter-organizational relationships for environmental sustainability and energy efficiency: evidence from the cruise port destinations. In: Lamboglia, R., Cardoni, A., Dameri, R., Mancini, D. (Eds.), Network, Smart and Open. Lecture Notes in Information Systems and Organisation. 24. pp. 43–55. https://doi.org/10.1007/978-3-319-62636-9_3.

Di Vaio, A., Varriale, L., 2016. Management Control Systems for the Water Concessionaires Governance: a Multiple Cases Study in the Italian Seaports. Strengthening Information and Control Systems. Springer International Publishing, pp. 145–156. https://doi.org/10.1007/978-3-319-26488-2_11.

Di Vaio, A., Varriale, L., Alvino, F., 2018. Key performance indicators for developing environmentally sustainable and energy efficient ports: evidence from Italy. Energy Pol. 122, 229–240. https://doi.org/10.1016/j.enpol.2018.07.046.

Dinwoodie, J., Tuck, S., Knowles, H., Benhin, J., Sansom, M., 2012. Sustainable development of maritime operations in ports. Bus. Strateg. Environ. 21 (2), 111–126. https://doi.org/10.1002/bse.718.

Eide, M.S., Longva, T., Hoffmann, P., Endresen, Ø., Dalsøren, S.B., 2011. Future cost scenarios for reduction of ship CO_2 emissions. Marit. Pol. Manag. 38 (1), 11–37. https://doi.org/10.1080/03088839.2010.533711.

Eijgelaar, E., Thaper, C., Peeters, P., 2010. Antarctic cruise tourism: the paradoxes of ambassadorship,“last chance tourism” and greenhouse gas emissions. J. Sustain. Tourism 18 (3), 337–354. https://doi.org/10.1080/09669581003653534.

Elkington, J., 1997. Cannibals with Forks. The Triple Bottom Line of 21st Century.

El-Zein, A., Nasrallah, R., Nuwayhid, I., Kai, L., Makhoul, J., 2006. Why do neighbors have different environmental priorities? Analysis of environmental risk perception in a Beirut neighborhood. Risk Anal. 26 (2), 423–435. https://doi.org/10.1111/j.1539-6924.2006.00751.x.

ESPO, 2012. Towards Excellence in Port Environmental Management and Sustainability.

Etkin, D.S., 2003. Modeling oil spill response and damage costs. In: Proceedings of the 2003 International Oil Spill Conference. American Petroleum Institute, Washington DC.

Garza-Gil, M.D., Prada-Blanco, A., Vazquez-Rodriguez, M.X., 2006. Estimating the short term economic damages from the Prestige oil spill in the Galician fisheries and tourism. Ecol. Econ. 58 (4), 842–849. https://doi.org/10.1016/j.ecolecon.2005.09.009.

Geng, Y., Zhu, Q., Doberstein, B., Fujita, T., 2009. Implementing China's circular economy concept at the regional level: a review of progress in Dalian, China. Waste Manag. 29 (2), 996–1002. https://doi.org/10.1016/j.wasman.2008.06.036.

GESAMP, 2001. A Sea of Troubles. IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) and Advisory Committee on Protection of the Sea. Reports and studies no. 70. IMO, London.

Gibbs, D., Rigot-Muller, P., Mangan, J., Lalwani, C., 2014. The role of sea ports in end-to-end maritime transport chain emissions. Energy Pol. 64, 337–348. https://doi.org/10.1016/j.enpol.2013.09.024.

Grech, A., Bos, M., Brodie, J., Coles, R., Dale, A., Gilbert, R., Rasheed, M.A., 2013. Guiding principles for the improved governance of port and shipping impacts in the Great Barrier Reef. Mar. Pollut. Bull. 75 (1), 8–20. https://doi.org/10.1016/j.marpolbul.2013.07.013.

Henriques, A., Richardson, J., 2004. The Triple Bottom Line: Does it Add up. Earthscan, London.

Hoffecker, J., Goldenberg, C., 1994. Using the balanced scorecard to develop company wide performance measures. Journal of Cost Management 8 (3), 5–17.

Horngren, C.T., Harrison, W.T., Bamber, L.S., Willis, B., Jones, B., 2005. Accounting.

Pearson Education.
Howitt, O.J., Revol, V.G., Smith, I.J., Rodger, C.J., 2010. Carbon emissions from international cruise ship passengers' travel to and from New Zealand. Energy Pol. 38 (5), 2552–2560. https://doi.org/10.1016/j.enpol.2009.12.050.
IFAW, 2007. Chronic Oil Pollution in Europe. IFAW, Brussels, Belgium.
INFRAS/IWW, 2000. External Costs of Transport: Accidents, Environmental and Congestion Costs of Transport in Western Europe. INFRAS/IWW, International Union of Railways, Paris.
Jalkanen, J.P., Johansson, L., Kukkonen, J., Brink, A., Kalli, J., Stipa, T., 2012. Extension of an assessment model of ship traffic exhaust emissions for particulate matter and carbon monoxide. Atmos. Chem. Phys. 12 (5), 2641–2659. https://doi.org/10.5194/acp-12-2641-2012.
Johnson, D., 2002. Environmentally sustainable cruise tourism: a reality check. Mar. Pol. 26 (4), 261–270. https://doi.org/10.1016/S0308-597X(02)00008-8.
Kaplan, R.S., Norton, D.P., 1996. Using the Balanced Scorecard as a Strategic Management System.
Keceli, Y., Choi, H.R., Cha, Y.S., Aydogdu, Y.V., 2008. A study on adoption of port community systems according to organization size. In: Convergence and Hybrid Information Technology, 2008. ICCIT'08. Third International Conference on Seaport Industry and Port Community System. 1, 493-501, IEEE.
Kia, M., Shayan, E., Ghotb, F., 2000. The importance of information technology in port terminal operations. Int. J. Phys. Distrib. Logist. Manag. 30 (3/4), 331–344. https://doi.org/10.1108/09600030010326118.
Lack, D.A., Cappa, C.D., Langridge, J., Bahreini, R., Buffaloe, G., Brock, C., Lerner, B., 2011. Impact of fuel quality regulation and speed reductions on shipping emissions: implications for climate and air quality. Environ. Sci. Technol. 45 (20), 9052–9060. https://doi.org/10.1021/es2013424.
Lam, J.S.L., Notteboom, T., 2014. The greening of ports: a comparison of port management tools used by leading ports in Asia and Europe. Transport Rev. 34 (2), 169–189. https://doi.org/10.1080/01441647.2014.891162.
Lam, J.S.L., Van de Voorde, E., 2012. Green port strategy for sustainable growth and development. In: Transport Logistics for Sustainable Growth at a New Level, International Forum on Shipping, Ports and Airports (IFSPA), pp. 27–30.
Langfield-Smith, K., 1997. Management control systems and strategy: a critical review. Account. Org. Soc. 22 (2), 207–232. https://doi.org/10.1016/S0361-3682(95)00040-2.
Lee-Partridge, J.E., Teo, T.S., Lim, V.K., 2000. Information technology management: the case of the Port of Singapore Authority. J. Strat. Inf. Syst. 9 (1), 85–99. https://doi.org/10.1016/S0963-8687(00)00035-4.
Lin, J., Lin, C.C., Cleland-Huang, J., Settimi, R., Amaya, J., Bedford, G., Zou, X., 2006. Poirot: a distributed tool supporting enterprise-wide automated traceability. In: Requirements Engineering, 14th IEEE International Conference, pp. 363–364.
Liu, X., Wirtz, K.W., 2006. Total oil spill costs and compensations. Marit. Pol. Manag. 33 (1), 49–60. https://doi.org/10.1080/03088830500513352.
Lu, C.S., Liu, W.H., Wooldridge, C., 2014. Maritime environmental governance and green shipping. Marit. Pol. Manag. 41 (2), 131–133. https://doi.org/10.1080/03088839.2013.819134.
MARPOL 73/78/97, 1997. International Convention for the Prevention of Pollution from Ships (MARPOL): 1973 Convention, 1978 Protocol, 1997 Protocol - Annex VI; Entry into Force: 2 October 1983 (Annexes I and II).
Mintzberg, H., 1994. The fall and rise of strategic planning. Harv. Bus. Rev. 72 (1), 107–114.
MIT, 2014. Piano Strategico Nazionale della Portualità e della Logistica. Rome, Italy.
Murugesan, S., 2008. Harnessing green IT: principles and practices. IT professional 10 (1), 24–33. https://doi.org/10.1109/MITP.2008.10.
Nasiri, F., Manuilova, A., Huang, G.H., 2009. Environmental policy analysis in freight transportation planning: an optimality assessment approach. International Journal of Sustainable Transportation 3 (2), 88–109. https://doi.org/10.1080/15568310701779519.
Neely, A.D., 1998. Measuring Business Performance.
Ng, A.K., Song, S., 2010. The environmental impacts of pollutants generated by routine shipping operations on ports. Ocean Coast Manag. 53 (5), 301–311. https://doi.org/10.1016/j.ocecoaman.2010.03.002.
Nordhaus, W.D., 2008. A Question of Balance: Economic Modeling of Global Warming. Yale University Press, New Haven.
Norreklit, H., 2000. The balance on the balanced scorecard a critical analysis of some of its assumptions. Manag. Account. Res. 11 (1), 65–88. https://doi.org/10.1006/mare.1999.0121.
Nørreklit, H., 2003. The balanced scorecard: what is the score? A rhetorical analysis of the balanced scorecard. Account. Org. Soc. 28 (6), 591–619. https://doi.org/10.1016/S0361-3682(02)00097-1.
Park Nam Kyu, K., Choi, H.R., Lee, C.S., Kang, M.H., Yang, J.W., 2005. Port management information system towards privatization. In: Proceedings of IAME 2005 Annual Conference. International Association of Maritime Economists, Limassol, Cyprus.
Peris-Mora, E., Orejas, J.D., Subirats, A., Ibáñez, S., Alvarez, P., 2005. Development of a system of indicators for sustainable port management. Mar. Pollut. Bull. 50 (12), 1649–1660. https://doi.org/10.1016/j.marpolbul.2005.06.048.
Poplawski, K., Setton, E., McEwen, B., Hrebenyk, D., Graham, M., Keller, P., 2011. Impact of cruise ship emissions in Victoria, BC, Canada. Atmos. Environ. 45 (4), 824–833. https://doi.org/10.1016/j.atmosenv.2010.11.029.
Rawson, C., Crake, K., Brown, A., 1998. Assessing the environmental performance of tankers in accidental grounding and collision. SNAME Transactions 106, 41–58.
Sheng, D., Li, Z.C., Fu, X., Gillen, D., 2017. Modeling the effects of unilateral and uniform emission regulations under shipping company and port competition. Transport. Res. E Logist. Transport. Rev. 101, 99–114. https://doi.org/10.1016/j.tre.2017.03.004.
Sirkar, J., Ameer, P., Brown, A., Goss, P., Michel, K., Nicastro, F., et al., 1997. A Framework for Assessing the Environmental Performance of Tankers in Accidental Groundings and Collisions. SNAME T and R Ad Hoc Panel.
Straughan, R.D., Roberts, J.A., 1999. Environmental segmentation alternatives: a look at green consumer behavior in the new millennium. J. Consum. Market. 16 (6), 558–575. https://doi.org/10.1108/07363769910297506.
Villalba, G., Gemechu, E.D., 2011. Estimating GHG emissions of marine ports-the case of Barcelona. Energy Pol. 39 (3), 1363–1368. https://doi.org/10.1016/j.enpol.2010.12.008.
Walker, G., King, D., 2008. The Hot Topic: what We Can Do about Global Warming. HoughtonMifflinHarcourt.