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Tools for evaluating environmental performance at Brazilian public ports: Analysis and proposal

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ABSTRACT

The port sector critically needs improved management techniques to evaluate its environmental performance. In the present study, we conducted an exploratory research to understand the metrics used in the Brazilian public ports to assess their environmental performance. We considered two state agencies and two port authorities of southern Brazil. As preliminary results, we found that economic factors are excluded in the tools for measuring environmental performance. A system of indicators to address this shortcoming was then proposed, but it could not be applied because of data deficiencies. Thus, the system was divided into two parts: a simplified system with 7 indicators (measuring costs related to criteria were measured only technically) and an advanced system with 5 indicators (approaching costs were currently difficult to measure). Thus, the proposed indicators can be applied by port authorities to facilitate decision-making related to environmental management. As suggestions for further work, we propose research that includes more ports, both public and private, to provide an overview at the national level.

1. Introduction

Ports are crucial for the global economy because they are strategic points in supply chains that are becoming increasingly globalized. In 2014, cargo transportation by sea increased by 3.4% worldwide (Unctad, 2015), and in Brazil, this growth was 4.25% in the same year (ANTAQ, 2016). In Brazil, from 1993, the port system was opened to greater participation of the private sector and adopted the landlord port model (Bank, 2001; Galvão et al., 2013). Since then, efforts have been made to modernize ports with the creation of agencies for regulation and strategic management of the sector; however, challenges in integrating these persist, and the environment around the ports is still under the influence of the reality of bureaucracy and complexity of federal, state, and municipal laws (Kaiser et al., 2013).

Ports can cause environmental effects on the ocean, soil, and air, leading to deterioration of both marine and terrestrial ecosystems (Darbra et al., 2005). A strategy to incorporate sustainability criteria for port management is the creation of metrics for environmental performance (Darbra et al., 2009). These metrics, however, need to monitor the environmental quality from a technical point of view and should be appropriate for managerial decision-making. Thus, technical information can be translated into decisions, thereby facilitating the management process.

Currently, the main models for environmental performance measurement in Brazilian public ports were developed by the National Agency of Waterway Transportation (ANTAQ) and the Secretariat of Ports (SEP). These models are the Environmental Performance Index (IDA) and the National Plan for Port Logistics (PNLP). Both tools have different goals, but both do not satisfactorily consider economic and financial criteria. In addition, some models have been proposed in the literature (Lirn et al., 2013; Peris-Mora et al., 2005; Puig et al., 2014; Saengsupavanich et al., 2009), but these models also have shortcomings in terms of inclusion of economic and financial variables.

To address this issue, the present article discusses the different evaluation models of port environmental performance and proposes a set of indicators for Brazilian public ports while considering the economic and financial criteria. To accomplish this, we first present a review on the port environmental performance measurement, followed by the method we used, the results obtained and their discussions, and lastly conclusions of the study.

2. Literature review

One of the main issues in port performance management is the environmental performance evaluation. Environmental management is an issue that has gained the most competitive and strategic importance over the years in port management (ESPO, 2012). To assist in making decisions on environmental criteria, systems that enable the generation and adaptation of relevant, comparable, and accurate information for managers are required. Indicators of environmental performance can

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be used for this purpose, and some indicator systems for environmental management in ports have been proposed in the literature. The main studies on this topic were conducted in European ports (Peris-Mora et al., 2005; Puig et al., 2014), where the major environmental effects of port activities were identified and indicators were created to measure them. Studies were also conducted in Thailand (Saengsupavanich et al., 2009) and Asian ports (Lirn et al., 2013). The main indicators presented in the cited studies are given in Table 1.

We found that the only study that proposes an indicator to measure environmental costs was by Saengsupavanich et al. (2009); however, the authors show that this indicator was not applied in the study because appropriate databases were absent in the participating ports. Others studies did not consider economic or financial variables.

In Brazil, the reformulation of the port sector that occurred in the 1990s did not consider the environmental issue, and thus, their practices were included in the port system through specific legislation (Jaccoud and Magrini, 2014). Environmental management in Brazilian ports is in a consolidation phase: although there were 37 active public ports in 2013, 62.16% had environmental operating license, 16.21% were in the process of obtaining the license with environmental agencies, and 21.62% had no license and were not in the process of obtaining it (ANTAQ, 2013). The port of Santos, the largest port in the country, is among the ports that have no license and are in the process of obtaining one.

It is noteworthy that obtaining environmental license is only the first step in seeking greater environmental performance (Kaiser et al., 2013). The main environmental laws nationwide that are applicable to Brazilian ports refer to (i) environmental licensing, (ii) solid waste, and (iii) emissions (ANTAQ, 2011). Subsequent to complying with the environmental standards for the port sector, it is necessary to implement an Environmental Management System (EMS), which will regulate the internal procedures and promote sustainability (Darbra et al., 2005). In this phase, we can also seek voluntary certifications, which can open most demanding markets with environmental issues. With the consolidation of the EMS at the port, environmental performance evaluation will occur naturally as it is an important part of the system.

In Brazil, there are two main indicator systems for ports that include environmental performance and have been developed and implemented by two state agencies: IDA developed by the ANTAQ and the PNLP developed by the SEP. IDA uses the analytic hierarchy process (AHP) method to assess environmental criteria in ports. There are four categories of indicators for this assessment: (i) economic-operational, with 24 indicators; (ii) sociological-cultural, with 3 indicators; (iii) physical-chemical, with 8 indicators; and (iv) biological-ecological, with 3 indicators. Each category and indicator member has a certain weight. The category with the most representative weight is the economic-operational. Notes for the indicators are assigned on the basis of qualitative questionnaires assessing compliance criteria associated with each indicator. IDA combines a quantitative note with the qualitative criteria based on pre-established weights. There is an indicator for environmental costs in the economic-operational category that seeks to measure the organizational ability to identify and measure environmental costs in the port, but it does not measure the values itself. The main purpose of IDA is to provide data on environmental management for each port authority, seeking to guide the improvement of environmental management at each public port.

PNLP was developed by the SEP and comprise a wide range of port performance indicators, which are included in the following categories: i) management and economics, with 12 indicators linked to 3 strategic objectives; ii) operations, with 18 indicators linked to 5 strategic objectives; iii) logistics, with 11 indicators linked to 3 strategic objectives; and iv) environment, with 3 indicators linked to 3 strategic objectives. The environmental indicators for an area are shown in Table 2.

Note that the PNLP information and targets refer to the port system as a whole, thereby achieving an overall performance view of the Brazilian port system. This is due to the executive characteristic of SEP, which manages the entire Brazilian port system. These data are used for action plans in the ports; however, the indicators themselves do not convey the relevant information to the port authorities about the environmental performance of the individual ports. PNLP uses IDA as support in one indicator, showing that there are convergent politics between the two agencies.

Knowing the models currently available in the literature and considering the need to include financial and economic information in the EMS of ports, it is necessary to propose indicators that could fill this gap.

Table 1
Key measurement indicators of environmental performance in the literature.

Proposed indicators	Reference
Water consumption	Peris-Mora et al. (2005), Saengsupavanich et al. (2009), Puig et al. (2014)
Waste generation	Peris-Mora et al. (2005), Lirn et al. (2013), Puig et al. (2014)
Environmental accidents	Peris-Mora et al. (2005), Saengsupavanich et al. (2009), Lirn et al. (2013)
Pollutant emissions	Peris-Mora et al. (2005), Lirn et al. (2013), Puig et al. (2014)
Environmental training	Saengsupavanich et al. (2009), Lirn et al. (2013), Puig et al. (2014)
Energy consumption	Peris-Mora et al. (2005), Lirn et al. (2013)
Effects on the local ecosystem	Peris-Mora et al. (2005), Lirn et al. (2013)
Environmental policy	Saengsupavanich et al. (2009), Puig et al. (2014)
Noise	Peris-Mora et al. (2005), Lirn et al. (2013)
Environmental costs	Saengsupavanich et al. (2009)

3. Method

This paper presents a qualitative and exploratory research. The use of an exploratory approach is justified in this case, as it is necessary to become familiar with the subject and construct hypotheses for its incorporation in the current Brazilian scenario. Thus, we chose to understand port environmental management strategies, identify their applicability to Brazilian ports, and propose a complementary system of indicators to currently use and check its applicability with the professionals.

To achieve the proposed objectives, the following steps were followed:

a) Review of the literature, understanding of topics such as port environmental management in Brazil and in the world, and investigation of indicator systems for environmental performance in ports;
b) Proposal for a set of indicators based on the literature for the environmental assessment from economic and financial viewpoint for ports;
c) Semi-structured interviews, transcribed with Express Scribe®, with two federal public agencies, ANTAQ and SEP, to understand the roles of these stakeholders in environmental performance evaluation in Brazilian ports, the environmental indicators developed by them, and the applicability of the proposed indicators;
d) Semi-structured interviews, transcribed with Express Scribe®, with two port authorities, Superintendence of Ports and Waterways (SPH) and the Superintendence of Rio Grande Port (SUPRG), to understand how they evaluate their environmental performance and for the possibility of adopting the proposed indicators in their ports with the current structure.

Following these steps, we sought to achieve the general and specific goals to contribute to the literature to start the discussion of economic and financial evaluation of environmental criteria in Brazilian public ports and, in practice, to take the participants' new ideas about ports to enhance national port management.

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