



The evaluation of seaport sustainability: The case of South Korea

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ABSTRACT

The concept of port sustainability has gained increasing attention and become one of the most important focus areas for improving port competitiveness. This research aims to identify crucial criteria for assessing sustainability of the ports in South Korea using the importance-performance analysis (IPA) technique. A total of 27 sustainability assessment items encompassing all three pillars of sustainability—environmental, economic, and social aspects—were established from previous research and interviews. A survey was conducted with the port managers to evaluate the importance of the identified assessment measures and their perceived performances. The findings indicate that the economic issue associated with offering employment opportunities was deemed the most important measure, followed by environmental concerns and social factors. They also provide useful managerial insights for the ports to understand port sustainability issues so as to discover areas for improvements and direct their resources to the appropriate areas to enhance port competitiveness.

1. Introduction

There has been phenomenal growth in maritime trade as well as the port industry over the past decades. Seaports, perceived as trade facilitators, play a significant role in the global supply chain and economic system (Lam and Van de Voorde, 2012). Due to serious deterioration of the environment driven by rapid economic growth and pressing global ecological problems, the environmental impact of port operations and development has become an ever-growing issue (Lu et al., 2012). In particular, existence of seaports may create negative environmental impacts on the ocean, soil, and air, resulting in deterioration of both marine and terrestrial ecosystems (Darbra et al., 2009). Thus, environmental issues and impacts related to sustainability have been studied extensively (Denktas-Sakar and Karatas-Cetin, 2012). The social dimension of sustainability, which includes stakeholder management, ethical issues, and corporate social responsibility, has also become increasingly important and has gained growing attention in recent years. However, the social dimension has been relatively ignored and rarely been addressed or studied in previous literature (Shiau and Chuang, 2015).

Lu et al. (2012) stated that as port organisations are the main operators in ports, understanding port sustainability from the port operator's perspective can produce useful information that can be used by governments to develop criteria for promoting sustainable development. Yet, these authors argued that there is near absence of an

unambiguous measure for assessing sustainability in the port sector that covers economic, environmental, and social dimensions. Therefore, they established a set of criteria for assessing sustainability of international ports, while considering all three dimensions. Their study was, however, limited to three ports in Taiwan, but this approach can be also applied to identify sustainability criteria in other geographical areas. Besides, a considerable body of prior literature has explored port sustainability in various regions, except South Korea (the UK: Kuznetsov et al., 2015; Spain: Peris-Mora et al., 2005; Taiwan: Lu et al., 2012; Vietnam and Cambodia: Le et al., 2014; Brazil: Roos and Neto, 2017; the EU: Darbra et al., 2009; Puig et al., 2015). South Korea has played a vital role in world trade and shipping. It possessed the seventh largest fleet in terms of deadweight tonnage in 2017; the sixth largest container throughput of roughly 20 million TEU in 2016; the third largest transshipment container throughput in 2016; and major ports such as the Port of Busan, Port of Gwangyang, and Port of Incheon acting as hub ports for Chinese and Japanese ports (United Nations Conference on Trade and Development [UNCTAD], 2017). Despite its important role in world shipping and the need for research on its ports' sustainable development, no studies examined port sustainability in the South Korean context until now. To fill this gap, this study first examines South Korean seaports' sustainability by employing the importance-performance analysis (IPA) technique.

Furthermore, South Korean economy is essentially export propelled, as it developed rapidly through export-led industrialisation strategies

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over the past few decades. Thus, the national and regional economies of South Korea are influenced significantly by port-related industries (Westphal, 1990). Ports in Northeast Asia such as the Port of Shanghai and Port of Hong Kong have been experiencing considerable growth in their overall port traffic, and they are focusing on the sustainable development of maritime operations (Wang and Ducruet, 2012). Establishment of sustainable development strategies has become a most important issue for ports in South Korea in order to achieve competitive advantage and improve their competitiveness. Accordingly, this study aims to apply the approach adopted by Lu et al. (2012) to the ports in South Korea, as there is lack of studies examining the assessment criteria for port sustainability, even though the sustainability concept has become increasingly important for the ports in South Korea. The next section reviews previous studies. Section 3 explains the methodology, while Section 4 shows the analysis and results. Finally, Section 5 presents the concluding remarks.

2. Literature review

2.1. Port sustainability

Port sustainability became important for ports as organisations performed the crucial task of integrating their operational activities with their supply chains and adapted to the business demand and environment, wherein the concept of sustainability is of mounting importance (Denktas-Sakar and Karatas-Cetin, 2012; Lu et al., 2012). The concept of sustainability is increasingly being embraced as a standard business practice, and hence sustainability for ports can be defined as business strategies and activities that meet the current and future needs of the port and its stakeholders, while protecting and sustaining human and natural resources (American Association of Port Authorities, 2007). Based on the triple bottom line (TBL) principle, the concept of port sustainability covers three major aspects (Adams et al., 2009; Sislian et al., 2016): The economic aspect involves returns and profitability of port investments, provision of port facilities that would enhance the performance of companies, and efficiency of the utilisation of port facilities and area. The environmental aspect includes environmental performance and provision of management facilities for air and water quality, dredging operations and disposal, and noise pollution. The social aspect involves direct or indirect contribution to employment in the companies, liveability of areas in the vicinity of ports, and port-city interaction and interrelationships.

Although port activities and developments encourage both economic and commercial growth, they tend to have adverse effects on the environment, with the deterioration of air, water, and soil quality in the vicinity of port areas and noise pollution being the most common issues (Trozzi and Vaccaro, 2000; Ault et al., 2009; Roh et al., 2016). Although port sizes and geographical conditions as well as activity profiles may vary by ports, port authorities are increasingly realising the importance of sustainability and are required to direct their management objectives toward sustainable development while fulfilling economic demands, cost and risk reduction, and port industrial activities (Puig et al., 2015; Roh et al., 2016).

2.2. Port sustainability assessment

The concept of sustainable development and sustainability is clearly the foundation of sustainability assessment (Pope et al., 2004). International organisations including UNCTAD, International Chamber of Shipping, the UN Global Compact, International Maritime Organization, Organisation for Economic Co-operation and Development, and many others have suggested relevant principles stating that assessment for sustainability should incorporate economic, environmental, and social aspects, which are inextricably linked (Lu et al., 2012).

A large number of international ports have presented sustainability reports and developed sustainability assessment criteria about the three

components, or pillars, of sustainability (Lu et al., 2012). The Port of Busan, which handled the sixth largest container throughput in the world in 2017 and is the largest container seaport in South Korea, actively initiated a plan for port sustainability and environmental friendliness. Busan Port Authority (BPA) established the ‘Comprehensive Plan to Establish Green Busan Port’ to address the environmental impacts of port operations in 2012, as green performance, including air, marine, and noise pollution management, is regarded as a key sustainability issue for the port. BPA evaluated sustainability in accordance with the three aspects of the TBL concept, namely, economic, environmental, and social value creation. It also considered other sustainability issues of the port as well, such as improving competitiveness as a global hub port, developing future growth engines, enhancing the port safety management system, increasing customer satisfaction, generating employee value, promoting strategic social contribution activities, and expanding shared growth activities (BPA, 2014). Along with the TBL approach to sustainability, the Port of Los Angeles (2011) introduced the grow-green philosophy to operate in the most environmentally and socially responsible way and pursue long-term growth. The Port of Los Angeles developed the ‘Sustainability Assessment and Plan Formulation’ to evaluate sustainability efforts and identify material issues that are deemed most significant for achieving sustainable operations. These material issues include health risk reduction, air and water quality, energy and climate change, relationships with stakeholders, habitat protection, open space and urban greening, land use, local economic development, environmental justice, and green growth (Port of Los Angeles, 2011).

Building a green port and adopting green port policies and regulations to accelerate green port strategies have become common practices for enhancing port sustainability effectively (Shiau and Chuang, 2015). This is because green port policies can be used to direct ports to incorporate sustainable practices into their operations and developments by encouraging an organisational culture of environmental improvement and economic and social responsibility (Lam and Notteboom, 2014). Thus, many international ports consider green performance as one of the most important sustainability indicators (Lirn et al., 2013).

Environmental issues in ports have become increasingly important, and they have become a crucial topic in the global trend towards sustainable development. Hence, port environmental issues in the context of sustainability have become a subject of research for many scholars around the world (Shiau and Chuang, 2015). Gupta et al. (2005) investigated the environmental impacts of port and harbour activities and operations and identified sources of pollution. They showed that the impacts are mainly associated with surface water quality and air quality, the former being caused by bilge and sludge wastes, sewage, and oil discharge and leakage generated by ports and the latter being caused by dust and particulate matter from traffic, emissions from transport vehicles and ships, construction activities, rock excavation, and site clearing. Their research also included various measures for the protection of the environment as well as for prevention and control of water and air pollution, which will be useful for developing an appropriate environmental management plan for ports and harbours. Ng and Song (2010) assessed the environmental impacts of daily routine activities and shipping operations in ports, such as cargo stevedoring and bunkering, and they conducted an empirical analysis for the Port of Rotterdam.

Yet, Peris-Mora et al. (2005) indicated that there is very limited research on the main indicators of port sustainability and hence proposed a system of indicators for sustainable management. The research was, however, focused on environmental sustainability rather than economic aspects, and 17 environmental sustainability management indicators were developed. Lirn et al. (2013) also examined green performance criteria in particular and focused on five dimensions, namely, air pollution, noise pollution, solid waste pollution, liquid pollution management, and marine biology preservation, to come up with 17 green performance indicators by using the analytic hierarchy

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