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Citation for final published version:

Lim, Sehwa, Pettit, Stephen , Abouarghoub, Wessam and Beresford, Anthony 2024. Sustainability activities affecting competitive advantage of container ports. Presented at: International Conference of Logistics and Transport, Seoul, Korea, 18th - 22 November 2024.

Publishers page:

Please note:

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Sustainability Activities Affecting Competitive Advantage of Container Ports

Sehwa Lim, Stephen Pettit, Wessam Abouarghoub, Anthony Beresford
Logistics and Operations Management, Cardiff Business School, Cardiff University, UK

Abstract

Purpose: This study aims to strategically analyse the sustainability activities that drive competitive advantage in container ports. It focuses on addressing the strategic management of sustainability in the port sector by identifying and prioritising sustainability activities that influence the competitive advantage of container ports.

Design/methodology/approach: Adopting a strategy-as-practice view, the study employs the Relative Importance Index methodology to assess and rank the perceived significance of sustainability activities in achieving competitive advantage. Data were collected from port managers across 35 countries, and the analysis considered differences in regional contexts, port sizes, and managerial perspectives to provide a nuanced understanding of sustainability priorities for strategic decision-making.

Findings: The study found that social sustainability practices are the most critical for enhancing container ports' competitive advantage, making a shift from the traditional focus on economic factors. The findings suggest potential opportunities for strategic collaboration, particularly between Asian and European ports. Additionally, the significant role of port managers at different levels is emphasised in decision-making processes for effective sustainability strategies and superior competitive performance.

Originality/value: This study contributes to the theoretical understanding of port sustainability by integrating a strategy-as-practice perspective, which has been underexplored in port studies. Methodologically, it advances the application of the RII in evaluating the strategic importance of sustainability activities in ports. The research also provides practical insights for port managers and policymakers by identifying best practices in sustainability that align with competitive strategies, thus expanding the scope of port studies for strategic sustainability management.

Keywords: Port sustainability, Port competitive advantage, Port competitiveness, Relative Importance Index, Strategy-as-practice

Introduction

Fully embracing sustainability involves a complete shift in how organisations operate, requiring them to rethink their goals and strategic approaches (Thakhathi *et al.*, 2019). In this sense, the ability to effectively manage their sustainability performance is of strategic importance in the current competitive environment. Strategic implementation of sustainability management enables organisations to generate additional value for sustained success, while contributing to their better competitive position (Porter, 1985). Therefore, it is important for ports to explore strategic ways to implement port sustainability to ensure that the transformation process is sustainable and beneficial to port performance. Many studies on port sustainability reach a consensus view that sustainability practices have positively contributed to the financial performance of ports through improved eco-efficiency and effectiveness (e.g. Lu and Chiang, 2016; Jiang *et al.*, 2020; Castellano *et al.*, 2020). As environmental and social regulations have influenced the dynamics of the port market, sustainable operations have been recognised as a crucial factor influencing port competitiveness (Yu *et al.*, 2023). Although numerous variables and factors of port sustainability have been examined and employed to evaluate the sustainability performance of ports (Lim *et al.*, 2019), there is currently a dearth of research clarifying sustainability activities that can impact the competitive advantage of ports. This complexity can make it challenging for port managers to identify key priorities, determine areas for improvement, and acquire the necessary resources and expertise to manage sustainability effectively.

Thus, this study aims to identify sustainability activities that affect port competitiveness to develop strategic port sustainability management that enhances port performance from a competitive point of view. Drawing upon the Strategy-As-Practice (SAP) approach and utilising the Relative Importance Index (RII) to analyse these activities, it explores how port sustainability practices can be conceptualised as strategies for driving the competitive advantage of ports.

Theoretical background

Sustainability presents a considerable challenge to organisations as it poses a threat to their existing systems and competitive positions. However, this situation also offers valuable opportunities to create and implement novel tactics that establish a clear distinction from other ports. These two facets suggest that ports should actively cultivate strategic competencies in sustainability to ultimately attain the desired competitiveness and ensure the long-term thriving of ports through value creation or value capture from port management (Beresford and Pettit, 2019). Port sustainability analysts have stressed the strategic need for sustainability practices to realise sustainable port development (Hossain *et al.*, 2021), affirming that port's strategic actions can determine better sustainability management.

Strategic management has been extensively developed based on Porter's concept of competitive advantage (1985), prompting numerous studies to examine how firms' strategies impact organisational performance. Recent research suggests that differences in performance outcomes can be linked to the implementation of different practices, emphasising the relationship between the actual practice management of an organisation and a set of key activities (Jarzabkowski *et al.*, 2022). This scholarly view has been fuelled by the emergence of the SAP perspective to understand strategic planning and implementation while shedding light on the strategic activities that an organisation should pursue for better competitiveness (Whittington, 1996). The SAP view focuses on how strategies are formed through the actions of organisations and individuals. It sees strategy as an ongoing activity performed by people and the importance of those involved in the practice. Its focus is on the practices that constitute daily activities in organisations that are essential for survival and creating value (Mantere, 2008). Whittington (2006) proposed three key components for strategising: practices, practitioners, and praxis. Jarzabkowski *et al.*, (2016) further argued that the three components should demonstrate strategic outcomes resulting from conducting practice, proposing a strategic practice model. By adopting the model, this study develops a conceptual strategy model in the context of port sustainability operations and management, as illustrated in Figure 1. This study examines the relationship between sustainability practices, activities, and the desired outcomes of sustainability, i.e. competitive advantage.

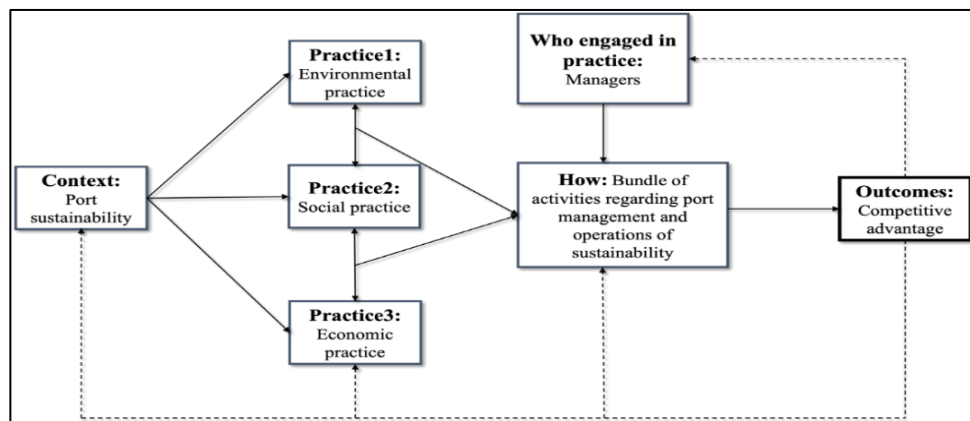


Figure 1: A proposed strategic practice model (Source: Authors)

Methodology

The RII is used to analyse the significance of the factors or attributes in a study. It helps prioritise these elements for quantitative evaluation by assigning rankings to each factor according to their relative importance (El-Sayegh, 2008). By employing the RII method, this study analyses how port practitioners perceive sustainability activities that impact the competitive advantage of ports and prioritise them in terms of their importance to the overall competitive advantage of ports. It also explores how these perceptions vary based on practitioners' backgrounds. The RII value ranges from 0 to 1, with 0 indicating no inclusivity, and a higher RII value representing a stronger impact of sustainability activities on the competitive advantage of ports. For the measurement items, the 30 sustainability indicators identified by Lim *et al.*, (2019) were adopted, and examples of survey questions are as follows: 'Public relations strengthen the competitive advantage of my port/terminal' and 'Container throughput strengthens the competitive advantage of my port/terminal', including a detailed description and definition of each sustainability activity and competitive advantage in the study. The survey was distributed to port managers at various management levels, from frontline to top-level managers in container ports and terminals worldwide. Data were gathered between March and July for five months in 2020.

Result and Discussion

A total of 217 valid responses were collected from participants across 35 countries and analysed using spreadsheet tools. All the activities from the three aspects of sustainability were assessed and assigned specific priority levels. The prioritisation of sustainability activities was examined based on respondent characteristics such as geographical location, port size, and managerial levels.

Sustainability activities

The overall indices for the three aspects of sustainability were calculated using the average RII values. The average RII values were 0.782, 0.862, and 0.856 for environmental, social, and economic sustainability, respectively. This indicates that social sustainability is viewed as the most significant practice for enhancing the competitive advantage of ports, with only a slight difference from economic sustainability. The acknowledgement of social sustainability as a critical component of long-term value differentiation may reflect a shift in the perceptions of the social aspects of port operations, which have been neglected. However, this shift may have been a snapshot of being affected by the COVID-19 pandemic during which the study was conducted. The pandemic experience might lead to a heightened awareness of social resilience and the importance of employee and stakeholder well-being. This finding suggests that port sustainability strategies for a competitive advantage should incorporate socially oriented practices. In a context where social considerations have been a blind spot, ports that proactively develop social strategies can secure a first-mover advantage and be acknowledged for their expertise in social initiatives. According to the RII values for 30 sustainability activities, overall, economic sustainability ranked highest, followed by social and environmental activities (Table 1).

Sustainability aspect	Sustainability activity	RII	Ranking
Social	Health and safety	0.909	1
Economic	Port operational efficiency	0.907	2
Economic	High-quality services	0.905	3
Economic	Port infrastructure construction	0.886	4
Economic	Value-added productivity	0.877	5
Economic	Operating revenue	0.876	6
Economic	Container throughput	0.871	7
Economic	Cost-efficiency	0.871	8
Social	Job training	0.870	9
Social	Public relations	0.867	10
Economic	Reducing operating costs	0.864	11
Social	Social image	0.862	12
Social	Quality of working and living environment	0.862	13
Social	Job creation and security	0.850	14
Social	Social participation	0.850	15
Economic	GDP	0.840	16
Economic	Port development funding	0.824	17
Social	Gender equality	0.822	18
Economic	Benefits from external stakeholders	0.819	19
Environmental	Waste pollution management	0.812	20
Environmental	Green port management	0.811	21
Environmental	Energy and resource usage management	0.803	22
Environmental	Air pollution management	0.789	23
Environmental	Green construction and facilities	0.787	24
Environmental	Soil occupation and pollution management	0.780	25
Environmental	Ecosystem and habitat protection	0.777	26
Environmental	Water pollution management	0.769	27
Environmental	Odour pollution management	0.758	28
Environmental	Noise pollution management	0.733	29
Economic	Foreign direct investment	0.733	30

Table 1: RII values and rankings of all 30 sustainability activities (Source: Authors)

The recognition of “Health and safety” as the most important activity to strengthen the competitive advantage of ports highlights the need for a detailed plan to promote occupational health and safety management within port areas. The least important was “Establishing open and direct foreign investment”. This finding contrasts with those of previous research, which identified this activity as a key indicator for assessing the economic sustainability of ports (Lim *et al.*, 2019). Consequently, it may not be a suitable measure to evaluate port competitiveness. Additionally, ports appear to prioritise internal factors over external ones for economic sustainability. Traditionally, internal-related activities have been considered crucial for physical port development, but the changing view of their significance might

indicate that many ports have reached a mature stage, focusing on leveraging existing resources for competitive advantage.

Ranking by port size

The annual container throughput was used as a criterion for categorising the port size: small (500,000 TEUs or less), medium (between 500,000 and less than 5 million TEUs), and large (more than 5 million TEUs). The majority of the respondents (53%) were involved with medium-sized ports, while 23% were involved with small ports and 21% with large ports. Table 2 provides a summary of the rankings of the three aspects of sustainability activities across different port sizes.

Sustainability		Port size		
		Large	Medium	Small
Environmental	Water pollution management	9	8	7
	Air pollution management	5	4	5
	Energy and resource usage management	1	3	3
	Noise pollution management	10	9	10
	Green port management	2	2	2
	Ecosystem and habitats protection	7	5	8
	Soil occupation and pollution management	8	6	4
	Waste pollution management	3	1	1
	Green construction and facilities	4	7	6
Odour pollution management	6	10	9	
Social	Health and safety	1	1	1
	Job creation and security	5	6	7
	Job training	2	3	4
	Public relations	3	2	3
	Gender equality	8	8	8
	Social image	4	4	5
	Quality of working and living environment	6	5	2
Social participation	7	7	6	
Economic	Foreign direct investment	12	12	12
	Value-added productivity	7	4	4
	Port operational efficiency	1	2	2
	High quality services	2	1	1
	Reducing operating costs	9	8	6
	Benefits from external stakeholders	11	11	9
	Port development funding	10	10	10
	Port infrastructure construction	3	5	3
	Container throughput	4	3	11
	GDP	8	9	8
	Operating revenue	5	6	7
Cost-efficiency	6	7	5	

Table 2: Sustainability activities by port size (Source: Authors)

Large-sized ports prioritise “Energy and resource usage management”, while medium and small ports consider “Waste pollution management” as the most important for competitive advantage. Large ports generally have a higher volume of activities, more complex operations and extensive infrastructure. Efficient management of energy and resources can lead to significant cost savings and is crucial for sustainability and port competitiveness. They are also more likely to face regulatory scrutiny and stakeholder pressure to adopt green practices, making energy management a competitive advantage (Ashrafi *et al.*, 2020). Although the overall rankings were similar, it is worth noting that large ports prioritise “Odour pollution management” higher than medium and small ports. This is likely due to the higher volumes of garbage and ship waste generated during cargo operations and maintenance, leading to increased odour issues.

In terms of social sustainability activities, regardless of port size, “Health and safety” was prioritised, while “Gender equality” was deemed least important. Large ports had the highest average RII value (0.874), indicating a greater recognition of social sustainability activities in enhancing competitiveness. This is likely because of their larger workforce, broader stakeholder engagement, and greater impact on the surrounding communities. Furthermore, large ports are more likely to be visible and may face greater scrutiny from the government, international organisations, and the public (Ashrafi *et al.*, 2020). As such, focusing on social sustainability can enhance reputation, attract talent, and reduce conflicts with internal and external communities, all of which can contribute to maintaining a competitive edge. Notably, small ports ranked “Quality of working and living environment” as a higher priority than large and medium ports.

In the analysis of economic sustainability activities, large ports prioritised “Port operations efficiency” as the most important, while medium and small ports emphasised “High quality services”. All port sizes agreed that “Foreign direct investment” was the least important activity. Furthermore, large ports rank “Value-added productivity” lower compared to medium and small ports. This reflects that larger ports have relatively established facilities and services, thus viewing this activity as less critical. The ranking for “Container throughput” showed differences among port sizes; it was ranked 4th by large ports, 3rd by medium ports, and only 11th by small ports. This discrepancy indicates that smaller ports may face capacity challenges that hinder competitiveness.

Ranking by geographical location

The RII analysis included 35 countries that were grouped into seven regions for comparison by geographical location: Africa (6.5%), Oceania (12.4%), North America (10.5%), South America (9.6%), East and Southeast (ESE) Asia (25%), West and South (WS) Asia (10%), and Europe (26%). Table 3 summarises the rankings of environmental, social, and economic sustainability activities by geographical location, showing these regional differences.

Sustainability		Region						
		Africa	Oceania	North America	South America	ESE Asia	WS Asia	Europe
Environmental	Water pollution management	4	3	7	3	7	9	9
	Air pollution management	3	2	1	8	4	6	3
	Energy and resource usage management	7	5	2	10	5	1	1
	Noise pollution management	10	1	9	9	10	8	10
	Green port management	8	8	3	5	1	2	3
	Ecosystem and habitats protection	6	4	4	1	9	3	8
	Soil occupation and pollution management	5	6	8	2	6	5	7
	Waste pollution management	1	7	5	4	2	4	2
	Green construction and facilities	9	9	6	7	3	7	4
Odour pollution management	2	10	10	6	8	10	6	
Social	Health and safety	1	1	3	1	1	1	1
	Job creation and security	2	7	1	3	7	4	6
	Job training	3	3	5	7	2	5	3
	Public relations	5	2	2	5	6	3	2
	Gender equality	4	8	6	8	8	7	8
	Social image	6	4	7	4	4	2	5
	Quality of working and living environment	7	6	4	2	5	8	4
Social participation	8	5	8	6	3	6	7	
Economic	Foreign direct investment	12	12	12	12	12	12	12
	Value-added productivity	2	7	8	8	4	3	4
	Port operational efficiency	3	2	3	3	1	1	2
	High quality services	6	3	2	2	2	2	1
	Reducing operating costs	9	8	9	5	8	5	5
	Benefits from external stakeholders	10	9	11	9	11	9	11
	Port development funding	11	11	7	11	10	11	9
	Port infrastructure construction	1	4	6	6	3	10	3
	Container throughput	7	1	5	1	5	4	10
	GDP	4	10	10	10	9	6	8
	Operating revenue	5	5	1	4	6	8	7
Cost-efficiency	8	6	4	7	7	7	6	

Table 3: Sustainability activities by geographical location (Source: Authors)

In terms of environmental sustainability, Africa prioritises “Waste pollution management” and “Odour pollution management”. By contrast, these activities are considered less important in other regions. Oceania emphasises “Noise pollution management”, reflecting the increasing concerns related to noise from seagoing vessels that affected local residents (Miller, 2019). ESE Asia and Europe showed a similar trend, prioritising “Green construction and facilities” more than other regions.

Regarding social sustainability, the “Health and safety” activity ranked as the top priority for port competitiveness in all regions except North America, where it placed third. This finding reinforces previous studies highlighting the importance of occupational health and operational safety in managing operating costs and mitigating risks to humans in ports (Antão *et al.*, 2016). Conversely, “Job creation and security” received higher priority in North America, Africa, and South America, but were ranked lower in Europe, Oceania, and ESE Asia. This suggests a potential correlation between financial capacity and employment stability in port competitiveness, as ports in the latter regions tend to have

greater financial soundness due to higher container throughput. Interestingly, Africa places significant importance on “Gender quality” compared to other regions, reflecting the efforts of African ports to promote social justice and community value, particularly in the context of national laws addressing poverty and inequality (Molelu and Enserink, 2018).

When it comes to economic sustainability, it appears that “Foreign direct investment” has a limited impact across various regions. A similar trend was observed in ESE Asia, WS Asia, and Europe, where the busiest container ports face common economic sustainability concerns. Overall, different regions exhibit varying perceptions of the economic activities that strengthen the competitive advantage of ports. This implies the need to develop distinct strategies for sustainable economic growth tailored to individual ports. Collectively, similarities are noted between the Asian (particularly East and Southeast) and European ports. Considering that leading container ports are primarily in Asia and Europe, both regions share common sustainability challenges and responsibilities, suggesting potential mutual benefits of communication and benchmarking between Asian and European ports for strategic sustainability development.

Ranking by management level

In this study, respondents were classified into three management levels: top managers (14.2%), middle managers (59%), and frontline managers (26.8%). The rankings of sustainability activities by different levels of management are outlined in Table 4.

Sustainability		Management level		
		Top	Middle	Frontline
Environmental	Water pollution management	4	8	7
	Air pollution management	5	5	3
	Energy and resource usage management	3	3	2
	Noise pollution management	9	10	10
	Green port management	1	1	4
	Ecosystem and habitats protection	7	7	8
	Soil occupation and pollution management	6	6	9
	Waste pollution management	2	2	1
	Green construction and facilities	8	4	5
Odour pollution management	10	9	6	
Social	Health and safety	1	1	1
	Job creation and security	7	7	3
	Job training	4	2	4
	Public relations	2	3	6
	Gender equality	8	8	7
	Social image	3	4	5
	Quality of working and living environment	5	6	2
Social participation	6	5	8	
Economic	Foreign direct investment	12	12	12
	Value-added productivity	3	4	7
	Port operational efficiency	2	1	1
	High quality services	1	2	2
	Reducing operating costs	6	6	9
	Benefits from external stakeholders	9	11	11
	Port development funding	10	10	10
	Port infrastructure construction	4	3	4
	Container throughput	5	8	5
	GDP	11	9	8
	Operating revenue	8	7	3
Cost-efficiency	7	5	6	

Table 4: Sustainability activities by management level (Source: Authors)

Frontline managers view “Green port management” as less important, contrasting with top and middle managers, who rank it as a top priority. This difference implies that management authority influences the perceptions of environmental activities. Top and middle managers, with greater evaluative and diagnostic responsibilities, focus on monitoring sustainability plans and guiding processes, leading them to recognise the significance of green port management for their ports’ competitiveness (Egels-Zandén and Rosén, 2015). According to the average RII of social sustainability, all levels of management agree that “Health and safety” held the most importance, recognising its foundational role in both operational success and social sustainability. Frontline managers gave more importance to internal human resource management as “Quality of working and living environment” and “Job creation and security” place higher rankings. On the other hand, top and middle managers placed greater emphasis on external factors such as “Social image”, “Public relations”, and “Social participation”. In terms of economic sustainability,

there is a relatively consistent perception of importance across management levels. Managers at all levels prioritise business and service-related activities over those related to the economic structure. This perception highlights a strategic focus on enhancing service quality and operational performance as key drivers for achieving economic sustainability for competitive advantage.

Overall, the findings of managerial levels highlight the significance of internal capacity in achieving a competitive advantage in port sustainability management. It appears that managers perceive critical sustainability activities differently based on their capacity to influence performance, suggesting a link between management level and competitive sustainability outcomes. Hence, participative decision-making that involves managers at all levels can enhance the design and implementation of multilevel port sustainability strategies, leading to superior performance through more impactful sustainability initiatives (Lim, 2022).

Conclusion

This study aims to investigate key sustainability activities that strengthen the competitive advantage of ports. Using the RII analysis, the perceived priority of 30 sustainability activities was assessed and ranked in relation to their impact on competitive advantage. This study provides valuable insights for decision-makers with the best practices for managing port sustainability. The priorities identified for sustainability activities can help set specific targets to maintain competitive advantage and update the determinants of sustainable practices. Port managers can use this information to effectively allocate resources, leading to improved competitiveness. Additionally, this study considers various factors, such as port region, size, and manager roles, to present a holistic view of sustainability priorities. These classifications can serve as benchmarks for identifying areas of improvement and developing focused strategies and supporting policies. Furthermore, this study introduces the SAP approach to port research, expanding the theoretical knowledge of port sustainability management from a strategic perspective. By clarifying which sustainability activities to prioritise for competitive advantage, this study enhances the understanding of the ‘what’ aspect of SAP and advances the literature on strategising port sustainability performance at the operational level. From a methodological perspective, this study introduces the RII approach as the first application of this technique in port research, traditionally dominated by the AHP method for relative importance analysis. By presenting RII as an alternative for prioritising attributes, it enables port researchers to compare various analytical methods, thereby expanding the methodological landscape in the field.

Nonetheless, the data for this study were collected unevenly across different regions, with some areas contributing as many as 57 responses, whereas others provided only 14 responses. This could potentially lead to biased results that offer a limited perspective on the circumstances in particular regions. A more evenly distributed sample across regions or targeted regions would be beneficial for obtaining more focused perspectives and facilitating the identification of region-specific factors and their corresponding sustainability activities. Furthermore, the findings of the study may possess limited applicability to current conditions because of the elapsed time since data collection. The COVID-19 pandemic has potentially altered viewpoints on sustainability performance in ports; therefore, future research is needed to obtain updated information and to conduct comparative research before and after the pandemic.

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