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ASSESSMENT OF THE INTERPLAY OF VARIOUS FACTORS IN PORT GOVERNANCE: DEVELOPMENT OF THE THEORETICAL FRAMEWORK

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Abstract: Port governance plays a pivotal role in shaping global trade efficiency, sustainability, and resilience. This study develops a comprehensive framework integrating political, environmental, economic, risk-related, and change-oriented dimensions to address the complexities of modern port management. By synthesizing institutional theory and contemporary governance challenges, the framework provides actionable insights for achieving sustainability, operational adaptability, and stakeholder collaboration. The study highlights such critical constructs as political stability, environmental management, and leadership, offering a structured approach for empirical evaluation through a questionnaire tool. While advancing theoretical understanding, this work also identifies limitations and proposes future research directions to refine port governance models and address emerging global challenges.

Keywords: port governance, sustainability, theoretical framework, environmental management.

1. INTRODUCTION

Port governance is a critical determinant related to the efficiency and sustainability of global trade networks. As ports serve as nodal points in complex supply chains, their governance structures and operational frameworks influence economic development, regional connectivity, and environmental outcomes [Verhoeven 2009; 2010]. However, the governance of ports has become increasingly complex, driven by such factors as regional competition, environmental regulations, and the growing influence of private actors. Despite its significance, the interplay of these factors remains underexplored in academic literature, leaving a notable gap in our understanding of effective port governance strategies.

The urgency of addressing this gap is underscored by evolving global challenges, such as climate change, economic shocks, and geopolitical disruptions

[Fajar et al. 2024]. These phenomena call for adaptive governance models that integrate sustainability, stakeholder collaboration, and technological innovation [Notteboom and Haralambides 2023]. Moreover, the transition to landlord port models and the increasing reliance on public-private partnerships (PPPs) highlight the need for frameworks that reconcile public interest with market efficiency [Vining and Boardman 2008]. However, there is limited empirical research offering comprehensive tools to evaluate how governance frameworks accommodate these multifaceted dynamics.

This paper aims to fill this gap by developing a theoretical framework to assess the interplay of critical factors in port governance. The proposed framework serves as the foundation for a research tool, specifically a questionnaire designed to measure key dimensions of governance, including operational efficiency, sustainability, stakeholder integration, and regulatory adaptability. By bridging theoretical insights with practical assessment tools, this study seeks to advance the understanding of port governance and provide actionable insights for both academic and managerial applications.

2. LITERATURE REVIEW

Port governance operates at the nexus of institutional frameworks, sustainability imperatives, logistical integration, and resilience-building, reflecting its multifaceted and interdisciplinary nature. Institutional theory provides the foundational lens for examining how governance structures mediate interactions between public authorities, private entities, and broader societal interests. These frameworks are pivotal in addressing challenges, such as regulatory complexities, stakeholder engagement, and market failures. Public-private partnerships, as mechanisms within these frameworks, demonstrate the balance of public and private sector interests while ensuring the provision of critical infrastructure, although their efficacy depends on resolving stakeholder conflicts and ensuring alignment with long-term governance goals [Vining and Boardman 2008].

Sustainability has become a cornerstone of contemporary port governance, driven by increasing global emphasis on environmental stewardship and decarbonization [Dávid et al. 2024]. Ports serve as focal points for sustainable energy transitions, such as becoming hubs for green hydrogen [Notteboom and Haralambides 2023]. Governance models must therefore incorporate sustainability considerations into policy and operational decision-making. The role of regulatory and incentive-based frameworks is crucial for enabling ports to adopt sustainable practices, yet the operationalization of sustainability often lacks clarity. The proposed metrics include emissions reduction, modal shifts, and adoption of green technologies, but these require more robust integration into governance models

to ensure measurable outcomes [Verhoeven and Vanoutrive 2012; Merk, Hoffmann and Haralambides 2022].

Logistical integration is another critical construct, reflecting the evolving role of ports as central nodes in global supply chains. Ports are increasingly required to act as facilitators within value-driven logistical systems, bridging maritime operations with hinterland and intermodal transport networks. This involves the development of adaptive strategies to address bottlenecks and enhance connectivity. Governance frameworks must ensure that logistical integration aligns with broader sustainability objectives, as improved connectivity can reduce supply chain inefficiencies and lower environmental impacts [Everett 2005; Verhoeven and Vanoutrive 2012]. Despite the growing recognition of logistical integration as a determinant of port competitiveness, the mechanisms through which governance models influence this integration remain underexplored.

Resilience has gained prominence as a critical dimension of port governance, particularly in light of recent global disruptions like the COVID-19 pandemic and geopolitical uncertainties [Guerrero, Letrouit and Pais-Montes 2022]. The capacity of ports to withstand and adapt to external shocks is contingent on governance models that incorporate redundancy, flexibility, and stakeholder collaboration. Resilient ports are characterized by their ability to maintain operational continuity and recover swiftly from disruptions, which requires governance structures that are both proactive and adaptive [Haralambides and Gujar 2023]. Resilience-building measures are essential components of effective governance, but further research is needed to operationalize these measures in diverse port contexts [Merk, Hoffmann and Haralambides 2022].

Institutional governance serves as the overarching framework within which sustainability, resilience, and logistical integration are interconnected. Sustainability objectives, when embedded within governance frameworks, can drive improvements in logistical integration and resilience. For example, ports adopting green energy solutions and modal shifts contribute to reducing environmental impacts while enhancing supply chain efficiency and reliability [Notteboom and Haralambides 2023]. Similarly, resilient governance frameworks that address systemic vulnerabilities strengthen the adaptive capacity of ports, enabling them to maintain logistical functionality even during crises [Guerrero, Letrouit and Pais-Montes 2022; Merk, Hoffmann and Haralambides 2022].

Despite significant advances in understanding these constructs, gaps persist in how they are operationalized and interconnected within governance models. Current research tends to isolate individual dimensions rather than examining their dynamic interrelations. For instance, while logistical integration is often discussed in terms of operational efficiency, its potential to enhance resilience through adaptive supply chain strategies remains underexamined [Everett 2005; Cheshmberah and Beheshtikia 2020]. Similarly, the integration of sustainability into resilience

frameworks, such as the role of green hydrogen hubs in reducing supply chain vulnerabilities, requires further investigation [Notteboom and Haralambides 2023].

This review identifies the need for a holistic framework that integrates these constructs into a cohesive governance strategy. Such a framework would provide a comprehensive tool for assessing the effectiveness of port governance structures in achieving economic, environmental, and operational objectives. By addressing the gaps in existing literature, this study aims to advance theoretical understanding and provide actionable insights for policymakers and practitioners.

3. THEORETICAL FRAMEWORK – FACTORS INFLUENCING PORT GOVERNANCE

The proposed framework (Tab. 1) aims to systematically evaluate port governance by identifying key subfactors that influence its effectiveness across political (P), environmental (EN), economic (EC), risk-related (R), and change-related (C) factors. These factors are derived from a comprehensive review of the literature and reflect the multifaceted challenges and opportunities inherent in port governance. The framework serves as the basis for the development of a questionnaire to assess these dimensions empirically.

Table 1. Factors influencing port governance

Factor ID	Factor Description	Relevant References
P1	National and local policy influence	[Everett 2005]
P2	Political pressure and lobbying	[Verhoeven 2009]
P3	Political stability and governance quality	[Haralambides and Gujar 2023]
P4	Infrastructure development support (PPP)	[Vining and Boardman 2008]
EN1	Air and water quality management	[Notteboom and Haralambides 2023]
EN2	Waste management and recycling	[Özkaynak and İçemer 2024]
EN3	Climate change adaptation and resilience	[Merk, Hoffmann and Haralambides 2022]
EN4	Energy management	[Notteboom and Haralambides 2023]
EN5	Biodiversity and ecosystem management	[Madon et al. 2023]
EC1	Trade dynamics and supply chains disruptions	[Haralambides and Gujar 2023]
EC2	Port competitiveness	[Verhoeven 2009]
EC3	Infrastructure investments	[Vining and Boardman 2008]
EC4	Financial stability and performance	[Ferrari, Parola and Tei 2015; Ntabe et al. 2015]
R1	Operational risk	[Merk, Hoffmann and Haralambides 2022]

R2	Financial risk	[Chien, Wu and Huang 2014]
R3	Technological risk	[Min 2022]
R4	Human resources risk	[Oborilová, Myšková and Melichar 2015]
R5	Supply chain risks	[Haralambides and Gujar 2023]
R6	Strategic risk	[Bichou, Bell and Evans 2014; Wu and Lin, 2015]
C1	Corporate governance	[Everett 2005]
C2	Leadership and management	[Dubey, Gunasekaran and Samar Ali 2015]
C3	Technological integration	[Verhoeven 2009]
C4	Regulatory compliance	[Merk, Hoffmann and Haralambides 2022]
C5	Stakeholder engagement	[Verhoeven 2009; Olofsson et al. 2023]

Source: own data.

The framework for assessing port governance is built on a multidimensional analysis that reflects the interconnected political, environmental, economic, risk-related, and corporate factors influencing port management. This comprehensive model is designed to evaluate governance structures, their effectiveness, and their adaptability to evolving challenges. Integrating insights from the literature the following establishes the foundation for empirical assessment.

Port governance hinges on political influences, including national and local policy alignment, political stability, and the impact of lobbying activities. National and local policies (P1) establish the regulatory and operational frameworks within which ports function. Their alignment with global economic trends and environmental standards ensures ports remain competitive and sustainable [Everett 2005; Notteboom, Haralambides and Cullinane 2024]. Political pressures (P2), such as lobbying and advocacy, often shape decision-making, sometimes skewing priorities towards immediate gains rather than long-term objectives. Governance quality and political stability (P3) provide the necessary foundation for consistent and predictable decision-making processes, essential for fostering trust among stakeholders and ensuring resilience [Haralambides and Gujar 2023]. These dimensions collectively highlight how governance decisions are influenced by political contexts.

Environmental factors are increasingly central to port governance, as ports play a crucial role in global sustainability initiatives. Air and water quality management (EN1), climate change adaptation (EN3), and energy management (EN4) are essential elements that ports must integrate into their operations [Notteboom and Haralambides 2023]. Governance models must ensure that environmental risks are minimized while enhancing the ports' roles as sustainable energy hubs. The role of waste management and recycling (EN2) and biodiversity management (EN5) is underexplored but essential for fostering an ecosystem-based approach to governance. This prompts questions about how environmental initiatives influence

operational priorities and decision-making flexibility, particularly in contexts requiring compliance with international standards.

Economic factors, such as trade dynamics and supply chain disruptions (EC1) as well as port competitiveness (EC2), highlight the interdependence between port governance and global economic systems. Trade disruptions, intensified by geopolitical tensions or economic shocks, underscore the importance of adaptive governance frameworks that can mitigate risks and ensure continuity [Haralambides and Gujar 2023; Fajar et al. 2024]. Infrastructure investments (EC3) and financial stability (EC4) are also critical for maintaining competitiveness and long-term operational viability [Vining and Boardman 2008]. These factors lead to questions about how economic priorities are balanced against environmental and political imperatives and how financial strategies influence governance resilience.

Risk management is integral to port governance, as ports must navigate diverse risks, including operational (R1), financial (R2), technological (R3), and strategic (R6) threats. Governance frameworks must address these risks comprehensively, incorporating tools like scenario planning and risk matrices to anticipate and mitigate disruptions [Merk, Hoffmann and Haralambides 2022]. Supply chain risks (R5), particularly in light of global uncertainties, require governance models that foster redundancy and adaptability. Hence, the evaluation of the impact of each risk factor on decision-making elasticity and their relative importance in governance strategies have become crucial in maintaining or gaining competitive advantage.

Change-related factors, such as leadership and management (C2), stakeholder engagement (C5), and regulatory compliance (C4), are foundational to effective governance. Governance models must prioritize transparent leadership, active stakeholder participation, and adherence to complex regulatory requirements [Verhoeven 2009]. The integration of technological advancements (C3) into port operations further underscores the role of governance in enabling innovation while ensuring compliance with environmental and operational standards.

The factors within the framework are deeply interconnected, and their relationships are critical to understanding the dynamics of port governance. Political factors, such as national policy influence and infrastructure development support, directly affect economic dimensions, like competitiveness and investment. Similarly, environmental initiatives, such as energy management and climate adaptation, influence economic performance by reducing costs and enhancing the port's reputation as a sustainable operator. Risk management strategies are intertwined with all dimensions, as resilience depends on political stability, economic investment, and environmental adaptability.

Institutional governance serves as the overarching structure within which these factors operate. For instance, sustainability objectives embedded within governance frameworks drive improvements in logistical integration and resilience. Ports adopting green energy solutions and modal shifts contribute to reducing environmental impacts while enhancing operational efficiency. Conversely, resilient

governance models that address systemic vulnerabilities strengthen adaptive capacity, enabling ports to maintain logistical functionality during crises.

The framework encapsulates the interconnectedness of political, environmental, economic, risk-related, and change-related factors, demonstrating their collective influence on port governance. By operationalizing these factors and aligning them with governance strategies, the proposed model addresses the multifaceted challenges faced by ports. It emphasizes the importance of adaptability, sustainability, and stakeholder alignment in achieving effective governance outcomes. This framework not only highlights the theoretical foundations of port governance but also provides a structured approach to empirical evaluation through the questionnaire. The seamless integration of these factors ensures that the model captures the dynamic nature of governance, offering actionable insights for researchers and practitioners alike.

4. DISCUSSION

The proposed model for assessing port governance synthesizes existing theoretical constructs and empirical insights, aligning them with the dynamic demands of modern port management. In this section, the framework is discussed in the context of other relevant models and literature to highlight its contribution to understanding port governance.

The framework builds on institutional theory by focusing on how governance structures mediate interactions among stakeholders and address systemic challenges. This is consistent with the works of Everett (2005), who emphasized the need for governance models to integrate political, economic, and environmental dimensions. However, the proposed model advances Everett's perspective by explicitly incorporating risk-related and change-oriented factors, which are critical in today's volatile global context.

The inclusion of public-private partnerships (PPPs) in the framework reflects insights from Vining and Boardman (2008), who highlight the role of PPPs in addressing infrastructure deficits. While their work focuses on the efficiency of PPPs in balancing public and private interests, the proposed framework expands this view by examining how PPPs can also contribute to sustainability (e.g., energy management) and resilience (e.g., climate change adaptation) [Fleta-Asín and Muñoz 2023].

The environmental dimension of the framework aligns with the growing emphasis on sustainability in port governance [Notteboom and Haralambides 2023]. Their work underscores the transformative potential of ports in global energy transitions, which the framework operationalizes through factors such as air and water quality management (EN1), energy management (EN4), and biodiversity protection (EN5). By linking these factors to governance, the proposed model

addresses the gap regarding the lack of operational metrics for integrating sustainability into governance [Notteboom and Haralambides 2023].

The economic factors in the framework, such as trade dynamics (EC1) and infrastructure investments (EC3), emphasis the port's competitiveness [Verhoeven 2009; Parola et al. 2017]. However, the proposed model adds depth by linking these factors to resilience and risk management. For instance, supply chain risks (R5) and strategic risks (R6) are explicitly addressed, reflecting the global uncertainty and key challenges in building reliable and resilient supply chains [Haralambides and Gujar 2023]. Current studies underscore the importance of adaptive governance in mitigating disruptions, a theme central to the proposed model [Haralambides and Gujar 2023].

Risk-related factors, such as operational risks (R1) and technological risks (R3), are critical in the proposed framework [Merk, Hoffmann and Haralambides 2022]. The vulnerabilities exposed by the COVID-19 pandemic, emphasizing the need for governance frameworks that prioritize resilience [Merk, Hoffmann and Haralambides 2022]. The proposed model operationalizes this by integrating risk management into broader governance strategies, ensuring that ports can adapt to disruptions while maintaining operational continuity.

Change-related factors, including leadership (C2), stakeholder engagement (C5), and technological integration (C3), stress the importance of governance in fostering collaboration and innovation [Verhoeven 2009]. The proposed framework extends these insights by explicitly linking change-related factors to risk and environmental dimensions, illustrating how effective leadership and engagement can drive sustainability and resilience.

In comparison to existing models, the proposed framework offers a holistic perspective that integrates diverse governance dimensions. While previous models often focus on isolated aspects of port governance, such as PPPs, sustainability, or resilience, the proposed framework captures their interdependencies. This multidimensional approach addresses the gaps in the literature, providing a comprehensive tool for evaluating governance effectiveness in diverse port contexts.

By embedding these interconnected dimensions into a single framework, the proposed model offers a nuanced understanding of port governance. It not only aligns with established theories and findings, but also extends them by incorporating contemporary challenges and priorities. This positions the framework as a valuable contribution to both academic research and practical applications in the field of port governance.

5. CONCLUSIONS

This study provides a comprehensive framework for assessing port governance by integrating political, environmental, economic, risk-related, and change-related dimensions. Through a systematic exploration of these factors, the research contributes to the theoretical understanding of port governance while offering actionable insights for practitioners. The proposed framework addresses key gaps in existing literature, operationalizes critical governance constructs, and forms the basis for empirical validation through the questionnaire tool.

The framework highlights the multifaceted nature of port governance, emphasizing the interconnectedness of various dimensions. Political influences, such as national policies and political stability, are foundational to establishing effective governance structures. Environmental considerations, including air and water quality management, climate adaptation, and energy transitions, underline the critical role of sustainability in modern port management. Economic factors, such as trade dynamics and financial stability, demonstrate the interplay between governance and global supply chain performance. Risk-related elements, from operational disruptions to supply chain risks, underscore the necessity of resilience-focused governance. Finally, change-related factors, including leadership, technological integration, and stakeholder engagement, illustrate the importance of adaptive and innovative governance practices.

For policymakers and port authorities, the framework offers a structured approach to evaluating governance effectiveness. By systematically addressing each dimension, decision-makers can identify weaknesses in their current governance models and implement targeted improvements. The integration of sustainability metrics ensures alignment with international environmental standards, enhancing the ports' global reputation and competitiveness. Incorporating risk management strategies, such as redundancy and scenario planning, strengthens resilience and operational continuity. Additionally, the emphasis on stakeholder engagement fosters collaborative decision-making, aligning diverse interests and reducing potential conflicts.

While the proposed framework offers a comprehensive perspective, it is not without limitations. First, the operationalization of some factors, such as biodiversity management or financial stability, may require additional refinement to account for regional variations and sector-specific nuances. Second, the reliance on a literature-driven approach may limit the inclusion of emerging governance trends not yet captured in existing studies. Third, while the framework integrates diverse dimensions, its empirical validation through the questionnaire is yet to be conducted, leaving room for iterative improvements based on practical applications.

Future research should focus on empirically validating the proposed framework across a diverse range of port contexts. Comparative studies could explore how governance priorities vary between developed and developing economies or between

different types of ports (e.g., landlord, service, or municipal ports). Additionally, research could investigate the integration of social equity and technological innovation into governance frameworks, addressing such emerging challenges as digitalization and workforce transformation.

Longitudinal studies could examine how governance frameworks evolve in response to global disruptions, such as pandemics or climate crises. Finally, expanding the framework to include additional dimensions, such as cultural and regional governance influences, would enhance its applicability and relevance. These future directions would not only refine the framework but also contribute to advancing the field of port governance research.

The conclusions reaffirm the study's contribution to bridging theoretical insights with practical tools, offering a foundation for both academic exploration and managerial innovation in port governance.

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