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Overcoming Strategies for Omani Seaport Challenges

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ABSTRACT

Academicians and researchers have focused on analyzing challenges and countering strategies as seaports are dynamic and crucial to global logistics. The Sultanate of Oman's particular seaport performance, however, has not been extensively studied. This paper aims to identify the challenges Omani seaports face and overcoming strategies to these challenges. An interpretative research philosophy and a qualitative methodology were applied. Nineteen seaport managers, executives from logistics firms, government officials, and managers from the Oman Logistics Association and Oman Logistics Centre participated in in-depth interviews. The semi-structured in-depth interview was further improved after a pilot study. NVivo14's thematic analysis was used to examine the participant responses. The results show that numerous important issues affect the Omani seaport, including those pertaining to connectivity, energy and the environment, capacity and operations, economics and competition, governance and regulations, and technology and integration. Counterstrategies for the issues Omani seaports face include training and development, infrastructure development, market and growth strategies, collaboration and partnership strengthening, safety and sustainability strategies, and the adoption of advanced technologies. The results also indicated that government involvement and policy support, performance measurement and technology and data utilization integration, cooperation and partnership, prioritized and targeted resource allocation, and human capital development are important elements of the framework that should be included in order to enhance seaports' contribution to SOLS2040. Collaboration and integration between ports and logistics actors, including the government, will help to implement the national logistics strategy (SOLS2040). The paper suggests that Omani seaports should expand their human capital, improve workforce competency, upgrade their infrastructure, use advanced technology and port automation, and capitalize on their strategic location.

1. Introduction.

Logistics has become a critical business activity influencing international trade and transactions. It has become pivotal in the growth and development of global and international economies and a critical enabler of manufacturing firms (Koçak, 2021; Sharipbekova & Raimbekov, 2018). Global sea transport dominates the shipment of goods, for which maritime transport accounts for 80% of the global shipment and freight. This makes seaports remain essential nodes in the global supply chain (UNCTAD, 2022). The context of seaports is multidimensional, extending beyond physical infrastructure for handling containers and cargo. Seaports operate as complex socio-economic and institutional entities embedded within broader governance, spatial, and functional frameworks (Acciaro et al., 2020; Krenar, 2017). As critical interfaces between maritime and terrestrial transport systems, seaports operate as strategic gateways that facilitate regional and international connectivity (Rodrigue & Notteboom, 2020; Ducruet et al., 2018).

The operation of ports has been enhanced by emerging technologies. Adoption of advanced technologies and implementation of data-driven decision making are reshaping the governance and operations of seaports, enhancing efficiency, ensuring transparency, and fostering responsiveness (Fernando,

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2023; Elena et al., 2022). Seaports' performances are determined by infrastructure quality, strategic location, technological adoption, regulatory efficiency, and management effectiveness (Notteboom & Rodrigue, 2021). In addition, performance of seaports can also be influenced by workforce capability, governance structures, and inter-organizational coordination (Di Vaio & Varriale, 2020; Carlan et al., 2017).

Oman is strategically positioned connecting Asia, Africa, and Europe. In alignment with the Sultanate of Oman Logistics Strategy 2040 (SOLS 2040), the country has invested substantially in port infrastructure to strengthen its role as a regional logistics hub. Omani seaports currently handle a substantial proportion of national trade and play a key role in economic diversification. Salalah, Sohar, and Duqm ports are the main seaports that collectively contribute the largest share to cargo throughput, attracting foreign direct investment and industrial development, with increasing integration into global shipping networks (TRADLINK, 2025). As shown in the World Bank (2023) report on the Logistics Performance Index (LPI), Oman's performance indicated limitations in customs efficiency, infrastructure utilization, technology adoption, and tracking systems - (World Bank, 2023). Furthermore, Al Jabri (2022) identified the incidence of Omani businesses using UAE ports and trade hubs, claiming limitations in port and customs operations and fragmented trade processes. To this end, Albalushi et al. (2021) suggested revising customs regulations and procedures, improving the integration of systems and trade actors, adopting modern technologies, and training and developing human resources.

SOLS2040 capitalizes on Oman's strategic position and intends to place Oman as one of the top ten logistics hubs in the world. In addition, technology integration and infrastructure investment have been well stipulated within the national strategy. However, competition from ports in the GCC, fluctuations and volatility in the economy, and the existing geopolitical situation put pressure on Omani ports to accelerate their effort in modernizing and improving ports' adaptability and resilience to regional competition. Port authorities and other state and non-state actors need to improve the regulatory framework and coordination to foster achievement of the SOLS2040 objectives (Al-Riyami et al., 2017). This study, therefore, is conducted to explore the challenges affecting Omani ports in aligning their operations with SOLS2040 and to suggest overcoming strategies to accelerate the attainment of the national logistics strategy objectives.

Oman's logistics development stands on the Sultanate of Oman Logistics Strategy (SOLS 2040), which articulates clear and measurable ambitions across economic contribution, employment creation, global competitiveness, and perception (Table 1). Its target is to increase the GDP contribution to 14% by 2040 and create 300,000 jobs by 2040. Moreover, it aims to improve the LPI and to become one of the top 10 ranked countries in the world, and to position Oman as a recognized regional logistics hub by 2020 and a global logistics hub by 2030. Despite having strategic advantages and making continued investments, there are still logistics performance gaps that need investigation and intervention. The recently published LPI has shown issues concerning customs, timeliness, logistics competence, and service quality, in contrast to neighboring GCC ports such as Jebel Ali in the UAE and Khalifa Port in Saudi Arabia.

Table 1: SOLS 2040 ambitions.

No	Ambition		Targets			
			2014	2020	2030	2040
1	Economic indicators	Logistics indicators to GDP in real terms (OR)	1.5	3.0	8.0	14
2	Employment	Number of Logistics jobs	30,000	80,000	200,000	300,000
3	World Bank and World Economic Forum indices	Logistics index ranking	59	Top 30	Top 20	Top 10
		Competitiveness index ranking	46	Top 30	Top 20	Top 10
		Trade enabling index ranking	31	Top 20	Top 10	Top 5
4	International Perception	Regional Logistics hub		By 2020		
		Global logistics hub			By 2030	

Source: SOLS 2040.

Current studies, however, largely focus on examining Omani seaports separately and investigate only one dimension of such ports, such as technology adoption, level of infrastructure, or throughput efficiency. Limited attention has been given to integrated assessments that connect port performance with the SOLS 2040 strategy objectives. Moreover, theoretical fragmentation across prior studies highlights the need for a more unified analytical approach to understanding port competitiveness and strategic alignment. Therefore, exploring these challenges requires an in-depth investigation of the ports, logistics firms, government organizations and other stakeholders, which this study aims to undertake. Furthermore, recommending countering strategies based on the results of the in-depth qualitative study is the essence of this paper.

2. Review of Related Literature.

2.1. Review of Theoretical Literature.

Several theoretical perspectives guide the study of seaport efficiency and their challenges. Theo Notteboom and Jean-Paul Rodrigue, together with research by Kevin Cullinane and colleagues, applied the Resource-Based View (RBV) and Transaction Cost Economics (TCE) to examine how the level of infrastructure, adoption of technology, and management practices influence seaport efficiency and effectiveness. Furthermore, studies by Mary Brooks and Cullinane applied Michael Porter's Diamond Model to analyze and explain the competitiveness of ports and other sectors in relation to market demand and rivalry among firms. Other similar studies, such as those by Song and Yeo, identified determinants of seaport competitiveness such as logistics efficiency, hinterland connectivity, and access to markets. Studies on firm efficiency and performance employed institutional and stakeholder theories, particularly studies by Talley, Ng, and Pallis. Furthermore, the study by Notteboom and Cariou demonstrated the importance of institutional frameworks, environmental practices, corporate social responsibility, and stakeholder participation in shaping sustainable port development.

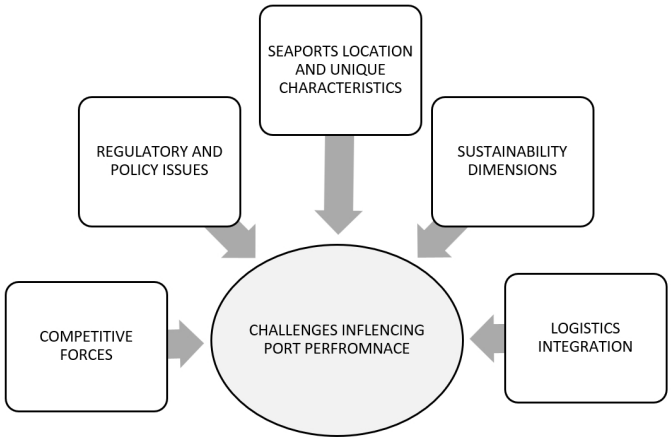
Literature on seaport performance identified the importance of foreign direct investment in tackling infrastructural challenges and technology transfer. The study by Greve and Hansen identified the role played by foreign investors, namely Maersk, in enhancing and improving port performance in Vietnam. Maersk's engagement has been in the development of infrastructure, enhancement of connectivity, reduction of logistics costs, and increasing export capacity. In addition, the study by Miller and Hyodo, using Stochastic Frontier Analysis, identified the effects of the Panama Canal expansion on Latin American and Caribbean ports in improving port efficiency resulting from berth length, terminal area, and ship-to-shore gantry cranes.

Researchers on port performance and challenges have utilized several theories, with the RBV dominating and being chosen as the main guiding theory for this study. As proposed by Jay Barney, RBV argues that organizational performance depends on valuable, rare, and inimitable resources and capabilities. It focuses on internal resources such as financial, technological, informational, legal, and relational assets as the basis for sustainable competitive advantage. In the context of the study, RBV explains how advanced infrastructure, technological integration, skilled labour, and effective management contribute to superior operational performance and successful logistics strategy implementation. Several studies indicated a positive relationship between innovation and technology adoption and port performance and competitiveness. In addition, human resources were also found to determine firms' uniqueness and performance, employing RBV as a guiding theory (Wu et al.; Brooks & Pallis). However, questions and critiques regarding RBV's conceptual ambiguity have been raised (Priem & Butler).

This paper has also considered institutional theory as a complementary theory to RBV, in that organizational policies, rules and regulations, culture, and employees' and societal expectations pose challenges to port performance. Institutional theory, as explained by Paul DiMaggio and Walter Powell, is concerned with the effect and the relationship between norms in organizations and stakeholders' interests, and management decision making and operations in organizations. The theory implies that decisions in ports can be determined by norms and culture within port organizations, as well as pressures from other stakeholders such as government institutions, private companies, and other actors in the chain. The study has also adopted network theory, as cooperation and collaboration among various stakeholders (shipping lines, logistics providers, government agencies) and port authorities can foster information sharing, minimize transaction costs, improve coordination, and improve operational efficiency. Together with this, Porter's Diamond Model has been reviewed to explain competitive forces such as factor conditions, supporting industries, demand conditions, and competitive rivalry and their effect on port performance and competitiveness.

Given the nature of the study objectives, RBV has been chosen as the main theoretical guide. RBV provides a framework for analyzing the relationship between organizational resources and firm competitiveness and performance. Analyzing Omani ports in terms of internal resources and capabilities and their effect on national logistics strategy objectives can be addressed using RBV. Institutional theory substantiates RBV in that external forces can also influence port performance and competitiveness, relationships among organizations, and integration of networks. These forces determine strategy implementation and the operational performance of ports, as well as ports' contribution to the SOLS2040 vision.

Figure 1: Categorization of Challenges in Port Performance and Strategy.



Source: Notteboom & Rodrigue, 2020; Sisson, 2021.

2.2. Empirical Review: Challenges of Seaports.

Various empirical studies have found several challenges affecting seaport efficiency and performance. Among others, limited investment in modern infrastructure and equipment, limited terminal capacity, and inability to accommodate the increasing size of container ships have been identified as challenges affecting port performance (Tongzon and Heng, 2005; Sisson, 2021; Notteboom & Rodrigue, 2020). Environmental regulations such as emission controls and waste management compliance challenge seaports. Moreover, water pollution has been cited by Roces (2019) as a challenge for the Port of Manila in the Philippines. In addition, social issues such as community opposition to port expansion pose challenges to port performance (Merk & Dang, 2013; Wang et al., 2020). Moreover, security concerns such as geopolitical tensions, terrorism risks, smuggling, and cyber-attacks challenge the performance of seaports (Notteboom and Rodrigue, 2005). Policy and regulatory related challenges were identified by Brooks & Pallis (2012), who found that restrictive regulations impede port performance. Arvis et al. (2018) stated that seamless customs procedures foster trade transactions and port performance (World Bank, 2020; Adwela et al., 2024).

2.3. Review of Challenges in Global and Regional Seaports' Performance.

Well performing seaports enhance international trade and national development. In the EU, ports integrating advanced technologies into their port infrastructure tend to experience enhanced performance and a surge in trade and transactions. EU

Table 2: Summary of key challenges.

No	Ambition		Targets			
			2014	2020	2030	2040
1	Economic indicators	Logistics indicators to GDP in real terms (OR)	1.5	3.0	8.0	14
2	Employment	Number of Logistics jobs	30,000	80,000	200,000	300,000
3	World Bank and World Economic Forum indices	Logistics index ranking	59	Top 30	Top 20	Top 10
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		Global logistics hub			By 2030	

Source: Authors.

seaports in the Netherlands, Germany, and the UK consistently achieve high rankings in the LPI and other performance measures. These ports are recognized for their high throughput and ability to facilitate smooth and efficient logistics and customs processes. To this end, the European Sea Ports Organisation (ESPO) reported that these ports excel in their performance and LPI (The World Bank, 2023).

Kumar et al. (2020) explored the critical role of infrastructure upgrades in improving port efficiency and competitiveness in the GCC region and offer empirical evidence supporting the importance of strategic investment in port infrastructure for sustainable economic growth in the Sultanate of Oman and other GCC countries. Al-Neaimi et al. (2019) investigated the performance of GCC seaports, including Oman, in relation to mainstreaming environmental standards and requirements. The study identified the presence of a better understanding of the nexus between port operations and environmental sustainability in the Sultanate of Oman and the rest of the GCC countries.

Study on Omani seaport performance has attracted several researchers due to the strategic location of Oman and the crucial role of its ports in the nation's economic diversification efforts. The two main Omani ports attracting researchers are the Port of Salalah and Sohar Port. The efficiency and effectiveness of these ports have been studied in terms of their role as pivotal hubs for global trade and logistics (Al-Mukhaini, 2022). He investigated the technical efficiency of the Port of Salalah and identified the port's high efficiency relative to regional competitors due to its advanced infrastructure and strategic management practices. Moreover, Al-Saidi and Al-Harthy (2021) studied the competitive position of Sohar Port and identified hinterland connectivity, service quality, and cost efficiency as determinants of its competitive position. The World Bank (2023) indicates that the development of Sohar Port has stimulated GDP growth in the surrounding region by attracting FDI and promoting the expansion of related manufacturing and logistics industries. Al-Shukaili et al. (2022) studied the environmental compliance of Omani seaports with international standards. They found that Salalah and Sohar ports have aligned operations with green port initiatives, such as reducing carbon emissions, managing waste, and enhancing energy efficiency.

3. Research Methodology.

3.1. Research Approach, Philosophy and Design.

This study adopts a qualitative approach with an exploratory research design to investigate the challenges affecting seaport strategy implementation and their contribution to the national logistics strategy in the Sultanate of Oman. This method is chosen for this study, as the study seeks to develop an in-depth understanding of the contextual, organizational, and institutional factors influencing seaport performance and logistics strategy execution. An exploratory design has been applied for this research, as it helps to delve into operational practices and experiences of participants that are difficult to capture quantitatively.

An interpretivist research philosophy has been adopted, as realities and practices in ports and logistics companies are socially constructed through the interactions of people engaged in strategic planning and implementation processes (Saunders et al., 2019). A qualitative research approach has been employed for this study, as it is suitable for studies that explore meanings and experiences associated with social and organizational phenomena (Creswell and Poth, 2018). As the implementation of strategies in seaports and logistics engages several stakeholders, such as government officers formulating policy, port managers and authorities, logistics firm managers and providers, and transport and shipping firm managers, these various participants provided relevant perceptions and insights based on their institutional, technological, and managerial experiences and the challenges facing Omani seaports. Furthermore, this study has adopted an exploratory research design, as it helps to delve into the challenges Omani seaports encounter in their operations. In addition, an exploratory design is preferred when empirical evidence is insufficient.

3.2. Data Collection and Analysis.

The study adopted primary and secondary sources, where the primary data was collected through semi-structured interviews, as they are a widely recognized instrument for gathering data through in-depth exploration of participants' perceptions, experiences, and interpretations (Creswell & Poth, 2018). The interview protocol, in a semi-structured format, was prepared and employed, and it was conducted face-to-face with participants involved in seaport planning, logistics strategy implementation, and operational management within Oman's seaport and logistics sectors. The research attracted 19 participants comprising CEOs, directors and managers, government officials, and operational managers from port authorities, logistics and shipping companies, customs, and other government organizations. The study utilized purposive sampling, as it is believed to be appropriate in qualitative research because it allows the researcher to identify information-rich participants capable of providing detailed and meaningful insights into the research problem (Babbie, 2015).

After ensuring participant consent, the researcher proceeded with the interviews. All interviews were audio recorded. Transcription of the audio-recorded interviews was conducted to create and extract reliable textual data ready for analysis. The study adopted thematic analysis as the main analytical method.

This is a widely adopted qualitative analytical method that helps researchers identify, analyze, and interpret recurring patterns and themes within qualitative data (Braun & Clarke, 2006). The standard thematic analytical process, consisting of familiarization and axial coding, was implemented with NVivo 14 software.

3.3. Reliability, Validity and Ethical Considerations.

Reliability and validity were ensured through data triangulation, applied through the integration of multiple data sources, including interviews, literature reviews, policy documents, and institutional reports; respondent validation was also employed to improve validity (Birt et al., 2016; Guion et al., 2011). Preliminary findings and interpretations were shared with selected participants to confirm the accuracy and relevance of the interpretations derived from the interviews (Birt et al., 2016). This process ensured that the findings accurately reflected participants' experiences and perspectives. Moreover, a pilot study was conducted to ensure the reliability of the instrument employed in the study.

The study applied essential procedures to ensure ethical principles, such as obtaining informed consent from the participants. Moreover, respondents were provided with the required information regarding the security and confidentiality of their responses. Participants were informed that their participation was voluntary, and they were told they could stop at any stage. To protect participant anonymity and confidentiality, personal identifiers were removed from interview transcripts and reports. Data were securely collected, stored, and used solely for academic research purposes (Saunders et al., 2019).

4. Results and Analysis.

This paper analyzed data collected from 19 high officials of government, logistics and shipping companies, and port authorities. Participants possessed relevant qualifications and rich experience in the fields of port administration, policymaking, and logistics and shipping firm management. Among others, P01 and P07 have substantial operational expertise and many years of experience and service in Omani seaports. In addition, P02, P05, P06, P08, P09, P10, P11, P12, P13, and P14 held senior managerial and executive positions in logistics, shipping firms, industrial zones, and ports. The positions they held, together with their extensive experience and qualifications, allowed them to provide deep insights on governance, technology adoption, strategic planning, stakeholder integration, and port competitiveness. Moreover, P03, P04, P15, P16, P17, P18, and P19 held key positions within the MTCIT, industrial and economic zones, and the customs office. Their insights enriched the study, providing strategic and policy-oriented perspectives on infrastructure development, maritime safety and security, customs operations, governance, human capital development, and alignment with SOLS2040.

4.1. Thematic Analysis and Findings on Challenges of Omani Seaports.

Thematic analysis was adopted to analyze the qualitative data gathered from the 19 participants. NVivo software was utilized to conduct the thematic analysis. The data collected was systematically coded, organized, and reviewed to uncover perspectives in relation to the objectives of the paper. The thematic analysis using NVivo led to the identification of key themes and related codes, as shown in Table 3.

Table 3: Themes and codes with participants (challenges).

Themes	Final Codes	Initial Codes	Participants
Regulatory and Governance	Regulatory Complexity Governance Structures Stakeholder Alignment	• Regulatory. • Stakeholder Alignment. • Management Structure	P01, P04, P05, P06, P07, P08, P09, P10, P11, P12, P16, P18, P19
Economic and Competitive	Economic Instability Regional Competition High Costs for SMEs	• Competition. Economic • Instability. • High-Cost SME.	P03, P04, P05, P06, P07, P08, P09, P10, P11, P12, P13, P14, P15, P17
Operational and Capacity	Operational Efficiency Capacity Constraints Manpower Shortages	• Capacity and Infrastructure. • Cargo • Volume. • Manpower Shortage	P01, P02, P03, P05, P06, P07, P08, P09, P10, P11, P12, P13, P14, P15, P16
Technological and Integration	Technology Implementation System Integration Modernization Needs	• Technology Implementation. • Integration. • Lack of Logistics Community	P03, P04, P05, P06, P07, P08, P09, P10, P12
Environmental and Energy	Climate Resilience Energy Transition	• Climate Change. • Energy Transition	P03, P05, P07, P08, P10, P17, P18
Connectivity Challenges	Connectivity Improvement Trade Facilitation	• Connectivity. • Foreign Dependency	P03, P04, P05, P06, P07, P08, P10, P11, P12, P13

Source: Authors.

Table 3 presents the themes, initial codes, and final codes drawn from NVivo. The table depicts the key coding structure and reference frequency associated with the challenges faced by seaports in Oman. It presents the distribution of references and participant files across various identified challenges, such as regulatory complexities, capacity and infrastructure constraints, workforce shortages, and economic instability.

The clustering of challenges and the frequency of respondents, along with the areas where challenges are most prominent, are presented in Table 4. The table provides insights into the primary internal and external challenges affecting seaport performance and the ranking of the challenges.

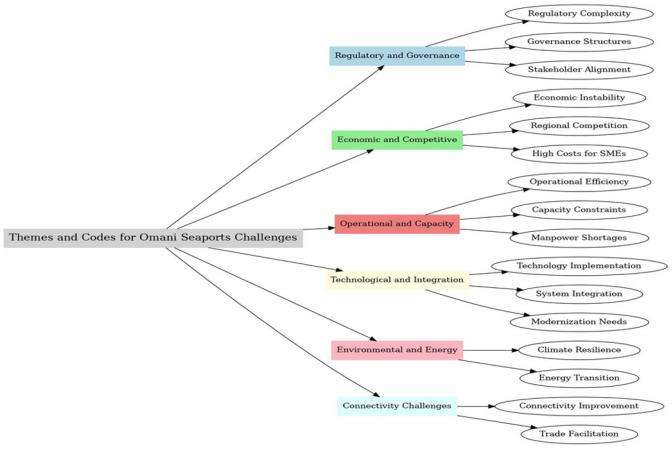
Table 4: Most frequent keywords on seaports challenges.

Factor Cluster	Sources Coded	References	% Coverage	Rank
Competitive	18	24	24.2%	1
Governance	18	24	24.2%	2
Operational	18	18	18.2%	3
Technological	18	18	18.2%	4
Connectivity Challenges	10	10	10.1%	5
Environmental and Energy	5	5	5.1%	6

Source: Authors.

The NVivo14-generated results are depicted in Figure 2, which visually organizes the themes and codes identified in the analysis of challenges facing Omani seaports. The chart categorizes challenges into primary themes, including regulatory, operational, technological, environmental, and connectivity factors, each with specific codes highlighting the nuanced challenges within these areas. The chart provides a clear overview and understanding of the internal and external challenges.

Figure 2: Themes and codes for Omani seaports challenges.



Source: Authors.

4.1.1. Regulatory and Governance Challenges.

The majority (13) of the respondents claimed that regulatory procedures focus more on ensuring compliance and control rather than operational efficiency. In addition, the scattered structure of governance and the loose interaction among stakeholders were identified as barriers affecting port efficiency. Some raised the customs clearance process as being characterized by lengthy administrative procedures resulting in delays, in contrast to neighboring ports. One of the participants stated that the regulatory framework was more control- than efficacy-oriented. One of the major challenges found in this study is control-oriented regulation that prolongs the turnaround time. It also affects the service quality and time provided by ports. Moreover, it adversely affects the performance and efficiency of the seaports. As complemented by the respondents, the governance structure has been characterized by loose interaction and integration among various government agencies, port authorities, and logistics actors, which challenges Omani ports' performance and competitiveness. Separate institutions with overlapping responsibilities were found to result in confusion in decision making and accountability.

The findings of the study imply that fragmented institutions have their own priorities, focusing little on integration and coordination, which affects the ports' capability to respond effectively to market changes. To complement this, participants stated that agreements and operational frameworks practiced among Omani ports were developed under earlier economic conditions, calling for amendment and change to make them fit for contemporary market conditions. Government and port authorities need to develop adaptive and more flexible governance structures that can easily accommodate advanced technology and digitization, foster innovation, and enhance integrated logistics operations. Moreover, promoting integration among stakeholders and port authorities has been suggested as imperative to improving logistics and port performance in Oman.

4.1.2. Economic Challenges and Competition.

Participants identified economic issues and market competition among regional ports as critical challenges facing Omani seaports. In addition, high operational costs among Omani ports erode their competitive capability, pushing shipping companies to neighboring ports. As further stated by participants, economic uncertainty has affected investors' participation, operational plans, and decisions on infrastructure expansion. Participants stated that seaports in Oman are sensitive to changes in global trade and economic performance, as downturns in international markets directly affect cargo volumes, trade activity, and revenue generation. Furthermore, participants revealed the competitive challenges Omani ports are facing from neighboring ports, particularly Jebel Ali Port, which suggests that Oman's port managers and authorities need to transform the ports to offer unique value propositions through specialized services, operational efficiency, competitive pricing, and niche logistics capabilities.

4.1.3. Operational and Capacity Challenges.

Participants stated that inefficient port operations, a shortage of skilled labor, and limited infrastructure are critical challenges posing an adverse influence on Omani port performance and competitiveness. As reported by the participants, longer response times in handling cargo and escalated operational costs were caused by disintegrated processes and workflows, lengthy operational procedures, and process redundancies. The challenges related to port and logistics operations and processes in cargo handling call for port authorities and actors in the supply chain to integrate emerging technology and update operational procedures. Participants highlighted the prevailing limited capacity as a key challenge influencing seaports in Oman, particularly during peak operational periods, caused by insufficient storage, warehousing, and container yard capacity. Strategic intervention to enhance warehouse and storage capacity in ports and container yards, and to enhance infrastructure for handling cargo, was proposed by participants.

Lack of skilled labor in maritime and logistics was identified by the participants as a critical challenge influencing Omani ports' competitiveness and performance. The lack of trained labor in port and logistics firms affects the quality of services provided as well as port performance and efficiency. Furthermore, it hinders the implementation and adoption of emerging technologies in ports and logistics firms. Participants recognized the presence of existing maritime and logistics training institutions, though they questioned the linkage of such institutions with the industry. Participants stated that universities and colleges operating in Oman need to align and strongly link their operations with the logistics and maritime industry, particularly port and logistics operations in Oman. Several re-

spondents stressed the importance of vocational training, professional development, and specialized maritime education in addressing workforce capability gaps.

4.1.4. Technological and Integration Challenges.

Emerging advanced technologies are transforming logistics and port operations. However, participants reported that Omani ports' use and adoption of these emerging technologies is slow, hindering the performance and competitiveness of the port and logistics sector. They suggested that Omani port authorities plan for integrating digital transformation and implementing modern technologies in their operations. Deployment of integrated systems can improve cargo handling, reduce delays in transaction processing, and help enhance the logistics and maritime industry. Several respondents noted that automation, artificial intelligence, and data analytics could improve resource allocation, predictive maintenance, operational monitoring, and workflow management.

The issue of scattered and disconnected systems and lack of communication among logistics and port actors was identified as a challenge that significantly impedes port performance and competence among Omani ports, as the in-depth interviews with participants revealed. Participants highlighted that isolated systems among ports, customs authorities, logistics providers, and shipping operators result in duplication, delays, and weak information sharing, which challenge Omani ports. Furthermore, infrastructure modernization emerged as another critical challenge within the findings. Participants suggested the importance of upgrading physical infrastructure alongside digital modernization initiatives. In addition, participants highlighted the growing importance of smart technologies, blockchain systems, automated security checks, and IoT-based monitoring systems in improving operational reliability and security.

4.1.5. Environmental and Energy Related Challenges.

Sustainability in terms of energy sources and environmentally friendly operations is critical to keeping firms competitive and internationally recognized. As raised by participants, port operations need to transition to renewable energy sources and sustainable business practices. In addition, participants emphasized ports' vulnerability to environmental risks due to climate change, demonstrated by rising sea levels, extreme weather, and supply chain disruptions. To this end, participants proposed the application of climate-resilient business operations and the deployment of renewable and sustainable energy sources in operational practices. This can drive firm performance and align operations with international standards. Respondents highlighted energy transition, such as the move to renewable energy sources such as solar and wind energy within Oman's geographical context, as capable of boosting operational efficiency and reducing operational costs. Many respondents recommended implementation of hybrid energy systems combining conventional and renewable energy to foster a transition to sustainable energy sources. Participants underscored the installation of robust infrastructure, enhanced drainage systems, and protective environmental measures as imperative to respond to and mitigate climate-triggered operational disruptions.

4.1.6. Connectivity Challenges.

Hinterland and multimodal connectivity issues were raised by participants as an important challenge affecting seaport performance and competitiveness. Improvement of multimodal transport connectivity and increasing independence of logistics networks are essential for strengthening Oman's position within regional and global trade systems. Reduction of dependence on foreign logistics networks needs to be minimized. The insufficient domestic transport networks, particularly road, rail, and multimodal logistics integration, were noted by the participants as critical to enhancing port performance and competitiveness. Inadequate transport connectivity between ports, industrial zones, and inland markets creates logistical bottlenecks that affect efficient cargo movement and flow in Omani ports. As participants highlighted, expansion of multimodal transport network infrastructure can improve the influence of Omani ports and upgrade the role of seaports as critical to the regional logistics hub. Participants also highlighted the challenge from trade facilitation, including customs procedures, aligning operations with international standards, and reducing dependence on foreign re-export routes; improving these can enhance Omani ports' performance.

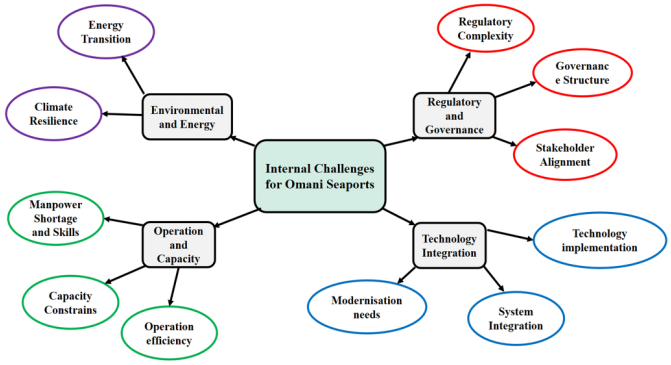
4.1.7. Findings of Internal Challenges Facing Omani Seaports.

Internal organizational procedures, such as layered and bureaucratic procedures, were challenges creating delays in cargo handling and clearance, eroding the ports' performance and competitiveness. The organizational structure within ports further limits the performance and efficiency of operations. Participants recognized that Omani seaports were investing in infrastructure and integrating operations, but capacity constraints such as inefficient resource utilization bottlenecks hinder them from employing their full potential. Besides this, participants noted the impediment caused by the lack of skilled labor, which has become an operational challenge for Omani ports. Participants noted the integration of advanced technology as an important challenge affecting Omani seaports. Participants called for modernization to enhance connectivity within the logistics ecosystem, yet the lack of a cohesive logistics community and minimal technological advancement limit the ports' ability to streamline operations and improve service offerings. Environmental and energy challenges, including climate resilience and the transition to sustainable energy sources, add another layer of complexity. These require proactive measures to protect the ports from environmental risks and to align with global standards in sustainability.

4.1.8. Findings of External Challenges Facing Omani Seaports.

The findings of the study indicate various external challenges Omani seaports face that hinder their ability to operate competitively in the regional and global market. Global economic fluctuations, competition among neighboring seaports, and high operational costs, particularly for SMEs, present critical challenges to Omani seaports' operations. These challenges also affect the future growth and expansion of Omani logistics services. Connectivity limitations exist, as Omani ports currently rely on foreign logistics routes, creating a dependency

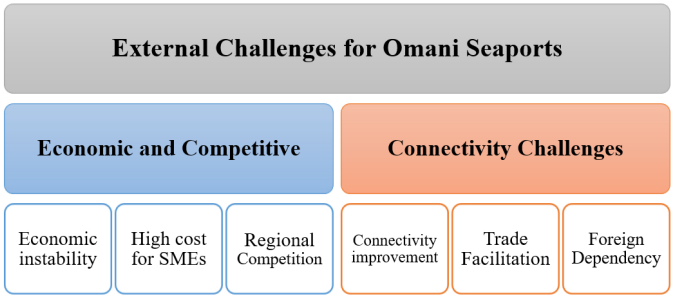
Figure 3: Findings of internal challenges of Omani seaports.



Source: Authors.

that can make the ports vulnerable to regional and geopolitical shifts. Enhanced connectivity and streamlined trade facilitation processes are needed to strengthen Oman's position as a self-sufficient logistics hub.

Figure 4: Findings of External Challenges of Omani Seaports.



Source: Authors.

4.2. *Thematic Analysis on Countering Strategies.*

Participants' responses regarding countering strategies were also analyzed using NVivo, and the analysis resulted in six significant areas, as depicted in Table 4 (Most frequent keywords for strategies). This implies that intervening in these areas will enable Omani seaports to improve performance and competitiveness in line with the strategic position of Oman.

Table 5: Most frequent keywords for strategies to counter challenges.

Factor Cluster	Sources Coded	References	% Coverage	Rank
Collaboration and Partnership	13	39	20.6%	1
Infrastructure and Connectivity Enhancement	12	36	19.0%	2
Training and Development	11	33	17.5%	3
Market and Growth Strategies	10	30	15.9%	4
Technology Advancement and Innovation	9	27	14.3%	5
Safety and Sustainability	8	24	12.7%	6

Source: Authors.

Table 5 shows that strengthening collaboration and partnership among actors and stakeholders needs to be prioritized to improve port performance, as it helps to minimize fragmented institutional operations, redundancy of operations, and fosters information exchange. The next priority area of intervention, as noted by the participants, is investing in and improving infrastructure and enhancing connectivity. Upgrading infrastructure can improve port performance and enhance the competitiveness of Omani seaports in contrast to their neighbors. Human resource development was found to be the third intervention area, as suggested by the participants. As skill shortages in logistics and maritime fields hinder port operations and efficiency in Oman, focusing on training and development through the enhancement of vocational and higher education institutions can resolve the issue of skill shortages. Furthermore, formulating marketing strategies and promoting the ports was suggested as an important intervention to counter the challenges seaports in Oman are facing. Adopting advanced digital technology and focusing on safety and sustainability were identified as the fifth and sixth countering strategies to address the challenges affecting seaports' performance in Oman.

Table 6: Themes and codes with participants (countering strategies).

Theme	Final Codes	Initial Codes	Participants
Training and Development	HR Development Skills Enhancement Benchmarking	Training, Workforce Development	P01, P03, P04, P05, P08, P09, P12, P13, P14, P17, P18, P19
Infrastructure and Connectivity Enhancement	Infrastructure Investment Improve Connectivity Port Service Trade Corridor	Investment in Infrastructure, Road/Rail Connectivity, Integrated Logistics Services, Port Community	P02, P03, P07, P10, P11, P12, P13, P16, P19, P06, P15, P18
Market and Growth Strategies	Marketing Industry Growth Global Integration	Economic Growth, Market Positioning, Competitiveness	P03, P04, P05, P06, P07, P09, P11, P14, P13, P15
Collaboration and Partnership	Strategic Partnership, Alignment, Gov Incentive, Secure Energy	Public-Private Partnerships, Port Service, Stakeholder Collaboration, Support	P02, P04, P05, P06, P07, P08, P09, P11, P12, P13, P15, P18, , P19
Safety and Sustainability	Risk Management, Environmental Standards Maritime Safety Decarburisation of Growth	Safety Measures, Sustainability Initiatives, Energy Transition, Environmental Impact	P03, P04, P05, P06, P07, P14, P18, P10
Technology Advancement and Innovation	Rapid Technology Adoption, Digital Transformation, Automation	Technology Implementation, Innovation, Benchmarking, System Integration	P02, P03, P06, P07, P08, P09, P10, P11, P13

Source: Authors.

4.2.1. *Training and Development Strategies.*

Development of human resources was identified as an important countering strategy to improve port performance and efficiency. It involves training the port and logistics workforce, as well as government and other stakeholder employees. Continuous skill enhancement and professional development of the workforce were suggested by participants for ports, logistics firms, government, and other stakeholders. Closely working with specialized training institutions dedicated to maritime and port operations to ensure standardized, high-quality training for both local and expatriate employees was highlighted. Respondents further stressed the importance of integrating practical training in vocational and higher education to tackle the skilled

manpower challenge facing Omani seaports. Participants suggested that benchmarking practices from various best - performing ports can help improve the capacity of port management to tackle challenges and improve port performance and efficiency. As part of capacity and knowledge acquisition, respondents highlighted the importance of learning from successful ports globally, including the Port of Singapore and the Port of Rotterdam. Acquiring best practices and knowledge in human resource development, integrated port and logistics systems, and managerial and operational aspects can help improve the competence of Omani ports.

4.2.2. Infrastructure and Connectivity Enhancement Strategies.

Analysis of the in-depth interviews implies the presence of infrastructure- and connectivity-related challenges. Enhancing investment in infrastructure and improving connectivity can critically help tackle the challenges encountered by ports in Oman. Enhancement of integrated logistics operations and multimodal transport systems can strengthen the capacity of Omani port facilities in handling cargo. Expanding logistics facilities, warehousing infrastructure, and cargo handling contributes to accommodating increasing trade volumes and attracting international shipping lines. Furthermore, interventions to strengthen and enhance road, rail, and multimodal transport linkages were substantiated by respondents as essential for facilitating efficient cargo movement among ports, industrial zones, and regional markets. The findings indicate that enhanced hinterland connectivity would reduce logistics costs, improve cargo transit times, and strengthen the competitiveness of Omani ports within regional supply chains. Rail connectivity among GCC countries was suggested by participants as an important mode of transport for improving connectivity, thereby improving port performance and efficiency. Optimizing port services, with an emphasis on efficient cargo handling, customs clearance, and logistics support services, is necessary for improving operational performance and customer satisfaction. The establishment of strategic trade corridors also emerged as a significant competitive strategy. Participants noted that dedicated trade corridors and expedited customs procedures could facilitate the movement of high-priority and time-sensitive cargo.

4.2.3. Market and Growth Strategies.

Port competitiveness was found to be determined by market positioning and promotion in the market, in contrast to other neighboring ports in the region, which helps improve the visibility of Omani ports in the world. Besides this, expanding industries and pursuing global integration can contribute to port competitiveness and sustainability, and are essential to improving Oman's place in global maritime logistics. Respondents highlighted that a targeted marketing strategy focusing on strategic position, modern infrastructure, and specialized port capabilities can improve Omani ports' competitiveness. For instance, P03 stressed this significance, stating: "Effective marketing is essential to make our ports known globally. We need to communicate our value proposition more clearly and differentiate ourselves from nearby ports."

Respondents also suggested that focusing on industrial - growth and expansion would help ensure the sustainability of Omani ports. Enhancing integration among port, logistics, and government actors was highlighted by participants as pivotal for ensuring Omani ports' performance and sustainability, as stated by P05: "Developing the industry around the ports will create a more integrated logistics ecosystem, which in turn attracts more business and makes our ports more competitive." Moreover, participants suggested that connecting Omani ports and logistics actors with global logistics and maritime sectors through alliances and partnerships can contribute to improving Omani ports' performance and sustainability. The location of Oman was highlighted as strategic in connecting three continents—Asia, Africa, and Europe—providing substantial opportunities for positioning the country as a regional logistics gateway. However, achieving this objective requires alignment with international operational standards, supportive trade policies, and stronger partnerships with global shipping lines and logistics companies.

4.2.4. Collaboration and Partnership.

Participants highlighted the pivotal role that inter - organizational collaboration and partnership agreements play in determining ports' performance and competence. Collaboration and partnership can enhance the internationalization of operations, technology and capital flow, and the security of shipments, which can contribute to port performance and the regional and global competitiveness of Omani seaports. To this end, partnership agreements were highlighted as crucial for technology transfer and enhancing Omani ports' alignment with international maritime and shipping standards. Respondents emphasized the investment contributions of partnerships in addition to management and technical expertise. To this end, P13 stated: "International collaborations are crucial, not just for the funding they bring, but for the operational expertise that can elevate our standards to meet international benchmarks." In addition, P14 highlighted: "Our collaboration with international ports, like Rotterdam, provides us with a framework to strengthen our processes and enhance our global positioning."

4.2.5. Alignment with Government Incentives.

Participants highlighted the importance of incentives and policy support for investors ready to finance and operate in the field of port and logistics infrastructure expansion. Policy support and incentives are important enablers for fostering collaboration and partnership. Participants highlighted that fiscal incentives, regulatory facilitation, and investment-friendly policies are essential for attracting and sustaining foreign partnerships. As stated by P15: "Tax exemptions and regulatory benefits make Oman an attractive option for global logistics firms seeking a stable base in the region." P19 substantiated the importance of policy support, stating: "Government support and incentives help us draw in global logistics players, who see Oman as a strategically located hub with strong policy backing." This was also complemented by P16, who stated: "To remain competitive, we need policies that allow for flexibility

and adapt to the needs of both local and international stakeholders."

4.2.6. Energy Security and Sustainability.

Transitioning to sustainable energy sources has become a determinant of port performance, efficiency, and competitiveness. Implementation of secure and sustained energy through renewable energy sources was identified by participants as a foundational requirement for operational continuity and competitiveness. Participants emphasized that reliable energy supply is essential for maintaining uninterrupted port operations. In this regard, P11 stated: "Reliable energy supply is essential to maintain operational efficiency, especially as any disruptions could severely impact our reputation and cost structure." Participants highlighted the strategic value of renewable energy integration in port operations. To this end, P15 noted: "Integrating renewable energy solutions at our ports is not just a cost-saving measure; it aligns with global environmental standards, making Oman's ports more attractive to international shipping lines focused on sustainability."

4.2.7. Safety and Sustainability.

The thematic analysis identified insufficient risk management mechanisms, failure to comply with global environmental requirements, and maritime security and safety challenges as critical issues influencing port performance and efficiency. In addition, the issue of decarbonisation was noted as an important contemporary challenge encountered by Omani seaports. Respondents suggested that ensuring resilient and globally credible ports is, above all, pivotal for ports in Oman. Deployment of sustainable energy systems was suggested by respondents for Omani ports. Establishment of risk management systems to prevent and mitigate operational and supply chain disruptions, in order to ensure business continuity, was suggested as critical for port authorities and logistics managers. This will help build investor and stakeholder confidence. As P03 stated: "Safety protocols are critical in high-volume port environments to prevent and handle operational disruptions that can have economic and reputational consequences."

As conceptualized by P19: "Risk management is not just about compliance; it is about actively protecting our assets and ensuring a resilient infrastructure that can handle unexpected challenges." This reflects a shift towards anticipatory risk governance designed to prevent and mitigate operational vulnerabilities. In addition, participants highlighted the importance of environmental compliance, as it is a key determinant of global competitiveness. Participants noted that complying with international environmental standards is increasingly a prerequisite for attracting global shipping lines. To complement this, P14 said: "For Oman to remain competitive, our ports must meet international environmental standards, as this is often a decisive factor for companies looking to establish long-term relationships." P16 also complemented the importance of compliance with international standards.

The issue of safety and maritime security was noted by respondents as a critical challenge Omani ports are encountering. To quote the response of the participants, P11 stated: "Maritime safety protocols are foundational for our operations. Every aspect, from cargo handling to vessel management, must adhere to strict safety standards to avoid incidents." P13 further complemented this, noting the role of conducting continuous safety audits in maintaining compliance with international standards and reinforcing institutional credibility. In addition, participants coined decarbonisation as a strategic intervention aligned with global climate transition agendas. To complement this, P08 noted that reducing emissions is essential for maintaining competitiveness in a rapidly decarbonising logistics sector. Similarly, P05 emphasized that sustainable operational practices are no longer optional but necessary for long-term viability.

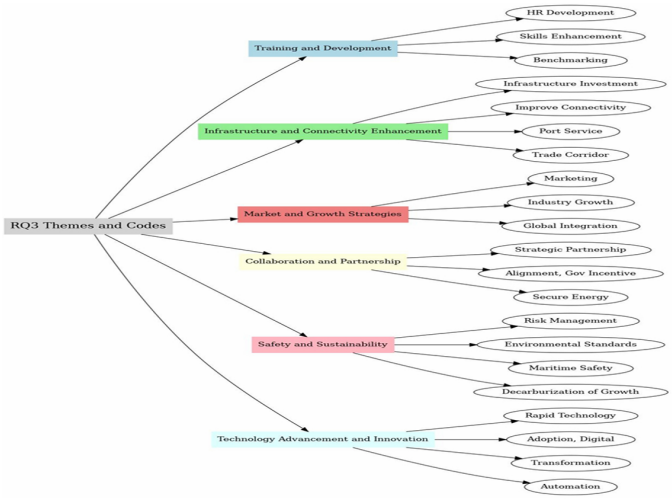
4.2.8. Technology and Advanced Innovation.

Deployment of emerging technologies in port and logistics operations and management was identified by participants as an essential overcoming strategy to improve port performance, competitiveness, and coordination among seaports and other stakeholders. Analysis of the responses revealed several overcoming strategies, namely rapid adoption, innovation, benchmarking, system integration, digital transformation, and automation. Integrating advanced technology into port and logistics operations was highlighted as a key intervention for overcoming existing operational limitations. This can enhance operational efficiency and port performance. Participants noted that failure to adopt advanced port and logistics technology can reduce port efficiency and undermine competitiveness (P03). As added by P10, ports need to focus on acquiring and applying effective technology in their operations. Innovation was also identified as essential for developing context-specific solutions to operational challenges. P14 highlighted that innovation plays a critical role in tailoring port strategies to local conditions while maintaining international competitiveness.

Participants consistently identified fragmented systems as a key source of inefficiency. Integrated digital platforms were viewed as essential for enabling real-time coordination across customs, logistics, and port operations. P07 emphasized that system integration enhances communication and operational - flow, while P02 described digital transformation as a structural necessity for aligning with global logistics standards. Automation was widely recognized as a critical driver of productivity and scalability. P18 highlighted its role in reducing delays and enabling higher cargo throughput, while P08 noted its potential to reallocate human effort toward strategic functions, thereby improving both efficiency and workforce engagement. Collectively, automation was viewed as central to future-ready port operations.

The study also suggests that ports and logistics firms have a well-planned and organized human resources development strategy. Moreover, attracting investors and deploying sufficient capital in port infrastructure was strongly recommended by participants. Strengthening multimodal connectivity and technology adoption, together with market positioning, was further highlighted by participants as a critical overcoming strategy for improving port performance and efficiency. A well-planned

Figure 5: Themes and codes tree chart created by NVivo software.



Source: Authors.

and managed Public-Private Partnership (PPP) to attract investment and facilitate knowledge transfer was also noted by participants. Moreover, participants emphasized the importance of aligning educational programmes with industry needs, investing in infrastructure and trade corridors, and fostering collaboration through government incentives. Sustainability and safety are essential to maintaining regulatory compliance and appeal to environmentally conscious partners, while rapid technological adoption and digital transformation ensure efficiency and competitiveness. Together, these elements form a cohesive strategy that aligns with Oman's national logistics goals, positioning its seaports as competitive, efficient, and responsible hubs in the global logistics network.

5. Discussion, Conclusion, and Implications.

This part of the paper presents a discussion of the findings, conclusions drawn from the findings, and implications and recommendations for academics, policy makers, and future researchers. The study findings are broadly classified into two categories: the key challenges Omani ports are facing, and suggested overcoming strategies to counter these challenges. The key challenges Omani ports are encountering consist of the regulatory framework and governance structure, economic instability and competition from regional seaports, operational and capacity constraints, limitations in technology adoption and system integration, environmental compliance and energy transition, and restricted connectivity. The challenges identified in this study align with the findings of DiMaggio & Powell (1983), who identified the effect of limitations in governance structures on operational inefficiency and reduced competitiveness. Accordingly, reforming the regulatory framework can help streamline port processes and enhance governance structures, which will in turn enhance overall port performance and efficiency. It is also suggested that there is a need to renegotiate previous

Figure 6: Findings of Effective Omani Seaports Strategy Elements.

Source: Authors.

concession agreements with international port operators to better reflect the current economic realities of the Omani logistics sector.

The study also identified competition as an emerging challenge threatening Omani seaports, for which port authorities need to transform port infrastructure and services. As stated by the respondents, neighboring ports such as Jebel Ali dominate the regional market, undermining Omani ports' ability to fully utilize their port capacity and attract sufficient cargo. This finding is consistent with the work of Brooks & Cullinane (2007), who suggested differentiation of port services to improve operational efficiency and foster competitiveness. Economic uncertainty, such as fluctuations in oil prices, was also found to be an obstacle to maintaining consistent port operations and growth.

Port inefficiency and limited capacity utilization were identified as critical challenges affecting Omani ports. Underutilization of capacity was reported by respondents for Salalah and Duqm ports. This finding aligns with the work of Notteboom & Rodrigue (2005), who identified capacity management as a challenge in ports and suggested that port management set strategies to optimize capacity and operational capabilities for handling increasing cargo. Moreover, a lack of skilled manpower, particularly in operating high-technology and modern infrastructure, was an important challenge found in this study, drawing port authorities' management towards sustainable human resource development.

The strategic position of Oman underlines the importance of location in fostering port competitiveness, supporting the arguments put forth by Notteboom et al. (2021). This has to

be substantiated by robust marketing and positioning efforts to attract more demand for ports. The finding on infrastructure development aligns with the literature's emphasis on leveraging geographical advantages to attract shipping lines and cargo. The study by Schramm et al. (2020) asserts that ongoing investments in port facilities are essential for maintaining operational efficiency. The focus on enhancing workforce skills and reducing reliance on expatriate labor highlights the need for comprehensive human capital development strategies (Rodrigue et al., 2021). Moreover, slow technology adoption, as noted by Di Vaio and Varriale (2020), was found to be a key challenge facing Omani ports. Furthermore, the need for improved stakeholder collaboration further substantiates the literature's claim that effective stakeholder engagement is essential for optimizing port operations (Freeman, 2010).

5.1. Effective Strategies to Counter Challenges Faced by Omani Seaports.

The findings of the research reveal several overcoming strategies. These overcoming strategies comprise training and development of human resources, infrastructure development and connectivity enhancement, launching of marketing and growth strategies, collaboration and partnership, focusing on safety and sustainability, and adopting emerging technologies and innovation.

The finding on human resource development aligns with the theoretical and empirical literature reviewed. The guiding RBV theory emphasizes internal organizational capability (human resources) as a determinant of performance and competitiveness (Barney, 1991). Ports' continuous efforts in training and developing workers, as suggested by the participants, align with the findings of Notteboom & Rodrigue (2005). The finding on infrastructure development aligns with the work of Song & Yeo (2020), who identified physical and operational infrastructure as key to enhancing logistics efficiency. The study's finding regarding connectivity enhancement aligns with the study by Cullinane et al. (2006), which confirms the positive effect of improved connectivity to hinterlands and the establishment of trade corridors on seaport competitiveness.

Strengthening partnerships and collaboration aligns with the literature advocating for stronger ties between the public and private sectors in logistics (Brooks & Cullinane, 2007). By fostering these partnerships, Omani seaports can better understand the intricacies of international trade and global logistics, confirming calls for integrated logistics services that enhance overall operational efficiency. Moreover, the emphasis on safety, risk, and sustainability aligns with the growing emphasis on environmental compliance and risk management in port operations (He et al., 2019). The need for rapid technological adoption reflects ongoing discussions in the literature regarding the importance of innovation in maintaining competitive advantage in the logistics sector (Kaplan & Norton, 2004). In summary, the responses and reflections provided by the participants contribute valuable knowledge to the discourse on improving port performance in the Sultanate of Oman, confirming the importance of strategic planning and implementation in line with SOLS2040.

5.2. Conclusion and Implications.

This paper aims to explore the challenges affecting the performance and efficiency of Omani seaports. It also aims to propose overcoming strategies based on in-depth interviews conducted with high officials in government, port authorities, logistics firms, and other related actors. Based on the findings and analysis of the study, it is concluded that regulatory inefficiencies, weak governance structures, a shortage of skilled local workforce, slower adoption of technology, sustainability and environmental issues, and limited multimodal connectivity are critical challenges. These challenges affect Omani ports' performance and competitiveness. The study concludes that structured and planned human resource development, increased investment in infrastructure through the attraction of foreign direct investors and public-private partnerships, adoption of digital transformation, implementation of sustainability initiatives, and enhancement of multimodal transportation networks are overcoming strategies to counter these challenges.

The study enriches RBV theory by extending it beyond tangible assets to include intangible capabilities such as policy alignment, governance flexibility, collaborative networks, and technological adaptability. The theoretical implication is the advancement of knowledge in strategic logistics management and port administration, enriching the RBV framework. The study demonstrates that factors such as institutional alignment, collaborative capacity, governance adaptability, and technological readiness are critical resources that shape competitive advantage in developing-country seaports. It also broadens existing logistics literature by linking seaport performance with broader national economic transformation, rather than focusing only on operational efficiency or cargo throughput. It also has practical implications by providing practical inputs for policymaking, managing ports and logistics firms, researchers and educators in higher education institutions, and other stakeholders. The study findings support revisiting and resetting the regulatory framework. The study practically implies deployment of environmentally compliant technology and working procedures in ports and logistics firms. Methodologically, the study contributes to logistics and transport policy research with qualitative thematic analysis that integrates institutional, strategic, and stakeholder perspectives. As a result, this research provides a foundation for future studies on sustainable port development, logistics transformation, and strategic governance in emerging economies.

5.3. Recommendations.

Establishment of an inter-organizational team to plan and oversee the integration and adoption of modern technology, - streamline customs procedures, automate cargo operations, and enhance coordination among stakeholders is recommended to improve port operations and efficiency. Increasing investment in port infrastructure and its integration with emerging technologies such as AI, automated cargo handling and tracking systems, IoT, and blockchain will further improve port competitiveness and performance. Fostering public-private partnerships (PPP) can further enhance port infrastructure and technology transfer. Promoting collaboration among seaports, freight

forwarders, customs offices, and multimodal transport networks can streamline logistics operations and port performance. Furthermore, implementation of sustainable and environmentally friendly port operations, use of renewable energy, reduction of carbon emissions, and implementation of internationally compliant standards can upgrade port performance and contribute to the national logistics policy (SOLS2040).

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