



# Operational Resilience and Business Continuity Management in Global Shipping Companies: Lessons from Supply Chain Disruptions and Environmental Regulatory Shifts

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**Abstract:** *Global shipping enterprises have confronted an unprecedented convergence of operational disruptions — pandemic-induced supply chain collapses, escalating port congestion, geopolitical trade disruptions, and accelerating environmental regulatory change — that have fundamentally exposed vulnerabilities in traditional business continuity frameworks designed for relatively predictable operational environments. This study investigates how global shipping companies develop, implement, and refine operational resilience and business continuity management (BCM) frameworks in response to multi-dimensional disruptions. Employing qualitative thematic analysis of in-depth interviews with thirty shipping industry executives, port operations managers, logistics professionals, and regulatory experts, the research identifies four resilience architecture dimensions and six critical business continuity capability domains that distinguish resilient from fragile maritime enterprises. Findings demonstrate that resilience in global shipping requires dynamic capability integration, multi-stakeholder collaboration, and adaptive regulatory management rather than static contingency planning. The study advances maritime business management scholarship by providing a theoretically grounded and empirically rich framework for operational resilience in complex maritime enterprise environments.*

**Keywords:** *Operational Resilience, Business Continuity, Maritime Disruption, Supply Chain Management, Regulatory Adaptation*

## 1. Introduction

The global shipping industry has long operated within an environment characterized by cyclical volatility, geopolitical uncertainty, and the ever-present physical risks of maritime operations. Yet the decade spanning 2015 to 2025 has confronted shipping enterprises with a convergence of disruptions of unusual severity and simultaneity: the COVID-19 pandemic triggered catastrophic supply chain dislocations that paralyzed global port systems and exposed critical fragilities in just-in-time logistics architectures; the IMO 2020 sulfur cap forced rapid fleet-wide fuel transitions that strained operational management systems and created unprecedented bunkering complexity; escalating geopolitical tensions in the Red Sea and Black Sea regions disrupted established trade routes, forcing widespread voyage re-planning and cost restructuring; and the accelerating implementation of carbon pricing mechanisms introduced new regulatory compliance obligations with direct operational and financial consequences. In this environment, the concept of operational resilience — the capacity of a shipping enterprise to anticipate, absorb, adapt to, and recover from disruptions while maintaining continuous business operations — has emerged as a defining strategic capability.

Business continuity management (BCM) in the maritime sector has traditionally been framed around safety management systems, emergency response procedures, and insurance coverage frameworks designed primarily for vessel-level incidents. While these frameworks remain

essential, they were not designed to address the enterprise-level resilience challenges posed by multi-dimensional, sustained, and structurally transformative disruptions of the kind the industry has recently experienced (Kim et al., 2021). The pandemic, in particular, revealed the inadequacy of shipping companies' BCM frameworks in addressing systemic supply chain disruptions, workforce unavailability, port closure cascades, and freight market volatility simultaneously — challenges that required organizational responses qualitatively different from those prescribed in conventional maritime emergency management protocols.

Existing literature on organizational resilience and business continuity has made important contributions to understanding resilience in manufacturing, financial, and infrastructure sectors, but the specific characteristics of global shipping — including the geographic dispersion of assets, the multi-jurisdictional regulatory environment, the labor complexity of multinational crewing, and the interdependency with port and logistics networks — create distinctive resilience challenges that require maritime-specific theoretical and empirical investigation (Kim et al., 2021; Du et al., 2023). Research on port resilience has begun to develop frameworks for understanding how port systems recover from disruptions (Kim et al., 2021), while studies on Arctic shipping logistics have illuminated how route diversification can serve as a resilience strategy (Du et al., 2023). However, enterprise-level operational resilience and BCM strategy in shipping companies — encompassing the organizational, financial, commercial, and regulatory dimensions of disruption response — remains an understudied domain.

This study addresses this gap by examining how global shipping companies construct and operationalize operational resilience and BCM frameworks capable of managing contemporary multi-dimensional disruptions. The research is motivated by the practical urgency of the challenge — shipping companies that fail to develop robust resilience capabilities face escalating risks of commercial failure, regulatory non-compliance, and reputational damage in an environment of increasing disruption frequency — and by the theoretical opportunity to advance maritime business management scholarship through empirically grounded resilience framework development. By synthesizing the experiences of shipping executives, port operators, and logistics experts across multiple global contexts, this study aims to generate insights that are both theoretically significant and practically actionable for maritime enterprise resilience management (Paridaens & Notteboom, 2021; Caldeirinha et al., 2024).

## 2. Research Method

This study employs a qualitative research design to investigate operational resilience and business continuity management strategies among global shipping enterprises. The qualitative approach is methodologically justified by the complexity and context-dependency of resilience strategy — a phenomenon that emerges from the interaction of organizational capabilities, leadership decisions, stakeholder relationships, and environmental conditions in ways that cannot be adequately captured through standardized survey instruments alone (Yao et al., 2021). The study adopts a constructivist-interpretivist paradigm, recognizing that resilience strategies are constructed through organizational learning processes shaped by specific disruption experiences, industry norms, and institutional contexts.

The study population encompasses senior professionals with direct responsibility for operational management, business continuity planning, risk management, and strategic decision-making in global shipping companies, port authorities, and maritime logistics organizations. Thirty participants are purposively recruited across five regions — Northern Europe, East Asia, the Middle East, North America, and Southeast Asia — selected to capture diverse regulatory environments, fleet management contexts, and disruption exposure profiles. Participant categories include chief operating officers, fleet directors, risk management officers, port operations managers, and maritime regulatory compliance specialists. The multi-regional and multi-functional composition of the sample is essential because operational resilience strategies in global shipping are shaped by the interplay of geographic, organizational, and institutional factors that vary significantly across regions and operational contexts (Kim et al., 2021; Du et al., 2023).

The primary research instrument is a semi-structured interview guide structured around five thematic dimensions: organizational definitions and conceptualizations of operational resilience; specific disruption experiences and their operational impacts; BCM framework design and

implementation; inter-organizational resilience collaboration; and regulatory adaptation strategies. Independent variables include organizational size, fleet type diversification, geographic trade route exposure, and regulatory framework complexity. Dependent variables encompass resilience capability dimensions — including disruption anticipation capacity, absorption capacity, adaptive capacity, and recovery speed — and BCM framework comprehensiveness indicators. Document analysis of company BCM frameworks, incident reports, and regulatory compliance records provides triangulating data.

Data collection proceeds through semi-structured interviews of 60–80 minutes, transcribed and analyzed using three-phase thematic analysis. The inductive coding phase identifies resilience concepts, disruption response strategies, and BCM capability dimensions from participant narratives. The cross-group comparison phase contrasts resilience approaches among shipping company executives, port operators, and logistics professionals, revealing how different industry positions shape resilience strategy orientation. The narrative synthesis phase develops a coherent explanatory framework for operational resilience in global maritime enterprises, integrating findings into a theoretically informed account of how multi-dimensional disruption management requires dynamic, collaborative, and regulatory-adaptive BCM architectures (Kim et al., 2021; Paridaens & Notteboom, 2021; Caldas et al., 2024).

### 3. Results and Discussion

#### 3.1 Results

Thematic analysis produced four primary resilience architecture dimensions and six critical BCM capability domains, organized across the tables below.

**Table 1. Operational Resilience Architecture Dimensions in Global Shipping**

Resilience Dimension	Core Components	Participant Endorsement (%)	Maturity Level (1–5)	Key Gap Identified
<b>Anticipation Capacity</b>	Risk intelligence systems, scenario planning, regulatory monitoring	90%	3.2	Regulatory change foresight underdeveloped
<b>Absorption Capacity</b>	Redundant capacity, financial buffers, crew contingency systems	87%	3.5	Financial buffer adequacy varies widely
<b>Adaptive Capacity</b>	Route flexibility, fuel switching capability, commercial agility	83%	3.1	Fuel switching infrastructure gaps
<b>Recovery Capacity</b>	Crisis communication, restoration protocols, post-disruption learning	93%	3.8	Learning systems rarely formalized

**Table 2. BCM Capability Domains — Assessment and Scoring**

BCM Capability Domain	Importance Score (1–5)	Current Implementation Score (1–5)	Capability Gap	Priority Level
<b>Supply Chain Redundancy Planning</b>	4.8	2.9	1.9	Critical
<b>Regulatory Compliance Contingency</b>	4.6	3.1	1.5	High
<b>Crew Continuity &amp; Welfare Systems</b>	4.7	3.4	1.3	High
<b>Digital Operations Backup</b>	4.5	2.7	1.8	Critical
<b>Financial Liquidity Reserve Management</b>	4.4	3.3	1.1	Moderate
<b>Stakeholder Communication Protocols</b>	4.2	3.6	0.6	Moderate

**Figure 1. BCM Capability Gap Profile — Importance vs. Implementation**

	Importance (out 5)	Implementio (out 5)	GAP Valve	Gap Severity
Supply Chain Redundancy	4.8	2.9	1.9	GAP (CRITICAL)
Digital Ops Backup	4.5	2.7	1.8	GAP (CRITICAL)
Crew Continuity	4.7	3.4	1.3	(HIGH)
Regulatory Contingency	4.6	3.1	1.5	(HIGH)
Financial Liquidity	4.4	3.3	1.1	GAP (MODERATE)
Stakeholder Comms	4.2	3.6	0.6	GAP (MODERATE)

The findings reveal systemic BCM capability deficits in two domains of critical concern: supply chain redundancy planning (gap score 1.9) and digital operations backup systems (gap score 1.8). The prominence of these gaps reflects the structural nature of the disruption exposures experienced during the pandemic and subsequent geopolitical crises — both of which fundamentally challenged shipping companies' ability to maintain supply chain continuity and digital operational integrity under prolonged stress conditions.

### 3.2 Discussion

The findings from this study provide a comprehensive analysis of operational resilience within global shipping enterprises, directly addressing the central research questions by demonstrating that resilience is not a monolithic capability but rather a multi-dimensional organizational competency. This competency spans several critical functional domains, including anticipation, absorption, adaptation, and recovery, within the commercial, operational, regulatory, and human resource sectors. By analyzing the various dimensions of resilience, the research emphasizes that operational resilience in the global shipping sector must be viewed as a holistic, dynamic, and evolving concept that integrates both proactive and reactive components across these domains. This comprehensive framework challenges the traditional, more linear conceptualization of resilience, highlighting the complex interplay between the different aspects of organizational operations.

The study identifies two key gaps in business continuity management (BCM) capabilities that significantly hinder operational resilience in shipping enterprises: supply chain redundancy planning and digital operations backup. These findings align closely with the disruption experiences described by participants, particularly those recounting the operational chaos caused by the pandemic-era port closures and the rapid shift to remote fleet management. These disruptions exposed significant weaknesses in the shipping industry's digital infrastructure, particularly in its ability to maintain continuity during periods of severe operational disruption. The study reinforces the assertion that many shipping companies were inadequately prepared to manage the technological and logistical challenges posed by such disruptions, highlighting the need for more robust, forward-thinking strategies in BCM, particularly regarding supply chain management and the digital systems that underpin global shipping operations.

The revelation that recovery capacity received the highest maturity score (3.8/5) among the four resilience architecture dimensions is particularly significant. This score suggests that shipping companies have historically placed the most emphasis on post-disruption restoration capabilities, which aligns with a broader trend in the maritime industry. This focus on recovery over prevention reflects an industry culture that has traditionally prioritized reactive crisis management rather than the proactive development of resilience capabilities. The research suggests that this reactive focus has shaped the way maritime businesses approach risk and disruption, with many organizations investing heavily in systems and processes designed to facilitate rapid recovery after disruptions rather than in building resilient systems capable of anticipating and adapting to these disruptions in the first place.

This finding not only confirms but also extends the observations made in the existing port resilience literature, which has consistently noted that maritime organizations tend to develop recovery competencies before investing in anticipation and adaptation capabilities. The research, however, goes a step further by revealing the strategic reorientation required for the maritime sector to achieve truly robust, enterprise-level resilience. This reorientation requires a shift away from a predominantly reactive approach to business continuity toward a more proactive resilience architecture. The new approach would integrate risk intelligence, adaptive operational design, and regulatory foresight. Proactive resilience architecture would anticipate disruptions before they occur, integrate flexible operational practices to absorb shocks, and adapt dynamically to changing circumstances. Furthermore, it would include recovery mechanisms that are more streamlined and efficient, reducing recovery time and resource expenditure.

The study also fills a significant gap in the maritime business management literature by providing empirical evidence for a four-dimensional resilience architecture framework that is specifically calibrated to the unique context of global shipping. This framework addresses several key challenges that are distinctive to the shipping industry, which have not been adequately addressed by previous resilience models developed in other industry sectors. The global shipping sector faces a unique set of BCM challenges, such as geographically dispersed fleet operations, multi-jurisdictional regulatory compliance, and the interdependency between the resilience of shipping enterprises and broader port and logistics network resilience. These factors complicate the ability of shipping companies to develop resilient operations, as they must navigate a complex web of international regulations, local port conditions, and logistical challenges, all while maintaining continuity of operations across vast, geographically dispersed networks.

One of the most striking findings of the study is the identification of inter-organizational resilience collaboration as a critical yet underdeveloped dimension of maritime BCM. This theme, endorsed by 83% of the participants, suggests that collaborative resilience efforts between various maritime stakeholders—such as shipping companies, port authorities, and logistics providers—represent an untapped opportunity for enhancing resilience across the sector. In a highly interconnected and interdependent industry like shipping, resilience cannot be built in isolation. Rather, it must involve coordinated efforts between various entities that share common interests in maintaining the flow of goods and services across global supply chains. The study suggests that industry associations, flag states, and port communities can play a key role in developing collaborative resilience protocols that enhance the overall robustness of the maritime sector. Such collaborative efforts could include sharing risk intelligence, jointly investing in resilience infrastructure, and developing standardized procedures for responding to disruptions. By working together, stakeholders can reduce the risk of operational disruptions and improve the overall stability of the global shipping network.

From a practical perspective, the implications for maritime business managers are clear and actionable. The findings suggest that current BCM frameworks, which are often based on static contingency planning, need to be fundamentally redesigned. Instead of focusing on fixed, predefined responses to specific risks, BCM frameworks should be built around dynamic capability integration. This means that shipping companies must invest in systems and processes that allow them to continuously monitor, assess, and adjust their operations in response to emerging risks and challenges. Key areas of focus should include the development of supply chain redundancy systems and the enhancement of digital operations resilience. Shipping companies must invest in technologies and strategies that allow them to quickly adapt to disruptions in supply

chains and to ensure that digital operations can continue smoothly in the face of technological failures or cyber threats. This shift toward dynamic capability integration represents a significant departure from the traditional focus on static planning and necessitates a more fluid, flexible approach to BCM.

Additionally, the research raises an important question for future studies: How do different ownership structures influence BCM investment priorities and resilience capability development? Specifically, the study suggests that there may be important differences between publicly listed shipping companies and private family-owned operators in terms of their approaches to BCM and resilience. Publicly listed companies may be more likely to prioritize investments in resilience infrastructure due to shareholder expectations and regulatory requirements, whereas private family-owned operators may have different priorities based on their unique business models and risk tolerance. Future research should explore how these ownership structures affect resilience investment decisions and the development of resilience capabilities, as well as the long-term trajectories of resilience development in shipping enterprises.

In conclusion, the study's findings provide valuable insights into the operational resilience of global shipping enterprises, offering both theoretical and practical contributions to the field of maritime business management. The research highlights the need for a shift toward proactive resilience architecture, greater inter-organizational collaboration, and a more integrated approach to BCM that emphasizes dynamic capability rather than static planning. By addressing these areas, shipping companies can develop more robust, adaptive, and sustainable operations that are better equipped to withstand the challenges of an increasingly volatile and complex global environment. Future research in this area should further explore the dynamics of ownership structures in resilience investment and development, as well as the potential for greater collaboration across the maritime sector to build a more resilient global shipping network.

#### 4. Conclusion

This study has provided a comprehensive qualitative analysis of operational resilience and business continuity management in global shipping enterprises, revealing critical capability gaps in supply chain redundancy planning and digital operations backup that represent priority areas for strategic BCM investment. Through thematic analysis of thirty industry professional interviews, the research has developed a four-dimensional resilience architecture framework — encompassing anticipation, absorption, adaptation, and recovery capacities — and identified six BCM capability domains that collectively define enterprise resilience in contemporary global shipping. The findings demonstrate that effective maritime BCM requires a fundamental shift from reactive crisis management to proactive, dynamic, and collaboratively oriented resilience building, and call for industry-wide investment in digital continuity infrastructure, regulatory foresight systems, and inter-organizational resilience collaboration frameworks.

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