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Strategic Importance of Maritime Chokepoints: Trade, Energy Security, and Maritime Governance in the Twenty-First Century

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ABSTRACT

Maritime chokepoints constitute the backbone of the global maritime system by facilitating international trade, energy transportation, and strategic connectivity. Their uninterrupted operation is essential for maintaining global supply chains, economic stability, and international security. Existing scholarship has examined maritime chokepoints through the perspectives of maritime strategy, international trade, energy security, maritime governance, and security studies. However, these perspectives largely remain fragmented, providing limited understanding of how geographical, economic, institutional, and security factors collectively shape the resilience of strategically important maritime corridors.

This study develops the *Maritime Chokepoint Resilience Framework* (MCRF) as an integrated analytical model for evaluating the resilience of major maritime chokepoints. Using a qualitative comparative multiple-case study design, the research examines six strategically significant waterways: the Strait of Hormuz, the Strait of Malacca, the Suez Canal, Bab el-Mandeb, the Panama Canal, and the Turkish Straits. The analysis draws upon peer-reviewed literature, reports of international organisations, government publications, and maritime industry data to assess five interrelated dimensions: strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity.

The comparative analysis demonstrates that geography alone does not determine the resilience of maritime chokepoints. Instead, resilience emerges through the interaction of effective governance, secure maritime operations, diversified trade networks, reliable energy transportation, and institutional capacity. Chokepoints characterised by balanced performance across these dimensions exhibit greater ability to withstand geopolitical tensions, supply-chain disruptions, operational failures, and emerging non-traditional security threats.

The study makes three principal contributions. First, it introduces the Maritime Chokepoint Resilience Framework as a multidisciplinary analytical model that integrates previously fragmented strands of maritime scholarship. Second, it provides a consistent framework for comparative assessment of strategically important maritime corridors. Third, it offers an evidence-based foundation for strengthening maritime governance, resilience planning, and policy development in an increasingly interconnected global maritime environment.

KEYWORDS: *Maritime chokepoints; maritime resilience; maritime governance; energy security; global trade; maritime security; comparative analysis; Maritime Chokepoint Resilience Framework.*

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1. INTRODUCTION

Maritime transportation is the foundation of the global trading system, carrying more than 80% of international merchandise trade by volume and connecting production, consumption, and energy markets across continents. Within this extensive maritime network, a limited number of narrow waterways, commonly known as maritime chokepoints, perform functions far greater than

their geographical size. These strategic corridors connect major oceans and regional seas, shorten shipping distances, facilitate international trade, and enable the movement of critical energy resources. Consequently, their uninterrupted operation is essential for maintaining global supply chains, economic stability, and international security.

The world's principal maritime chokepoints include the Strait of Hormuz, Strait of Malacca, Suez Canal, Bab el-Mandeb, Panama Canal, and the Turkish Straits. Although these waterways differ in geography, governance, and commercial functions, each occupies a strategic position within the international maritime system. The Strait of Hormuz serves as the principal outlet for hydrocarbon exports from the Persian Gulf, while the Strait of Malacca provides the shortest maritime route linking the Indian and Pacific Oceans. The Suez Canal and Bab el-Mandeb connect Europe with Asia through the Red Sea, the Panama Canal links the Atlantic and Pacific Oceans, and the Turkish Straits provide access between the Black Sea and the Mediterranean. Together, these maritime corridors support international commerce, energy transportation, and regional strategic connectivity.

Recent geopolitical developments have demonstrated the vulnerability of maritime chokepoints to a wide range of disruptions. Armed conflicts, geopolitical rivalry, piracy, maritime terrorism, cyber threats, attacks on commercial shipping, climate-related hazards, and infrastructure failures have repeatedly affected maritime transportation and global supply chains. Incidents such as the *Ever Given* blockage of the Suez Canal in 2021 and recent security disruptions in the Red Sea illustrate how localised events can generate significant economic consequences by delaying cargo movements, increasing freight costs, disrupting manufacturing networks, and affecting global energy markets. These developments have shifted scholarly and policy attention from the strategic importance of maritime chokepoints towards their capacity to withstand, adapt to, and recover from disruption.

Existing research has examined maritime chokepoints from diverse disciplinary perspectives. Strategic studies have emphasised sea power and geopolitical competition, maritime economics has focused on trade and logistics, energy security research has examined hydrocarbon transportation, while legal and governance studies have analysed international maritime law and institutional cooperation. More recent scholarship has expanded this literature by examining maritime security, cyber resilience, environmental sustainability, and critical maritime infrastructure. Although these studies have substantially improved understanding of maritime systems, they largely examine these dimensions independently. As a result, limited attention has been devoted to understanding how geography, trade, energy security, governance, and maritime security interact to shape the resilience of strategically important maritime corridors.

This conceptual fragmentation represents an important gap in contemporary maritime scholarship. Maritime chokepoints function as integrated strategic systems in which physical geography, commercial connectivity, institutional governance, energy transportation, and security capacity are mutually reinforcing. Evaluating any one of these dimensions in isolation provides only a partial explanation of maritime resilience. An integrated analytical framework is therefore required to explain why some maritime chokepoints demonstrate greater resilience than others despite facing comparable geopolitical and operational challenges.

To address this gap, the present study develops the *Maritime Chokepoint Resilience Framework* (MCRF), a multidisciplinary analytical model that evaluates maritime resilience through five interconnected dimensions, strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity. Using a qualitative comparative multiple-case study design, the research applies the framework to six strategically significant maritime chokepoints to identify common determinants of resilience and context-specific vulnerabilities.

The study makes three contributions to maritime scholarship. First, it introduces the Maritime Chokepoint Resilience Framework (MCRF) as an integrated conceptual model that synthesises previously fragmented research traditions. Second, it provides a consistent basis for comparative analysis across strategically important maritime chokepoints. Third, it offers an evidence-based framework that can assist governments, international organisations, and maritime stakeholders in strengthening governance, resilience planning, and policy development for critical maritime infrastructure in an increasingly interconnected global maritime environment.

2. Theoretical Perspectives:

Understanding the strategic importance and resilience of maritime chokepoints requires an analytical perspective that extends beyond traditional maritime strategy. While classical theories explain the significance of geography and sea power, contemporary maritime systems

are increasingly shaped by economic interdependence, institutional governance, and multidimensional security challenges. No single theoretical perspective adequately explains the complexity of modern maritime chokepoints. This study therefore adopts an integrated theoretical approach that combines classical maritime strategy, complex interdependence theory, and resilience theory to provide the conceptual foundation for the Maritime Chokepoint Resilience Framework (MCRF).

2.1. Classical Maritime Strategy:

Classical maritime strategy provides the earliest theoretical explanation for the strategic importance of maritime chokepoints. Alfred Thayer Mahan argued that maritime commerce, naval capability, and control of strategic sea routes constitute the principal foundations of national power and international influence. According to Mahan, states capable of protecting maritime communications gain significant military and economic advantages because control of the sea enables secure trade, resource mobilisation, and strategic projection. Although developed during the late nineteenth century, his theory continues to explain why narrow maritime passages remain central to international competition.

Julian Corbett refined this perspective by arguing that maritime strategy should focus on securing Sea Lines of Communication (SLOCs) rather than achieving permanent command of the sea. He emphasised that maritime power derives from the ability to facilitate commerce, protect shipping, and support national political objectives. Contemporary maritime chokepoints reflect Corbett's proposition because their value lies not merely in geographical location but in their capacity to sustain uninterrupted commercial and strategic connectivity.

However, classical maritime theory primarily emphasises geography, naval capability, and interstate rivalry. While these factors remain important, they provide only a partial explanation of resilience in an era characterised by global supply chains, institutional governance, cyber threats, and economic interdependence.

2.2. Complex Interdependence Theory:

Complex Interdependence Theory, developed by Keohane and Nye, provides a broader understanding of maritime chokepoints by emphasising economic interdependence and institutional cooperation. The theory argues that international relations increasingly operate through multiple channels of interaction in which trade, investment, technology, and international institutions become as influential as military power. Maritime chokepoints exemplify this interdependence because they facilitate commercial exchanges that support both strategic partners and geopolitical competitors.

The uninterrupted operation of major maritime corridors depends upon cooperation among coastal states, international organisations, shipping companies, energy producers, and trading economies. Disruptions affecting strategic waterways therefore produce consequences that extend beyond regional security by influencing international trade, energy markets, and global supply chains. Complex Interdependence Theory thus complements classical maritime strategy by demonstrating that the strategic importance of maritime chokepoints derives from both geopolitical competition and economic connectivity.

Nevertheless, the theory gives comparatively limited attention to the physical characteristics of maritime infrastructure and the operational capacity required to manage emerging security challenges. Consequently, additional theoretical perspectives are necessary to explain resilience within complex maritime systems.

2.3. Resilience Theory:

Resilience Theory provides the conceptual foundation for analysing how maritime chokepoints respond to disruption. Originally developed within ecology and later applied to disaster management, infrastructure studies, and organisational systems, resilience refers to the capacity of complex systems to anticipate, absorb, adapt to, and recover from adverse events while maintaining essential functions.

Applied to maritime transportation, resilience extends beyond the prevention of disruption. It encompasses the ability of governance institutions, commercial networks, energy transportation systems, and security organisations to maintain operational continuity during geopolitical crises, cyber incidents, environmental hazards, infrastructure failures, and other emerging risks. Recent studies of critical infrastructure emphasise that resilience depends upon adaptive governance, institutional learning, redundancy, and coordinated crisis management rather than physical protection alone.

This perspective is particularly relevant because contemporary maritime chokepoints operate as interconnected socio-technical systems in which economic, institutional, technological, and security dimensions interact continuously. Resilience Theory therefore provides the analytical bridge between traditional maritime strategy and contemporary governance approaches.

2.4. Theoretical Synthesis:

Each of the preceding theories explains an important dimension of maritime chokepoints, yet none independently provides a comprehensive explanation of their resilience. Classical maritime strategy establishes the enduring importance of geography and secure maritime communications. Complex Interdependence Theory explains how global trade, institutional cooperation, and economic integration influence the strategic significance of maritime corridors. Resilience Theory extends these perspectives by demonstrating that long-term effectiveness depends upon the capacity of interconnected systems to adapt and recover from disruption.

Building upon these complementary perspectives, this study develops the Maritime Chokepoint Resilience Framework (MCRF). The framework integrates strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity within a unified analytical model for evaluating the resilience of strategically important maritime chokepoints. By synthesising classical and contemporary theoretical traditions, the MCRF addresses the conceptual fragmentation identified in existing scholarship and provides the analytical foundation for the comparative assessment undertaken in this study.

3. Literature Review:

Research on maritime chokepoints has expanded significantly over the past three decades in response to growing concerns regarding global trade, energy security, maritime governance, and geopolitical competition. Although the literature spans several academic disciplines, it remains fragmented, with individual studies focusing on specific aspects of maritime systems rather than their interconnected nature. Existing scholarship can be broadly grouped into three research traditions: strategic and geopolitical studies, political economy and maritime governance, and resilience-oriented research.

3.1. Strategic and Geopolitical Perspectives:

Early scholarship on maritime chokepoints was strongly influenced by classical maritime strategy and geopolitics. Building upon the work of Mahan and Corbett, researchers emphasised that control of strategic waterways provides military advantage, safeguards maritime communications, and enhances national influence. Subsequent studies extended these ideas by examining the geopolitical significance of major chokepoints within the evolving international order, particularly in relation to the Indo-Pacific, the Persian Gulf, and the Mediterranean.

Contemporary strategic research highlights the growing importance of maritime chokepoints in great-power competition. Increasing naval modernisation, freedom of navigation operations, maritime territorial disputes, and strategic competition among major powers have reinforced the geopolitical value of these waterways. Scholars also recognise that strategic maritime corridors are increasingly linked to wider regional initiatives such as the Indo-Pacific strategy, the Belt and Road Initiative, and evolving maritime partnerships.

Despite these contributions, strategic studies remain predominantly state-centric and security-oriented. Most analyses explain why maritime chokepoints are strategically important but devote less attention to the economic, institutional, and governance factors that influence their long-term resilience.

3.2. Maritime Political Economy, Trade and Governance:

A second body of literature examines maritime chokepoints through the perspectives of international trade, energy transportation, and maritime governance. Reports published by the United Nations Conference on Trade and Development (UNCTAD) consistently demonstrate that maritime transport carries the overwhelming majority of global merchandise trade, making uninterrupted navigation essential for international commerce.[1] Similarly, the International Energy Agency (IEA), the Energy Institute, and the U.S. Energy Information Administration identify the Strait of Hormuz, Strait of Malacca, Bab el-Mandeb, and the Suez Canal as critical corridors for global oil and liquefied natural gas transportation.

Research in maritime economics further shows that disruptions affecting strategic waterways rapidly influence freight costs, shipping schedules, commodity prices, and global supply chains. The temporary closure of the Suez Canal following the *Ever Given* incident demonstrated how operational disruptions in a single maritime corridor can generate significant economic consequences across multiple regions.

Parallel research has examined the institutional dimension of maritime governance. The United Nations Convention on the Law of the Sea (UNCLOS) establishes the principal legal framework governing international navigation, while the International Maritime Organisation (IMO) develops standards relating to maritime safety, environmental protection, and vessel security. Regional cooperation mechanisms, coordinated maritime patrols, and information-sharing arrangements have also been recognised as important instruments for

strengthening navigational safety and reducing operational risks.

Nevertheless, studies of trade, energy, and governance frequently remain sector-specific. Economic analyses generally prioritise commercial efficiency, whereas governance research focuses on legal and institutional arrangements. Comparatively little attention has been devoted to understanding how these dimensions interact with strategic geography and maritime security to influence overall resilience.

3.3. Emerging Perspectives on Maritime Resilience:

Recent scholarship has increasingly adopted resilience as a framework for understanding maritime systems. Building upon resilience theory and critical infrastructure studies, researchers argue that maritime transportation networks should be assessed according to their capacity to anticipate, absorb, adapt to, and recover from disruption rather than solely by their ability to prevent risk.

This perspective has encouraged new research on supply-chain resilience, climate adaptation, cybersecurity, digital maritime infrastructure, and critical logistics networks. Advances in artificial intelligence, satellite navigation, autonomous shipping, and smart port technologies have further expanded the scope of maritime resilience research by introducing new opportunities alongside emerging operational vulnerabilities.

Although resilience has become an important concept within maritime studies, existing research remains fragmented. Infrastructure resilience, cybersecurity, environmental sustainability, governance, and maritime security are often examined independently, with limited attempts to integrate these perspectives into a comprehensive analytical framework applicable across multiple maritime chokepoints. Comparative studies capable of systematically evaluating resilience using common conceptual criteria remain particularly limited.

3.4. Critical Synthesis and Research Gap:

The literature consistently demonstrates that maritime chokepoints are indispensable for global trade, energy transportation, and international security. However, four significant limitations remain.

First, existing scholarship is disciplinarily fragmented, with strategic studies, maritime economics, governance research, and security studies developing largely independent explanations of maritime chokepoints.

Second, many studies adopt single-sector approaches, concentrating on trade, energy, governance, or security individually rather than examining their interaction within an integrated strategic system. Third, much of the literature remains event-driven, focusing on individual crises such as piracy in the Gulf of Aden, tensions in the Strait of Hormuz, the *Ever Given* blockage, or attacks on commercial shipping in the Red Sea without developing transferable comparative frameworks.

Finally, while resilience has emerged as an important analytical concept, relatively few studies operationalise resilience through a multidimensional framework that combines strategic geography, trade connectivity, energy security, governance, and maritime security within a single model applicable across multiple maritime chokepoints.

These limitations provide the rationale for the present study. To address this gap, the research develops the Maritime Chokepoint Resilience Framework (MCRF), which integrates five interrelated dimensions into a unified analytical model for comparative assessment. By applying this framework to six strategically significant maritime chokepoints, the study seeks to advance both maritime theory and evidence-based policy analysis.

4. Research Objectives:

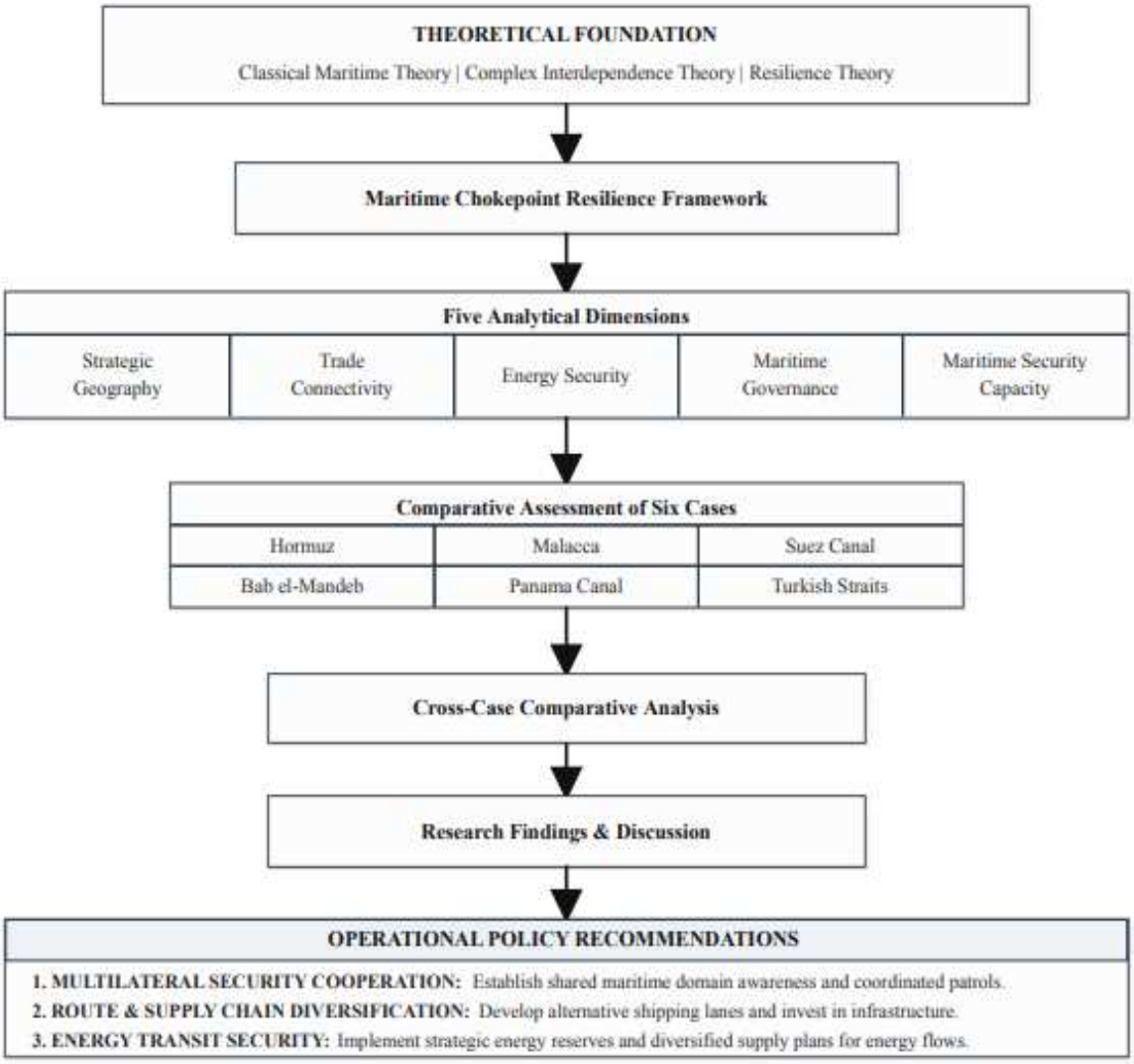
This study seeks to achieve the following objectives:

1. To examine the strategic importance of major maritime chokepoints in facilitating global trade, energy transportation, and international maritime connectivity.
2. To analyse how strategic geography, trade connectivity, energy security, maritime governance, and maritime security influence the resilience of major maritime chokepoints.
3. To develop the Maritime Chokepoint Resilience Framework (MCRF) as an integrated analytical model for evaluating the resilience of strategically significant maritime corridors.
4. To apply the MCRF in a comparative assessment of the Strait of Hormuz, Strait of Malacca, Suez Canal, Bab el-Mandeb, Panama Canal, and the Turkish Straits in order to identify common resilience determinants and context-specific vulnerabilities.
5. To derive policy implications for strengthening maritime governance, resilience, and the security of critical maritime infrastructure.

5. Methodology:

This study employs a qualitative comparative multiple-case study design to examine the strategic importance and resilience of major maritime chokepoints. A qualitative approach is appropriate because the research investigates complex interactions among geographical, economic, institutional, legal, and security factors that cannot be adequately explained through quantitative indicators alone. Multiple-case studies facilitate systematic comparison across diverse geopolitical settings while supporting analytical generalisation and theory development through cross-case analysis rather than statistical inference.

Fig 1. Operational Application of the MCRF



Source: Developed by the author.

5.1. Research Design:

The study follows an inductive comparative research design. Existing scholarship on maritime strategy, international trade, energy security, maritime governance, and resilience was critically synthesised to identify the principal determinants of maritime chokepoint resilience. These insights informed the development of the Maritime Chokepoint Resilience Framework (MCRF), which was subsequently applied to selected case studies. This iterative process of theoretical synthesis and empirical application is widely recognised as an appropriate approach for developing conceptual frameworks in qualitative research.

5.2. Case Selection:

Six maritime chokepoints were selected through purposive sampling based on five criteria: (i) strategic geographical significance; (ii) importance for international trade (iii) energy transportation; (iv) exposure to geopolitical or maritime security challenges; and (v) availability of reliable documentary evidence for comparative analysis.

The selected cases comprise the Strait of Hormuz, Strait of Malacca, Suez Canal, Bab el-Mandeb, Panama Canal, and the Turkish Straits. Collectively, these waterways represent different geographical regions, governance arrangements, commercial functions, and security environments while accounting for a substantial share of global maritime trade and strategic energy transportation. Their diversity enables systematic comparison across contrasting political and institutional contexts.

5.3. Data Sources:

The analysis relies exclusively on secondary data obtained from authoritative academic and institutional sources. These include peer-reviewed journal articles, scholarly books, reports published by international organisations, government publications, and maritime industry datasets. Major institutional sources include the United Nations Conference on Trade and Development (UNCTAD), International Maritime Organisation (IMO), International Energy Agency (IEA), Energy Institute, U.S. Energy Information Administration (EIA), and the World Bank. Using multiple documentary sources enhances the breadth and reliability of evidence while allowing cross-verification of information through data triangulation.

5.4. Analytical Framework:

The study applies the Maritime Chokepoint Resilience Framework (MCRF) as the principal analytical model. The framework evaluates each maritime chokepoint across five interrelated dimensions strategic geography, trade connectivity, energy security, maritime governance, maritime security capacity.

These dimensions were derived from the theoretical synthesis and literature review and provide a common basis for comparative analysis. Applying identical analytical criteria across all six case studies ensures conceptual consistency and facilitates systematic identification of common resilience determinants and context-specific vulnerabilities.

5.5. Data Analysis:

Documentary evidence was analysed using thematic analysis and cross-case comparison. Information relating to each maritime chokepoint was organised according to the five dimensions of the MCRF before being compared across the selected cases. The analysis focused on identifying recurring patterns, similarities, and differences in strategic importance, governance effectiveness, trade connectivity, energy dependence, and maritime security capacity.

Rather than measuring statistical relationships, the comparative approach sought to explain how interactions among these dimensions shape the resilience of maritime chokepoints. Cross-case synthesis enabled analytical generalisation by identifying mechanisms that operate across different geopolitical and institutional settings.

5.6. Rigour and Trustworthiness:

The credibility of the findings was strengthened through methodological triangulation, whereby evidence from academic literature, international organisations, government publications, and industry reports was systematically compared. Consistency was further enhanced by applying a common analytical framework across all six case studies, thereby reducing interpretative bias and improving comparability.

Although qualitative case studies do not aim for statistical generalisation, they provide analytical generalisation by generating theoretically informed explanations that may be transferable to similar strategic maritime environments.

5.7. Limitations:

The study relies exclusively on secondary data and is therefore constrained by the availability and quality of published information. Access to classified governmental or commercial datasets was beyond the scope of the research. Furthermore, geopolitical developments affecting maritime chokepoints continue to evolve, requiring periodic reassessment of empirical findings. Nevertheless, the proposed MCRF offers a flexible analytical framework that can be refined and validated through future quantitative and mixed-method research.

6. Maritime Chokepoint Resilience Framework (MCRF):

6.1. Rationale for Developing the Maritime Chokepoint Resilience Framework:

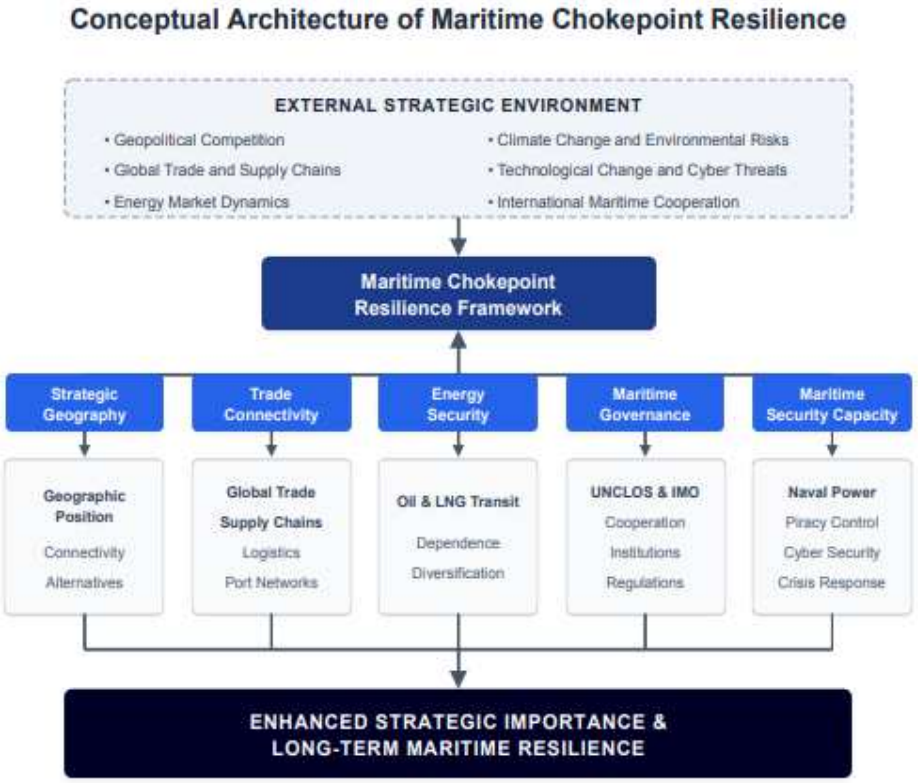
The preceding theoretical discussion and literature review demonstrate that existing scholarship explains maritime chokepoints through diverse disciplinary perspectives, including maritime strategy, international political economy, energy security, maritime governance, and security studies. These perspectives have significantly enhanced understanding of the strategic importance of maritime corridors but have largely developed

independently. Most studies focus on individual dimensions, such as naval strategy, commercial shipping, legal governance, or maritime security, without adequately explaining how these factors interact to determine the resilience of strategically important waterways.

This fragmentation limits both theoretical development and comparative policy analysis. Contemporary maritime chokepoints function as interconnected strategic systems in which geography, trade, energy transportation, governance, and security continuously influence one another. A disruption affecting any one dimension can rapidly generate cascading effects across global supply chains, energy markets, and regional security environments. Consequently, evaluating these dimensions independently provides only a partial understanding of maritime resilience.

To address this limitation, the present study develops the Maritime Chokepoint Resilience Framework (MCRF). The framework integrates five interrelated dimensions into a unified analytical model for evaluating the resilience of strategically important maritime chokepoints.

Fig 2. Conceptual Architecture of the Maritime Chokepoint Resilience Framework (MCRF)



Source: Developed by the author.

Rather than replacing existing theories, the MCRF synthesises their principal insights within a common comparative framework applicable across diverse geopolitical and institutional settings.

6.2. Conceptual Foundations:

The MCRF is grounded in three complementary theoretical traditions. Classical maritime strategy establishes the enduring importance of geography, sea power, and secure maritime communications in shaping international influence. Complex Interdependence Theory demonstrates that maritime chokepoints operate within highly interconnected networks of trade, energy transportation, and institutional cooperation. Resilience Theory extends these perspectives by emphasising the capacity of complex systems to anticipate, absorb, adapt to, and recover from disruption while maintaining essential functions.

Integrating these perspectives enables the MCRF to conceptualise maritime chokepoints as multidimensional strategic systems rather than isolated geographical passages. The framework assumes that resilience emerges through the interaction of physical location, commercial connectivity, institutional effectiveness, energy dependence, and maritime security. Consequently, no single dimension independently determines resilience; instead, each contributes to the overall performance of the maritime system.

6.3. Dimensions of the Maritime Chokepoint Resilience Framework:

The MCRF evaluates each maritime chokepoint using five interconnected analytical dimensions.

Strategic Geography examines the physical characteristics that determine strategic importance, including geographical location, connectivity between major oceans, navigational constraints, alternative routes, and proximity to global production and consumption centres.

Trade Connectivity evaluates the contribution of maritime chokepoints to international commerce by considering shipping density, cargo throughput, logistics efficiency, supply-chain integration, and commercial dependence on uninterrupted maritime transportation.

Energy Security assesses the role of maritime chokepoints in facilitating the movement of crude oil, petroleum products, liquefied natural gas, and other strategic commodities. This dimension considers the concentration of energy flows, dependence of importing and exporting states, and the availability of alternative transportation routes.

Maritime Governance analyses the institutional arrangements supporting maritime navigation, including implementation of the United Nations Convention on the Law of the Sea (UNCLOS), International Maritime Organisation (IMO) standards, regional cooperation mechanisms, information sharing, and administrative effectiveness.

Maritime Security Capacity evaluates the ability of maritime systems to prevent, respond to, and recover from conventional and non-conventional threats, including interstate conflict, piracy, maritime terrorism, cyberattacks, organised maritime crime, and attacks on critical maritime infrastructure.

Although presented separately for analytical clarity, these five dimensions operate as an integrated system. Improvements in governance strengthen maritime security, enhanced security supports commercial stability, resilient trade networks reinforce economic continuity, and strategic geography influences the effectiveness of every other dimension.

6.4. Operationalisation of the Framework:

To ensure analytical consistency, the MCRF applies identical evaluation criteria across all selected case studies. Each maritime chokepoint is examined through the five analytical dimensions using documentary evidence derived from academic literature, international organisations, government reports, and maritime industry sources. Table 1 summarises the operational indicators used in the comparative assessment.

Table 1. Operational Dimensions of the Maritime Chokepoint Resilience Framework (MCRF)

Dimension	Principal Indicators	Analytical Purpose
Strategic Geography	Location, connectivity, navigational constraints, alternative routes	Assess inherent strategic significance
Trade Connectivity	Cargo throughput, shipping density, logistics efficiency, supply-chain dependence	Evaluate commercial resilience
Energy Security	Oil and LNG flows, energy dependence, alternative transport options	Assess strategic energy importance
Maritime Governance	UNCLOS implementation, IMO standards, regional cooperation, institutional effectiveness	Evaluate governance capacity
Maritime Security Capacity	Naval presence, piracy, terrorism, cyber resilience, crisis response	Assess resilience to security threats

Source: Developed by the author.

6.5. Scholarly Contribution of the MCRF:

The Maritime Chokepoint Resilience Framework constitutes the principal conceptual contribution of this research. First, it integrates previously fragmented research traditions into a unified analytical model linking strategic geography, trade connectivity, energy security, maritime governance, and maritime security. Second, it operationalises maritime resilience through clearly defined analytical dimensions that permit systematic comparison across different geopolitical contexts. Third, it provides an evidence-based framework that bridges theoretical analysis and policy evaluation by identifying the institutional and strategic factors that enhance resilience in critical maritime corridors.

Accordingly, the MCRF extends existing maritime scholarship beyond sector-specific analyses and offers a transferable framework for comparative research, strategic assessment, and maritime policy formulation. The

following section applies the framework to six strategically important maritime chokepoints to evaluate its explanatory value and practical relevance.

7. Comparative Analysis of Major Maritime Chokepoints:

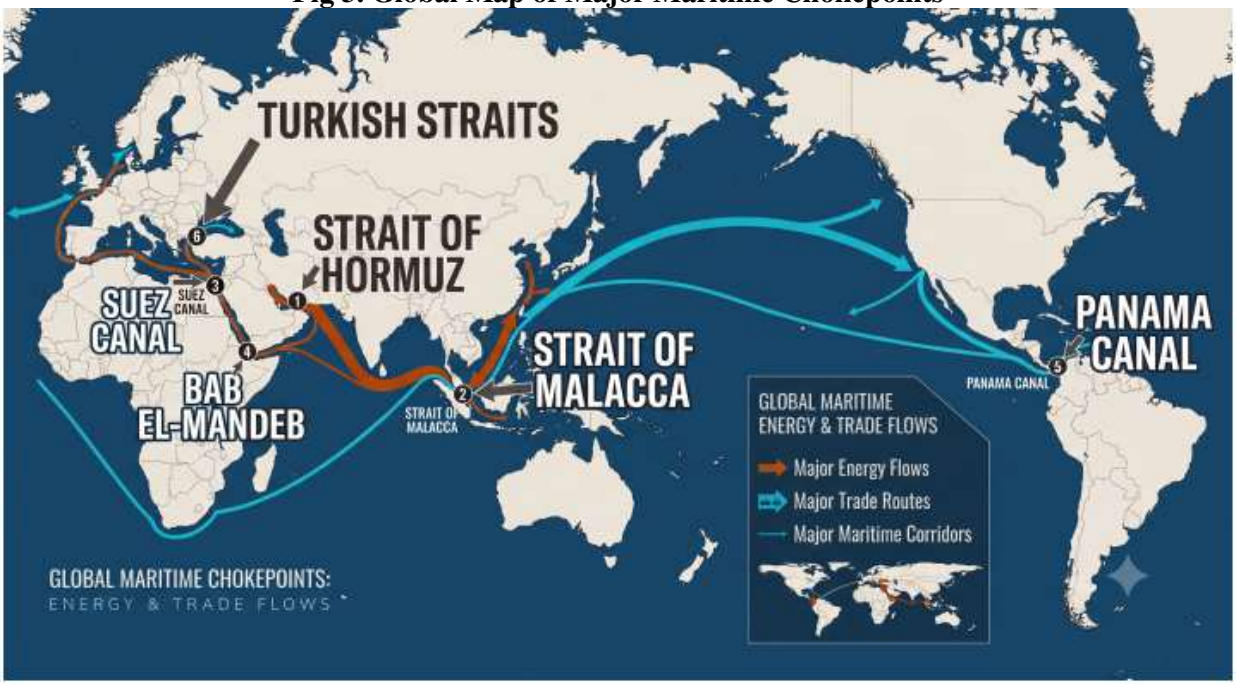
The Maritime Chokepoint Resilience Framework (MCRF) was applied to six strategically significant maritime chokepoints to examine how strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity interact to determine resilience. The selected waterways differ considerably in geographical location, institutional arrangements, commercial functions, and security environments. However, they collectively constitute the principal arteries of the global maritime system, supporting international trade, energy transportation, and strategic connectivity.

Rather than evaluating each chokepoint independently, the MCRF enables systematic comparison using common analytical dimensions. This approach highlights both shared resilience characteristics and context-specific vulnerabilities while providing a consistent basis for comparative interpretation.

7.1. Comparative Assessment of Strategic Geography:

Geographical location remains the primary determinant of the strategic importance of maritime chokepoints. Each of the six waterways occupies a position connecting major oceans, regional seas, or international trading routes. Nevertheless, the comparative analysis demonstrates that geographical advantage alone does not determine resilience.

Fig 3. Global Map of Major Maritime Chokepoints



Source: *Generated by the author using AI.*

The Strait of Hormuz occupies the world's most important maritime gateway for hydrocarbon exports, whereas the Strait of Malacca forms the principal maritime connection between the Indian and Pacific Oceans. The Suez Canal provides the shortest maritime route linking Europe and Asia, while the Panama Canal substantially reduces navigation distance between the Atlantic and Pacific Oceans. The Bab el-Mandeb serves as the southern gateway to the Red Sea, and the Turkish Straits provide the only maritime access between the Black Sea and the Mediterranean.

Although all six waterways possess exceptional strategic value, their resilience varies considerably. The Panama Canal benefits from comparatively stable governance despite increasing environmental constraints, whereas the Bab el-Mandeb experiences persistent security instability despite its favourable geographical position. The comparison demonstrates that geography establishes strategic importance, but resilience depends upon complementary institutional, commercial, and security capacities.

7.2. Comparative Assessment of Trade Connectivity:

The selected chokepoints differ significantly in their contribution to international trade. The Strait of Malacca and the Suez Canal support exceptionally high volumes of container shipping, manufactured goods, and

commercial traffic linking Asian production centres with European and global markets. The Panama Canal facilitates efficient inter-oceanic trade by reducing voyage distance and transportation costs, while the Turkish Straits primarily support regional commercial exchange within the Black Sea basin.

The comparative analysis indicates that highly integrated trade corridors also exhibit greater systemic vulnerability. Disruptions affecting the Suez Canal during the *Ever Given* incident demonstrated how delays at a single chokepoint can rapidly propagate throughout global logistics networks. Similar disruptions affecting the Strait of Malacca would generate even wider consequences because of its central role in East–West maritime trade. Consequently, trade connectivity simultaneously strengthens strategic importance and increases dependence on uninterrupted maritime operations.

7.3. Comparative Assessment of Energy Security:

The six case studies reveal substantial variation in the strategic importance of maritime chokepoints for global energy transportation. The Strait of Hormuz remains the world's most critical maritime energy corridor, carrying a significant proportion of internationally traded crude oil and liquefied natural gas. The Strait of Malacca functions as the principal maritime route supplying East Asian economies, while the Bab el-Mandeb and Suez Canal facilitate energy flows between the Middle East and European markets.

By comparison, the Panama Canal and the Turkish Straits perform more limited functions within global energy networks, although both remain regionally significant. This variation illustrates that the concentration of energy flows substantially increases geopolitical sensitivity. Chokepoints through which major hydrocarbon exports transit are more vulnerable to interstate conflict, coercive diplomacy, and market disruption. Energy resilience therefore depends not only on uninterrupted navigation but also on route diversification, strategic reserves, and effective regional cooperation.

7.4. Comparative Assessment of Maritime Governance:

Governance constitutes one of the principal differentiating factors among the selected chokepoints. The comparative evidence indicates that resilient maritime systems are characterised by effective institutional arrangements, regulatory consistency, and cooperative governance. International legal frameworks established through the United Nations Convention on the Law of the Sea (UNCLOS) and operational standards developed by the International Maritime Organisation (IMO) provide the normative foundation for maritime governance.

However, governance effectiveness varies considerably. The Panama Canal benefits from highly centralised administrative management, whereas the Strait of Malacca demonstrates the effectiveness of cooperative governance among littoral states through coordinated patrols and information-sharing mechanisms. Conversely, governance around the Bab el-Mandeb remains constrained by political instability and limited institutional capacity. These differences demonstrate that governance quality directly influences operational reliability, crisis response, and long-term resilience.

7.5. Comparative Assessment of Maritime Security Capacity:

Maritime security has become increasingly multidimensional across all six case studies. The Strait of Hormuz remains vulnerable to interstate confrontation and threats to energy infrastructure, while the Bab el-Mandeb experiences persistent risks arising from armed conflict, piracy, and attacks on commercial shipping. Although piracy has declined significantly in the Strait of Malacca through coordinated regional action, cybersecurity, illegal maritime activities, and hybrid threats continue to evolve.

Table 2. Comparative Characteristics of Major Maritime Chokepoints

Maritime Chokepoint	Strategic Geography	Trade Connectivity	Energy Security	Maritime Governance	Maritime Security Capacity	Overall Strategic Significance
Strait of Hormuz	Gateway between the Persian Gulf and the Arabian Sea	Moderate merchandise trade; critical tanker traffic	World's most important oil and LNG corridor	UNCLOS framework with complex regional politics	High naval presence; geopolitical tensions; asymmetric threats	Critical for global energy security
Strait of Malacca	Principal link between the Indian and	One of the world's busiest commercial	Major energy transit route for East Asia	Strong regional cooperation; coordinated	Improved piracy control; growing cyber	Critical for Indo-Pacific trade and

	Pacific Oceans	shipping routes		patrols	and congestion risks	connectivity
Suez Canal	Direct maritime link between Europe and Asia	Essential for Europe–Asia container and bulk trade	Important route for oil, LNG, and petroleum products	Centrally administered under Egyptian authority with international oversight	Vulnerable to operational disruptions and regional instability	Critical for Europe–Asia maritime commerce
Bab el-Mandeb	Connects the Red Sea with the Gulf of Aden	Essential for Red Sea shipping and access to the Suez Canal	Major transit route for Gulf energy exports	Governance constrained by regional instability	High exposure to piracy, armed conflict, and attacks on shipping	Critical but highly vulnerable
Panama Canal	Connects the Atlantic and Pacific Oceans	Vital for inter-oceanic commercial shipping	Limited importance for global oil transportation	Highly institutionalised canal management	Stable security environmen t; operational challenges from water availability	Critical for inter-oceanic trade
Turkish Straits	Connect the Black Sea with the Mediterranean	Regional commercial gateway	Important for Black Sea energy exports	Governed by the Montreux Convention and Turkish administration	Geopolitical sensitivity arising from Black Sea security	Critical for regional trade and strategic access

Source: Developed by the author using the Maritime Chokepoint Resilience Framewor (MCRF).

Note: The qualitative ratings (Very High, High, Moderate, Low) summarise the comparative interpretation presented in this study. They are intended as analytical classifications derived from the MCRF rather than quantitative measurements.

The Panama Canal and Turkish Straits experience comparatively lower levels of piracy but face operational challenges associated with geopolitical competition, infrastructure protection, and environmental change. These findings indicate that contemporary maritime security extends beyond naval power to include cyber resilience, intelligence sharing, maritime domain awareness, and coordinated institutional responses. Consequently, maritime resilience increasingly depends upon integrated security governance rather than military capability alone.

7.6. Comparative Synthesis:

Application of the Maritime Chokepoint Resilience Framework reveals four broad patterns. First, geography establishes the strategic importance of maritime chokepoints but does not independently determine resilience. Second, increasing trade and energy connectivity strengthen global economic integration while simultaneously increasing systemic vulnerability to disruption. Third, governance quality consistently enhances resilience by reducing operational uncertainty and strengthening institutional coordination. Finally, maritime security has evolved beyond conventional naval competition, requiring integrated approaches that combine legal, institutional, technological, and operational capabilities.

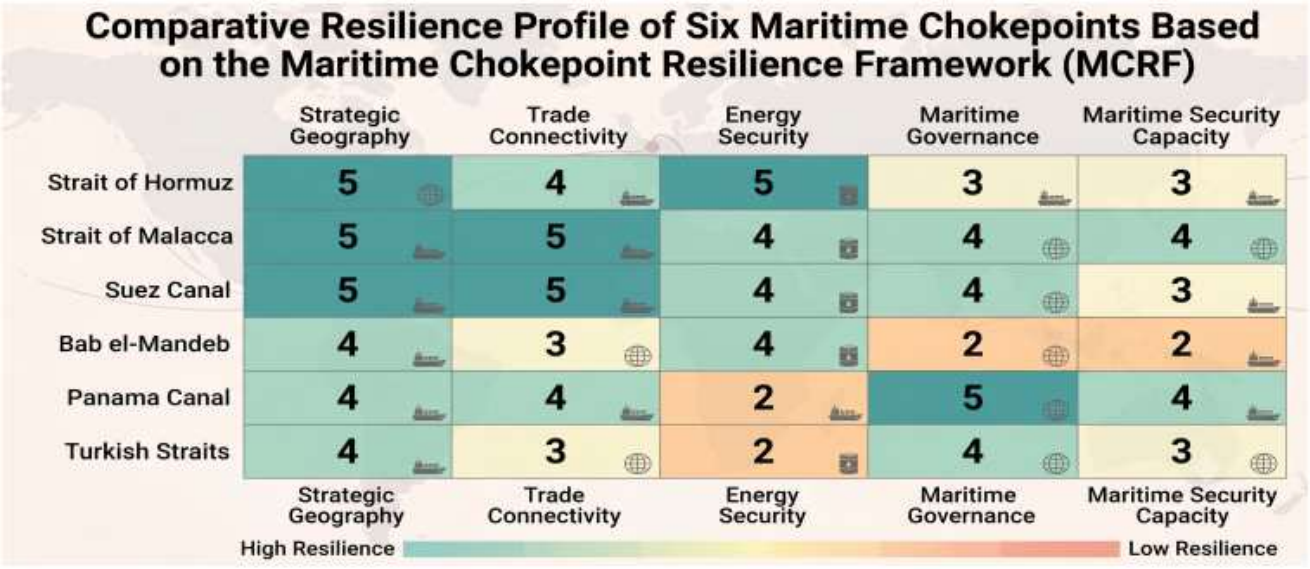
Table 3. Comparative Characteristics of Major Maritime Chokepoints

Maritime Chokepoint	Geographic Location	Connects	Primary Strategic Function	Principal Commodities	Key Security Challenges
Strait of Hormuz	Between Oman and Iran	Persian Gulf and Gulf of Oman (Arabian Sea)	Global energy transit corridor	Crude oil, LNG, petroleum products	Interstate tensions, military confrontation, threats to energy infrastructure
Strait of Malacca	Between Peninsular Malaysia	Indian Ocean and South China Sea	East–West trade and maritime	Container cargo, manufactured goods, petroleum,	Piracy, maritime congestion, cyber threats, navigational

	and Sumatra (Indonesia)		connectivity	LNG	safety
Suez Canal	Egypt	Mediterranean Sea and Red Sea	Europe–Asia maritime shortcut	Container cargo, oil, LNG, bulk commodities	Shipping disruptions, geopolitical instability, operational blockages
Bab el-Mandeb	Between Yemen, Djibouti and Eritrea	Red Sea and Gulf of Aden	Gateway to the Suez Canal	Oil, LNG, container cargo, dry bulk cargo	Armed conflict, piracy, attacks on commercial shipping, terrorism
Panama Canal	Panama	Atlantic Ocean and Pacific Ocean	Inter-oceanic commercial transit	Container cargo, grain, minerals, LNG	Water scarcity, climate variability, infrastructure capacity constraints
Turkish Straits (Bosporus and Dardanelles)	Türkiye	Black Sea and Mediterranean Sea	Regional trade and strategic naval access	Grain, petroleum products, dry bulk cargo, container traffic	Geopolitical tensions, navigational congestion, environmental risks

Source: Compiled by the author using UNCTAD, International Energy Agency (IEA), U.S. Energy Information Administration (EIA), International Maritime Organisation (IMO), and relevant peer-reviewed literature Collectively, these findings demonstrate that resilient maritime chokepoints are characterised not by a single strategic advantage but by balanced performance across all five dimensions of the MCRF. The comparative analysis therefore supports the central proposition of this study: maritime resilience is an emergent property arising from the interaction of geography, trade connectivity, energy security, governance, and maritime security.

Fig. 4 Comparative Resilience Profile Based on the MCRF



Source: Developed by the author.

The figure 4 presents a qualitative comparative assessment of six strategically significant maritime chokepoints across the five analytical dimensions of the Maritime Chokepoint Resilience Framework. Scores range from 1 (very low relative resilience) to 5 (very high relative resilience) and facilitate structured cross-case comparison. The scores represent qualitative comparative assessments derived from documentary analysis rather than quantitative statistical measurements.

The comparative assessment demonstrates that resilience is uneven across the six chokepoints. While the Strait of Malacca and the Suez Canal perform consistently across most dimensions, the Strait of Hormuz remains constrained by geopolitical tensions despite its strategic importance. Bab el-Mandeb exhibits the greatest governance and security vulnerabilities, whereas the Panama Canal derives resilience primarily from institutional capacity rather than energy significance. These comparative patterns provide the empirical basis for the findings discussed in the next section.

8. Findings:

Application of the Maritime Chokepoint Resilience Framework (MCRF) to six strategically important maritime chokepoints reveals that maritime resilience is determined by the interaction of strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity rather than by any single factor. The comparative analysis identifies five principal findings.

8.1. Strategic Geography Provides the Foundation but Not the Determinant of Resilience:

The analysis confirms that strategic geography remains the primary factor determining the global importance of maritime chokepoints. The Strait of Hormuz, Strait of Malacca, Suez Canal, Bab el- Mandeb, Panama Canal, and Turkish Straits all occupy locations that connect major oceans, regional seas, or global trading regions. However, geographical advantage alone does not ensure resilience. Chokepoints characterised by favourable locations but constrained governance or persistent security challenges demonstrate greater operational vulnerability than those supported by effective institutions and coordinated maritime management. Geography therefore establishes strategic significance, whereas resilience depends upon the interaction of multiple complementary dimensions.

8.2. Trade Connectivity and Energy Security Increase Both Strategic Value and Systemic Risk:

The findings indicate that maritime chokepoints supporting intensive commercial activity and major energy flows possess greater strategic importance but also experience higher exposure to disruption. The Strait of Malacca and the Suez Canal constitute critical commercial corridors linking Asian and European markets, while the Strait of Hormuz remains indispensable for global oil and liquefied natural gas transportation. The comparative analysis demonstrates that increasing economic interdependence amplifies the global consequences of local disruptions, making uninterrupted maritime connectivity essential for international trade, supply-chain stability, and energy security.

8.3. Governance Capacity Enhances Maritime Resilience:

Governance emerged as one of the strongest determinants of resilience across the six case studies. Chokepoints characterised by effective institutional coordination, implementation of international legal frameworks, and regional cooperation demonstrate greater operational stability than those affected by institutional fragmentation or political instability. The findings indicate that governance not only facilitates safe navigation but also improves crisis response, strengthens regulatory consistency, and enhances confidence among maritime stakeholders. Consequently, institutional effectiveness significantly contributes to the long-term resilience of strategically important maritime corridors.

8.4. Maritime Security Has Become Increasingly Multidimensional:

The comparative assessment demonstrates that maritime security extends beyond conventional naval competition. In addition to interstate rivalry, maritime chokepoints face evolving challenges arising from piracy, maritime terrorism, cyber threats, organised maritime crime, attacks on commercial shipping, and vulnerabilities affecting critical maritime infrastructure. The findings show that resilient maritime systems increasingly depend upon integrated security arrangements involving governments, naval forces, coast guards, international organisations, and commercial maritime operators. Security capacity therefore represents a multidimensional component of maritime resilience rather than a purely military function.

8.5. Validation of the Maritime Chokepoint Resilience Framework:

Application of the MCRF across six geographically and institutionally diverse maritime chokepoints demonstrates its analytical effectiveness. The framework consistently explains how strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity interact to influence resilience across different geopolitical contexts. Rather than treating maritime chokepoints as isolated geographical passages, the MCRF conceptualises them as interconnected strategic systems whose resilience depends upon balanced performance across multiple dimensions. The comparative findings therefore support the validity of the framework as a transferable model for analysing strategically important maritime corridors and informing evidence- based maritime policy.

9. Discussion:

The findings demonstrate that the strategic importance of maritime chokepoints can no longer be understood solely through the traditional lens of geography or sea power. While classical maritime theorists correctly recognised the enduring significance of strategic location and maritime communications, the comparative analysis indicates that resilience

depends equally on governance capacity, economic connectivity, institutional cooperation, and multidimensional security. This supports the continuing relevance of classical maritime strategy while extending its explanatory scope to contemporary maritime systems characterised by global economic interdependence and complex security challenges.

The study also reinforces the growing body of research that views maritime chokepoints as critical components of interconnected global supply chains rather than isolated geographical passages. Previous studies have largely examined trade, energy transportation, governance, and maritime security as separate fields of inquiry. The comparative evidence presented here suggests that these dimensions are mutually reinforcing. Disruptions to commercial shipping frequently generate energy insecurity, governance challenges influence operational reliability, and security threats directly affect trade efficiency. Maritime resilience therefore emerges from the interaction of these interconnected systems rather than from any individual strategic characteristic.

An important contribution of this research is the demonstration that governance plays a central role in determining maritime resilience. The comparative analysis shows that waterways characterised by effective institutional coordination, regulatory consistency, and regional cooperation generally exhibit greater operational stability than those affected by fragmented governance or prolonged political instability. This finding complements previous governance research while broadening its implications by demonstrating that institutional effectiveness contributes not only to navigational safety but also to economic continuity, crisis response, and long-term resilience.

The study further illustrates the evolving nature of maritime security. Conventional concerns relating to interstate conflict remain important, particularly in strategically sensitive regions such as the Strait of Hormuz and the Bab el-Mandeb. However, the comparative assessment indicates that maritime resilience increasingly depends on the ability to address non-traditional threats, including piracy, cyberattacks, organised maritime crime, attacks on commercial shipping, and vulnerabilities affecting critical maritime infrastructure. This broader understanding aligns with recent scholarship advocating integrated maritime security approaches that combine military preparedness with institutional cooperation, technological innovation, intelligence sharing, and civilian maritime management.

The principal theoretical contribution of this study is the development of the Maritime Chokepoint Resilience Framework (MCRF). Existing literature provides valuable explanations of maritime chokepoints from strategic, economic, legal, and security perspectives, yet relatively few studies integrate these dimensions within a single analytical model. By combining strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity, the MCRF offers a multidimensional framework for evaluating resilience across different geopolitical and institutional contexts. The comparative application of the framework demonstrates that it provides a coherent basis for analysing similarities and differences among strategically important maritime corridors while addressing the conceptual fragmentation identified in previous scholarship.

The MCRF also contributes methodologically by providing a consistent structure for comparative maritime analysis. Applying identical analytical dimensions across six major maritime chokepoints improves transparency, strengthens analytical consistency, and facilitates systematic cross-case comparison. The framework is sufficiently flexible to be applied to other strategically significant waterways and may also support future quantitative or mixed-method studies that incorporate measurable resilience indicators. Consequently, the MCRF represents not only a conceptual contribution but also a transferable analytical tool for maritime research.

From a policy perspective, the findings underscore the need for integrated approaches to maritime governance. Investments in naval capability alone are insufficient to ensure resilient maritime systems. Long-term resilience requires coordinated governance, secure digital infrastructure, effective regional cooperation, reliable legal frameworks, diversified supply chains, and adaptive institutional capacity. Governments and international organisations should therefore adopt multidimensional assessment models when evaluating strategic waterways and developing maritime policies. The MCRF provides such an approach by linking strategic, economic, institutional, and security considerations within a single analytical framework capable of supporting evidence-based decision-making.

The study advances maritime scholarship by demonstrating that resilience is an emergent property of interconnected maritime systems rather than a

function of geography alone. By integrating previously fragmented research traditions and validating the Maritime Chokepoint Resilience Framework through comparative analysis, the study offers a comprehensive perspective for understanding the strategic importance and resilience of major maritime chokepoints in the twenty- first century.

10. Significance:

This study makes important contributions to maritime scholarship, comparative policy research, and maritime governance. First, it advances the theoretical understanding of maritime chokepoints by moving beyond single-sector explanations centred on geography, naval power, trade, or energy security. By integrating these perspectives within the Maritime Chokepoint Resilience Framework (MCRF), the study provides a multidimensional approach for explaining how strategic geography, trade connectivity, energy security, maritime governance, and maritime security collectively determine the resilience of strategically important waterways.

Second, the study contributes methodologically by developing a structured comparative framework applicable across multiple maritime chokepoints. Existing research has predominantly examined individual waterways or specific dimensions of maritime systems. In contrast, the MCRF applies a common analytical structure to six strategically significant chokepoints, enabling systematic comparison and improving conceptual consistency. The framework also provides a foundation for future quantitative, mixed-method, and longitudinal research on maritime resilience.

Third, the study has practical significance for governments, international organisations, maritime authorities, and commercial stakeholders responsible for safeguarding critical maritime infrastructure. As geopolitical competition, supply-chain disruptions, cyber threats, climate change, and energy insecurity increasingly affect maritime transportation, integrated policy responses have become essential. The MCRF offers a practical analytical tool for identifying vulnerabilities, assessing resilience, strengthening institutional coordination, and supporting evidence-based maritime policy.

By bridging theory, comparative analysis, and policy practice, the study contributes to the growing literature on maritime resilience and offers a comprehensive framework for understanding the strategic importance of maritime chokepoints in the twenty-first century.

11. Conclusion:

Maritime chokepoints remain indispensable to the functioning of the contemporary international system by supporting global trade, energy transportation, and maritime connectivity. As geopolitical competition, supply-chain disruptions, technological transformation, and environmental challenges intensify, ensuring the resilience of these strategic waterways has become an increasingly important concern for both scholars and policymakers. This study examined the resilience of six major maritime chokepoints, the Strait of Hormuz, Strait of Malacca, Suez Canal, Bab el-Mandeb, Panama Canal, and Turkish Straits, through a comparative analytical approach that integrates strategic, economic, institutional, and security dimensions.

The study demonstrates that the resilience of maritime chokepoints cannot be explained solely by geographical location or military significance. Instead, resilience emerges through the interaction of strategic geography, trade connectivity, energy security, maritime governance, and maritime security capacity. The comparative analysis shows that waterways characterised by effective governance, diversified commercial connectivity, institutional cooperation, and adaptive security arrangements are better positioned to withstand and recover from geopolitical tensions, operational disruptions, and evolving non-traditional threats. These findings reinforce the argument that maritime resilience is a multidimensional and dynamic characteristic of interconnected maritime systems rather than a static consequence of physical geography.

The principal contribution of this research is the development of the Maritime Chokepoint Resilience Framework (MCRF). Unlike existing approaches that examine maritime chokepoints from individual strategic, economic, legal, or security perspectives, the MCRF integrates these dimensions within a unified analytical framework. By applying the framework consistently across six strategically significant maritime corridors, the study demonstrates its usefulness for comparative analysis while addressing the conceptual fragmentation identified in previous scholarship. The framework therefore contributes both to maritime theory and to the development of a structured methodology for analysing the resilience of critical maritime infrastructure.

The study also has practical relevance for maritime governance and policy. Governments, international organisations, and maritime authorities

require analytical tools capable of assessing vulnerabilities across interconnected strategic systems rather than through isolated sectoral approaches. The MCRF provides a structured basis for evaluating resilience, strengthening institutional coordination, improving maritime governance, and supporting evidence-based policy decisions. Its integrated perspective is particularly relevant for addressing emerging challenges associated with cyber threats, supply-chain disruptions, climate-related risks, and evolving geopolitical competition.

This research is subject to certain limitations. It relies primarily on qualitative comparative analysis and secondary documentary sources, while geopolitical conditions affecting maritime chokepoints continue to evolve. Future research may strengthen and extend the framework through quantitative resilience indicators, longitudinal assessments, network analysis, and additional comparative case studies involving other strategically significant maritime corridors. Such research would further refine the empirical application of the MCRF and broaden its usefulness for both scholarship and policy practice.

In conclusion, the study demonstrates that resilient maritime chokepoints are created not by geography alone but by the effective integration of governance, commerce, energy security, and maritime security within adaptive institutional systems. By introducing the Maritime Chokepoint Resilience Framework, this research provides a coherent conceptual and analytical foundation for understanding, comparing, and strengthening the resilience of strategically important maritime corridors in the twenty-first century.

12. Limitations of the Study:

This study has certain limitations that should be considered when interpreting its findings. First, the analysis is based on qualitative comparative case studies and secondary documentary sources. Although these sources provide reliable evidence from academic literature, international organisations, and government publications, they do not include primary data obtained through interviews, field observations, or stakeholder surveys. Second, the study examines six strategically significant maritime chokepoints that collectively represent major global trade and energy corridors. While these cases provide broad comparative insights, the findings may not fully capture the characteristics of smaller regional waterways or emerging Arctic maritime routes. Third, the dynamic nature of geopolitical competition, technological innovation, climate change, and maritime security means that the strategic environment surrounding maritime chokepoints continues to evolve.

13. Future Research:

The Maritime Chokepoint Resilience Framework (MCRF) provides a foundation for further theoretical refinement and empirical investigation. Future studies should develop quantitative resilience indicators to operationalise the five dimensions of the framework and examine their relative influence on maritime resilience across different geopolitical contexts. Longitudinal analyses could evaluate how resilience evolves in response to geopolitical crises, technological innovation, climate change, and shifts in global trade and energy networks.

Comparative research should expand the framework beyond the six maritime chokepoints examined in this study to include emerging strategic corridors such as the Arctic Northern Sea Route, the Mozambique Channel, the Lombok and Sunda Straits, and other regionally significant waterways. Such studies would test the transferability and robustness of the MCRF across diverse geographical and institutional settings.

Table 4. Research Contribution Matrix

Existing Literature	Limitation	Contribution of this Study
Maritime Strategy	Focus on sea power	Integrates strategy with governance and resilience
Energy Security	Focus on hydrocarbon transit	Links energy to resilience
Maritime Governance	Institutional emphasis	Integrates governance with strategic analysis
Maritime Security	Threat-oriented	Multidimensional resilience perspective
Comparative Studies	Individual case focus	Common framework across six chokepoints

Future research may also integrate Geographic Information Systems (GIS), maritime network analysis, artificial intelligence, and big-data analytics to develop dynamic resilience assessment models. Combining qualitative analysis with quantitative methods, stakeholder surveys, and expert interviews would further strengthen empirical validation of the framework. These developments would enhance the MCRF as a practical analytical tool for maritime governance, infrastructure

planning, and international security policy while contributing to the broader literature on maritime resilience and strategic studies.

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