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GEOPOLITICAL RISKS IN MARITIME SHIPPING: CHALLENGES AND STRATEGIC ADAPTATIONS FOR PRIMARY CHOKEPOINTS

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Abstract
Sea lanes account for more than three quarters of the global maritime trade routes in volume. These maritime trade routes, which are the critical arteries of global trade and commerce, face significant disruptions due to geopolitical tensions. The increasing geopolitical tension threatens the stability and efficiency of these shipping routes, ultimately leading to considerable disruptions in the global supply chain. The primary aim of this article is to discuss the challenges stemming from the current geopolitical risks, including trends of disruptions, showing their dependency and a risk mapping analysis of the chokepoints. It also explores the strategies adopted by nations, businesses and international organizations to attenuate these challenges and address potential future challenges. This paper recommends more effort on the diplomatic front and developing supplementary trade routes apart from alternative trade routes. IMO should work towards liaising closely with all key stakeholders in the conflict-stricken maritime routes to enable the safe and secure transit of seafarers and shipping. A comprehensive understanding of the implications of geopolitical tensions enables policymakers, businesses and international organizations to anticipate risks and devise strategies to ensure the continuity of global trade.

Keywords: Geopolitical tensions, maritime shipping, trade routes, chokepoints, resilience strategies

1. Introduction

Maritime shipping provides both economic and political leverage to countries involved in trade. Authoritative command over the sea is necessary to construct a narrative of power projection, as this maritime dominance is often considered a strategic asset (Clark et al., 2004). Efficient seaways are vital to the global economy as they enable the transportation of large amounts of goods, fuel and essential commodities between major markets. Maritime trade routes account for approximately 80% of global trade in volume (UNCTAD, 2024). Ensuring a continuous flow of goods along the trade routes is crucial in maintaining the continuity of the supply chain (Jensen, 2023). After the emergence of The New International Economic Order (NIEO), maritime trade became a critical influence on global economic growth and stability (Zaragoza, 2016). Studies have emphasized that the freedom to securely navigate along the Sea Lines of Communication (SLOCs) is crucial to maintaining global maritime trade efficiency and geopolitical stability (James & Dell, 2011). Maritime routes have strategic locations that act as chokepoints through which shipments must pass. The economic value of marine resources, coupled with the strategic importance of these maritime routes and the ambition to explore, exploit, conserve and manage the natural resources in the Exclusive Economic Zone (EEZ), make the shipping routes particularly sensitive to geopolitical tensions, economic sanctions, territorial disputes, and trade wars. These have a significant impact on the safety and efficiency of vessel transit (Garay, 2021). The rising geopolitical tensions make maritime trade less resilient to disruptions, adversely affecting its efficiency (Fu, 2024). These supply chain disruptions threaten the existing trade patterns and consequently increase operational risks, necessitating the development of improved resilience strategies by maritime stakeholders (Bosone & Stamato, 2023). The literature works on

'geopolitical tensions and maritime trade' substantiate a wave of unprecedented changes including geopolitical tensions, stringent regulations, technological advancements, and initiatives aimed at reducing carbon footprints. Piracy, terrorism, military tensions, regional conflicts, blockages at critical maritime chokepoints, and sanctions adversely impact the economy, such as elevating shipping costs, increasing insurance premiums and causing fluctuations in fuel prices, in addition to the operational challenges including route planning, schedule reliability, vessel size limitations and weather dependencies. The strategic recommendations to enhance maritime resilience, as referenced from the literature, include technological adaptations such as investing in advanced risk monitoring systems and evaluating operational efficiency. Furthermore, formulating a collective security framework, ensuring comprehensive insurance coverage, and identifying alternative trade routes are essential to mitigate risks (Cosar & Thomas, 2021). Studies on maritime trade route disruptions have shown that one of the busiest maritime trade routes, stretching from Aleutian Island to the Persian Gulf along the Asian continent has faced numerous territorial disputes, pirate attacks and terrorist threats (Cole, 2013). The South China Sea, a critical maritime route, pivotal for transporting a third of liquid natural gas, is marred by geopolitical tensions including territorial disputes and aggressive Chinese militarization. This will likely lead to the formation of a multi-polar world which makes the global landscape more volatile and increasingly unpredictable (Pache, 2024). Consequently, a 1% increase in geopolitical distance will lead to a 10% decrease in bilateral trade flows, provided other factors remain constant (Bosone & Stamato, 2023). Russia and Ukraine have dominated the energy and global grain exports, with the Black Sea serving as their strategic maritime hub. The war which broke out in 2022, having its roots way back in 2014, has significantly affected the energy markets, food security and logistics, across the globe. As a result, there has been a shift in maritime dynamics, suggesting that the maritime network has become more resilient in terms of its structure and ability to handle disruptions (Cong & Wang, 2024). Thus, the conflicts impacting the global maritime trade routes have unveiled a phenomenon whereby, when a particular area is under threat due to conflicts and experiences a significant decrease in shipping activities, the maritime network will adapt, redirecting through alternative routes around another region, resulting in overall growth. The disruptions in shipping activities caused due to the Russia-Ukraine war and the Suez Canal blockage of March 2021 have underscored the importance of securing the maritime trade routes. The repercussions of a disruption at a chokepoint may exist even after the blockage has been resolved (Pratson, 2023). To build on this perspective, firstly, this study focuses on understanding the major trade routes binding the maritime supply chain. Secondly, it details the current status of the major maritime choke points. Thirdly, it seeks to demonstrate the resilience strategies adopted by maritime stakeholders to mitigate trade disruptions and maintain supply chain continuity.

2. Literature Review

2.1 Overview of Maritime Chokepoints: A Point of Contention

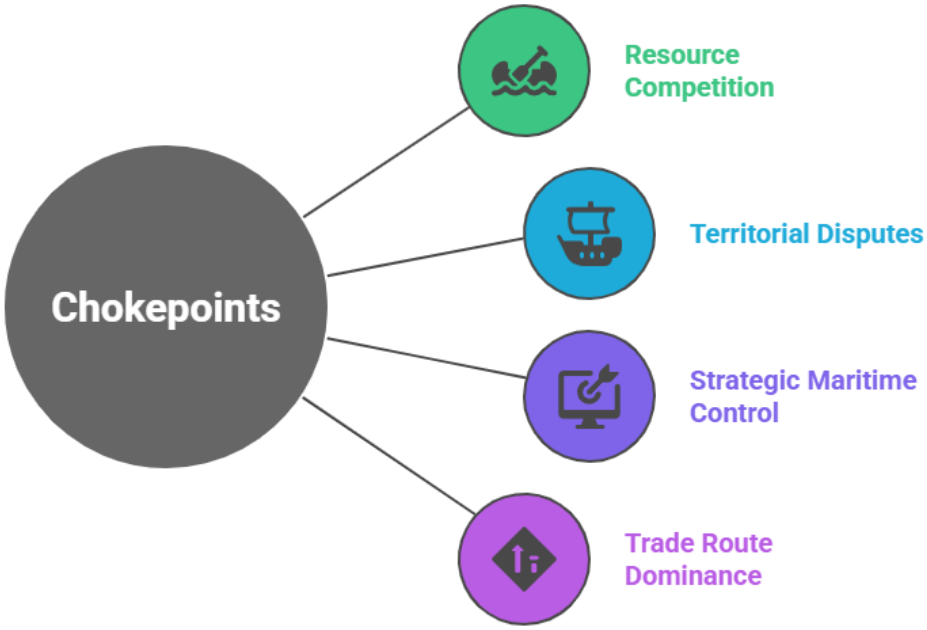


Figure 1: Factors influencing a chokepoint

Maritime chokepoints/flashpoints are troubled waters often plagued by geopolitical tensions such as border conflicts, resource claims, and strategic military ambitions. These disputes can be attributed to multiple states claiming sovereignty over the same maritime area, often based on historical precedence like China's Nine Dash Line claim in the South China Sea, customary usage and international legal frameworks like the United Nations Convention on the Law of the Sea (UNCLOS) (Gao & Jia, 2013). The narrow waterways like the Strait of Hormuz, Malacca Strait and Bab-el-Mandeb are vital for oil exports and global trade, making them vulnerable to geopolitical instability and other potential disruptions like climatic changes, accidents, naval blockages etc. These locations have become potential conflict zones due to the presence of valuable natural resources such as hydrocarbons, natural gas reserves and fish stocks. An ambitious drive by both regional and global players to control these resources gives rise to economic and strategic conflicts (Alexander & Morgan, 1988). Several key areas with heavily disputed maritime claims, such as the South China Sea, the Arctic and the Eastern Mediterranean, lack clear jurisdiction and have differing legal interpretations under international law. These uncertainties lead to long diplomatic standoffs and, in some cases, regional militarization. The importance of these marine chokepoints extends beyond regional conflicts; active territorial disputes considerably influence states' competition for extensive maritime control, driven by the pursuit of tangible economic benefits. The South China Sea contains overlapping maritime zones where China, Vietnam, the Philippines, Malaysia and Brunei assert sovereign claims, frequently resulting in naval disputes and diplomatic confrontations (Lavengood, 2024). Resource competition plays a pivotal role in shaping maritime conflicts, particularly concerning offshore oil and gas reserves and exclusive fishing rights. The Arctic region has emerged as a prominent chokepoint in this context, as climate-induced ice melt reveals untapped hydrocarbon reserves, prompting intensified territorial assertions by Russia, the United States, Canada, and other Arctic

Council members. Similarly, strategic maritime control remains an essential consideration, as states seek to regulate access to vital sea lanes, project naval power, and establish geopolitical influence (Lavengood, 2024). For instance, the Strait of Malacca is a critical passage for East Asian economies, where any potential blockade or military escalation could disrupt global supply chains. Furthermore, the imperative of trade route dominance exacerbates tensions, particularly in regions where major powers compete for maritime influence. The Indo-Pacific, for example, has become a focal point of strategic competition between China and the United States, given its role as a conduit for over 60% of global maritime trade (NATO, 2022). Lastly, military strategic positioning contributes to the securitization of marine chokepoints, with states deploying naval assets, conducting joint military exercises, and establishing forward-operating bases in contested waters. The increasing militarization of the South China Sea - where China has constructed artificial islands equipped with military infrastructure - underscores the intersection of geopolitical rivalry and maritime security.

2.2 Primary Marine Chokepoints:

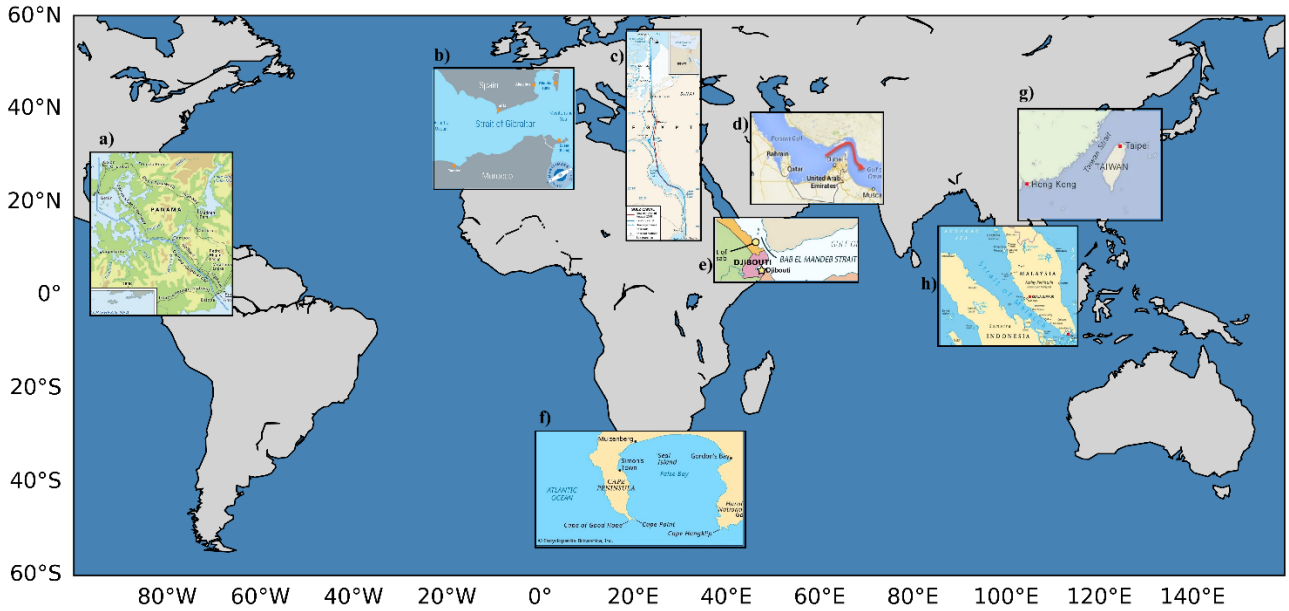


Figure 2: Primary Marine Chokepoints – a) Panama Canal, b) Strait of Gibraltar, c)Turkish Strait and Suez Canal, d) Strait of Hormuz, e) Bab-el-Mandeb (Red Sea), f) Cape of Good Hope, g) Taiwan Strait and h) Strait of Malacca

The primary marine chokepoints are the most important aspect of the maritime trade route network due to their strategic locations making them critical for maintaining supply chain efficiency. They offer a limited cost-effective alternative shipping lane in case of a geopolitical risk. Whereas, secondary chokepoints offer economically viable alternatives that can help mitigate disruptions, albeit with longer transit times and large detours. The following is a detailed analysis of each of the primary marine chokepoints affecting global trade, which are indicated in Figure 2.

a) Panama Canal: The Panama Canal, one of the artificial waterways that connect the Atlantic and Pacific Oceans. However, climate change poses new challenges as decreased rainfall in the region lowers water levels necessary for canal operations, potentially forcing ships to carry lighter loads or seek alternative routes. This situation offers a glimpse of how climate change might reshape maritime chokepoints in the future. It is a vital maritime chokepoint

for global trade, particularly for U.S.-China commerce and Latin American exports. As China expands its influence in Latin America through infrastructure investments, raising concerns over potential strategic control, Panama's political stability and governance of the canal remain critical to ensuring uninterrupted operations.

b) Strait of Gibraltar: The Strait of Gibraltar is a primary maritime chokepoint which connects the Mediterranean Sea to the Atlantic Ocean. Serving as the key trade route between Europe, Africa, and the Middle East, it is one of the major corridors for oil, gas, and container shipping (Dittmer, 2021). However, factors like vessel congestion, the complexity of tides, strong currents, and geopolitical tensions, particularly involving Spain, the UK (Gibraltar), and Morocco remain significant challenges. Further, smuggling, illegal migration, and naval military activity pose security risks which hinder the smooth functioning of the supply chain.

c) Turkish Strait: The Turkish Straits, comprising the Bosphorus and Dardanelles, represent a critical maritime chokepoint that connects the Black Sea and the Mediterranean Sea. This passage serves as the sole maritime conduit for Russia, Ukraine, and other nations bordering the Black Sea to trade with global markets, particularly regarding the export of oil, natural gas, and agricultural products. As Black Sea trade expands and energy exports from the Caspian region increase; whoever controls the strait could dictate the entry and exit of naval forces to traverse the Black Sea, thus making it an important component of military strategy. However, their operations have to navigate heavy congestion, complex navigation due to strong currents and narrow passages, and geopolitical tensions, especially amidst the Russia-Ukraine conflict. The strait is under the purview of Turkey, by the Montreux Convention (1936), an international treaty that imposes restrictions on military vessels during wartime and regulates maritime traffic, adding a layer of complexity to their management.

Suez Canal: The Suez Canal is a vital maritime chokepoint that revolutionized maritime trade by connecting the Mediterranean Sea to the Red Sea, serving as the shortest sea route linking Europe and Asia saving a 9000km voyage around Africa's Cape of Good Hope. London and Mumbai are the two base points. It handles around 12% of global trade, including significant volumes of oil, LNG, and containerized goods (Guo et al., 2022). It faces significant geopolitical challenges due to its location in Egypt, a region prone to political instability. Tensions in the Sinai Peninsula, where militant groups operate, pose security risks to shipping. Additionally, Egypt's control over the canal and its toll pricing policies have led to trade disputes with major shipping nations. The threat of blockages as seen in the Ever Given incident (2021) is prominent and has caused global supply chain disruptions costing billions of dollars daily (Wan et al., 2023). Additionally, climate change-induced water scarcity may impact the canal's role as a global shipping lifeline. Global conflicts, such as Russia-Ukraine tensions also impact the canal traffic, affecting energy and grain shipments.

d) Strait of Hormuz: The Strait of Hormuz, spanning 21 nautical miles at its narrowest point, connects the Persian Gulf to the Arabian Sea, and is the world's most critical maritime chokepoint. Approximately 20% of global oil production passes through this strait, making it highly influential on global oil prices in the event of any disruption. However, the Strait faces severe geopolitical challenges**,** primarily stemming from the tensions between Iran

andWestern nations, as well as regional rivalries involving Saudi Arabia, the UAE, and the U.S.

e) ***Bab el Mandeb:*** The Bab el-Mandeb Strait, which serves as a critical maritime conduit linking the Red Sea with the Gulf of Aden, represents a vital chokepoint for oil and container shipments traversing the routes between Europe, the Middle East, and Asia. Vessels passing through the Suez Canal must also navigate this strait. Nevertheless, it encounters substantial geopolitical challenges, notably the protracted conflicts in Yemen, wherein Houthi insurgents have directed their attacks towards commercial maritime vessels. Furthermore, the tensions among Saudi Arabia, Iran, and other regional actors exacerbate security vulnerabilities, while the menace of piracy near the Somali coast continues to pose a persistent hazard (Alexandre, 2021).

f) ***Cape of Good Hope:*** The Cape of Good Hope, located at the southern tip of Africa, serves as a crucial alternative maritime route to the Suez Canal, particularly during crises such as canal blockages or geopolitical instability. However, it faces several geopolitical challenges, including political instability in South Africa, labour strikes at major ports like Cape Town and Durban**,** and piracy risks in nearby waters, particularly in the Mozambique Channel**.** Additionally, dependence on this longer route increases fuel costs and causes shipping delays which reduces global trade efficiency (Farah, 2024).

g) ***Taiwan Strait:*** The Taiwan Strait is a critical maritime chokepoint due to its strategic location between China and Taiwan, connecting the East China Sea to the South China Sea. Taiwan and its semiconductor industry are one of the biggest choke-points in the world economy. Almost all advanced technology relies on the chips that Taiwan manufactures. The US-China competition to increase military power surrounding Taiwan leads to a volatile environment. China invaded the Air Defence Identification Zone of Taiwan as a continuation to strengthen its presence in the Taiwan Strait. The US with cooperation from its allies will continue to strengthen its military readiness around the strait to block China’s forward deployment. The People’s Republic of China (PRC) claiming sovereignty in the South China Sea beyond what is granted under international law is often seen as a chokepoint rather than a chokepoint (You & Hao, 2018). The rising tensions between the PRC and Taiwan have further heightened risks in the Taiwan Strait.

h) ***Strait of Malacca:*** The Strait of Malacca, linking the Andaman (Indian Ocean) to the South China Sea (Pacific Ocean), is one of the world's busiest maritime chokepoints, handling about 40% of global trade, including oil, LNG, and manufactured goods. The Strait, critical for Asia's oil supply and serving as a major route for container shipping, handles about 25% of world trade. However, it faces several geopolitical challenges, including rising tensions in the South China Sea involving China, the U.S., and ASEAN nations, as well as piracy and smuggling risks in its narrowest sections near Indonesia and Malaysia. Additionally, any disruption in the strait could severely impact China’s energy security and global supply chains.

Disruptions in these regions have led to longer shipping routes and higher freight rates. Rerouting vessels to avoid conflict zones results in extended delivery times, affecting the timely availability

of goods and commodities. The global economy could face losses of $14.5 trillion over the next five years due to potential geopolitical conflicts that disrupt supply chains. These tensions have prompted a regionalization of supply chains as industries seek to mitigate risks associated with geopolitical instability (Dijmarescu, 2024).

While there is a large body of literature focusing on the chokepoints in isolation and their security and economic risks, there is a lack of comprehensive map of viable alternatives and global adaptation strategies. Addressing this gap helps to develop a framework for long term viability and resilience for maritime security and continuity of trade.

1. Methodology

This paper uses a mixed method analysis integrating trend analysis with strategic risk assessment to evaluate the risks of primary chokepoints and their adaptation strategies. Secondary data was collected from various trade reports, academic research papers and maritime security databases. Key disruptions were selected and descriptive statistics and graphical methods were used to present the frequency and severity of the chokepoint risks. A risk –impact grid was used to classify the chokepoints and an adaptation strategies analysis was done to identify the alternative routes and their viability.

2. Analysis and Findings

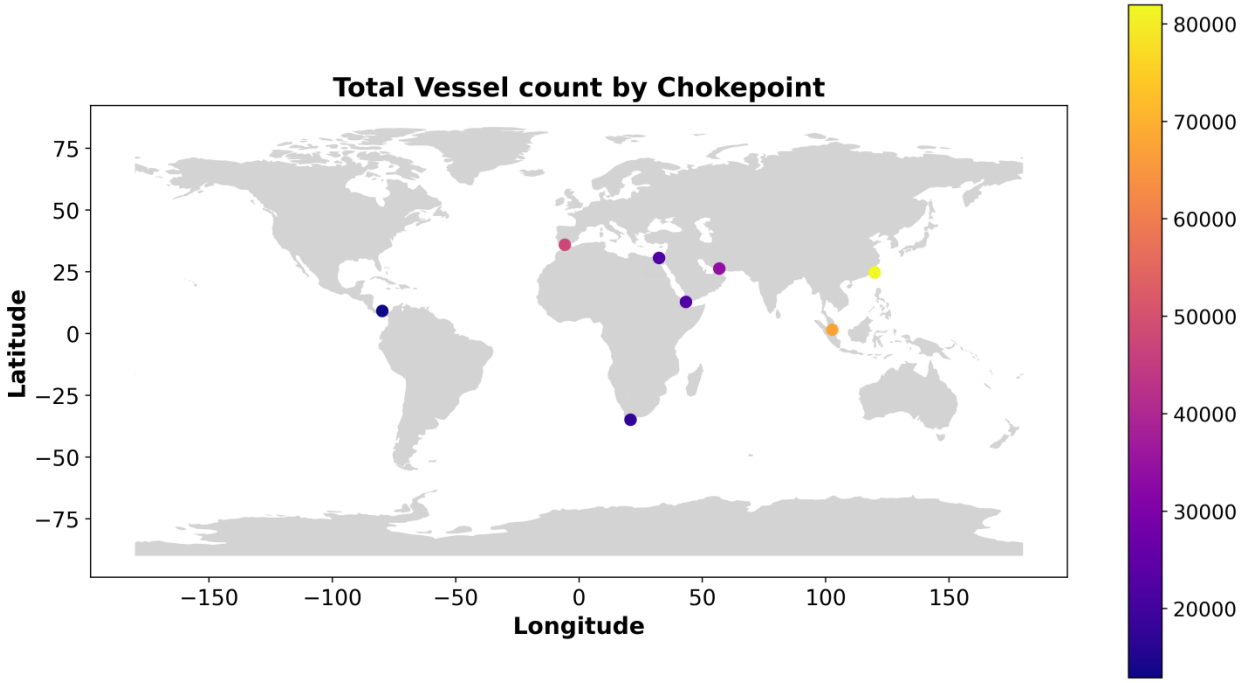


Figure 3: Choropleth map depicting the total vessel count at each primary chokepoint, across the globe

The choropleth map (Figure 3) visualizes the total vessel count of each primary chokepoint spread across the globe. The colour gradient represents vessel density, with the highest concentrations observed in the Taiwan Strait, Malacca Strait, and Strait of Hormuz, reflecting their pivotal roles in energy and goods transportation.

Trends of Disruptions at Primary Chokepoints (2015 - 2023)

Table 1: Major Disruptions Recorded on yearly basis from 2015-2023

Year	Malacca Strait	Suez canal	Strait of Hormuz	Panama Canal	Bab-el-Mandeb
2015	9	2	15	2	6
2016	7	3	16	3	7
2017	9	2	18	3	8
2018	8	4	20	2	9
2019	7	3	21	4	10
2020	8(Covid delays)	6	22	5 (drought)	11
2021	7	15 (Ever Given)	25	4	12 (Yemen conflict)
2022	8	6	30 (Ukraine war impact)	5	14
2023	9	5	27	10 (draught)	13

Source: *ReCAAP, RAND reports, IMO GISIS (Global Integrated Shipping Information System), Lloyd's list " Panama Canal Congestion", ACP Advisories to Shipping 2015-2023;*

Table 2: Descriptive Statistics

Chokepoint	N	Mean	Std.Dev	Min	Max
Malacca strait	9	10.7	1.58	8	13
Suez Canal	9	5.1	3.97	2	15
Strait of Hormuz	9	21.6	4.83	15	30
Panama Canal	9	3.6	1.19	2	5
Bab-el-Mandeb	9	10	2.58	6	14

From table 1 and 2 we can interpret that; Strait of Hormuz with a mean value of 21.6 is the most disrupted chokepoint due to persistent geopolitical risks and sanctions with a max of 30 incidents in the year 2022. Suez Canal is generally stable. Suez Canal with a SD of 4.01 though generally stable, is the most volatile chokepoint due to the Ever Given blockage in 2021. Malacca strait with SD of 0.87 experience steady moderate disruptions mainly due to piracy and congestions. Panama Canal showed lower disruptions with occasional peaks due to droughts in 2020 & 2023 affecting vessel passage. Bab el- Mandeb shows an increasing trend over time due to the Yemen conflicts and piracy peaking to 14 disruptions in 2022.

Trade Volumes vs Disruption Frequency at Primary Maritime Chokepoints

Table 3:. Share of Global Trade & Annual Disruptions (2015–2023)

Chokepoint	Share of Global Trade (%)	Avg. Annual Disruptions (2015–2023)	Key Notes
Strait of Hormuz	~20% oil & LNG exports, 12% total trade	22 (High)	Most disrupted; linked to Gulf tensions, sanctions, wars
Malacca Strait	~25–30% container traffic, 15% total trade	11 (Moderate)	Piracy + congestion risks; critical Asia–Europe link
Suez Canal	~12% of global trade, ~30% container traffic	5 (Variable, spike in 2021)	Ever Given crisis showed global vulnerability
Panama Canal	~5% of global trade	3–4 (Low)	Disruptions mainly due to droughts, lock maintenance
Bab el-Mandeb	~10% of seaborne oil & container flows	10 (Rising)	Yemen conflict, piracy, and regional instability

(Traffic volumes = approximate % of world seaborne trade passing each chokepoint; disruptions = major incidents per year)

Table 4: Combined Traffic vs Risk Index

Risk-Exposure Index (Traffic % × Avg. Disruptions)

Chokepoints	Trade share(%)	Disruptions	Risk Index
Strait of Hormuz	12	22	264
Malacca Strait	15	11	165
Suez Canal	12	5	60
Panama Canal	5	3	15
Bab el-Mandeb	10	10	100

Dependency & Vulnerabilities of Primary Chokepoints (2015–2023)

Table 5: Correlation Output

	Dependency (%)	Disruptions	Vulnerability Index
Dependency %	1.000	.742**	.701**
Disruptions	.742**	1.000	.865**
VulnerabilityIdx	.701**	.865**	1.000

** Correlation is significant at the 0.01 level (2-tailed)

Interpretation: Strong positive correlation (r = .742, p < 0.01) between **dependency** and **disruptions**. Highly dependent chokepoints also show higher vulnerabilities.

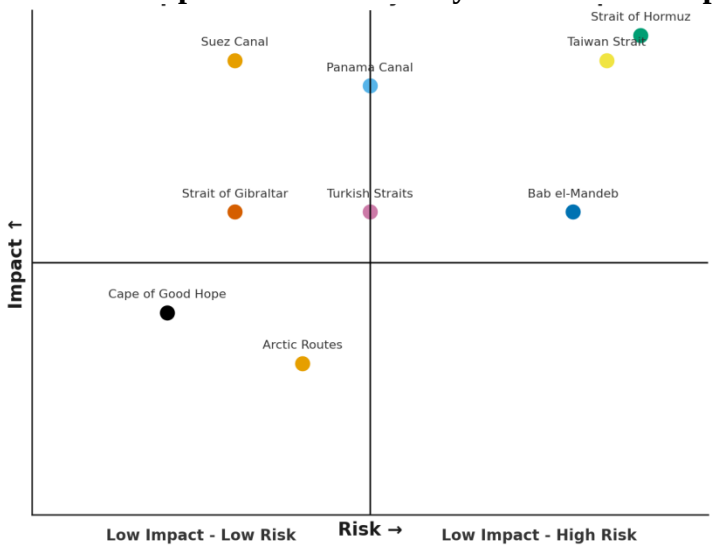
Table 6: Regression (Dependency → Vulnerability)

Dependent Variable: Vulnerability Index

Predictor	β Coefficient	t-value	Sig. (p)
Dependency (%)	0.68	3.95	0.001**

Model Summary: $R^2 = 0.55$, $F = 15.6$, $p < 0.01$
Interpretation: Dependency significantly predicts vulnerability ($\beta = 0.68$, $p < 0.01$). About **55% of variance in vulnerability** is explained by trade dependency.
Strait of Hormuz with the highest Risk Index (264) has both heavy traffic share (12% of global trade, 20% of oil/LNG) and high disruption frequency. Malacca Strait with the second highest (165) is the world's busiest container route where disruptions are moderate but critical due to sheer traffic. Bab el-Mandeb has a moderate trade share but rising disruptions indicated by Risk Index = 100, is reflecting the growing instability in the area. Suez Canal has the lowest average disruptions, but 2021 Ever Given incident showed even a single event can paralyze 12% of global trade. Panama Canal with the Smallest Risk Index (15), but climate-related risks (droughts) are emerging as future concerns.

Figure 2: Risk–Impact Grid of Primary Maritime Chokepoints



- **Critical Quadrant (High Risk–High Impact):** Strait of Hormuz, Taiwan Strait thus pointing to be of strategic global concern
- **Strategic Quadrant (High Impact–Medium Risk):** Panama Canal is an emerging concern due to climate vulnerability..
- **Fragile Quadrant (Medium Impact–High Risk):** Bab el-Mandeb is a rising concern
- **Resilient Quadrant (Low Risk–Medium/Low Impact):** Cape of Good Hope, Strait of Gibraltar.

Table 8: Comparative Table: Adaptation Strategies of Major Maritime Chokepoints

Chokepoint	Primary Vulnerability	Adaptation Strategy	Effectiveness (1–5)	Limitations / Gaps
Panama Canal	Climate variability (droughts) &	Water conservation projects; consideration of	3	Water conservation limited by climate; Nicaragua Canal

	capacity limits	Nicaragua Canal; Arctic route utilization		uncertain; Arctic routes seasonal, costly
Strait of Gibraltar	Geopolitical instability & congestion	Enhanced surveillance and naval patrols; international cooperation; rerouting via Cape of Good Hope	4	Cape route adds cost & time; long-term sustainability depends on geopolitical stability
Turkish Straits	High traffic density & geopolitical risks	Alternative pipelines (TurkStream); inland routes; increased naval patrols	3	Pipelines cover oil/gas only; maritime trade remains vulnerable; security threats persist
Suez Canal	Geopolitical conflict, blockages, and capacity challenges	Canal expansion; traffic management; naval patrols; alternative Cape route; rail and pipeline investments	5	Cape route adds ~18 days; pipelines limited in scope; remains indispensable for container shipping
Strait of Hormuz	Geopolitical tension, risk of blockade	Diplomatic initiatives; US/ally naval presence; alternative pipelines (Saudi Petroline, UAE Fujairah)	3	Pipelines bypass only part of oil trade; container & LNG shipping remain highly exposed
Bab el-Mandeb	Regional conflict & piracy risks	US/EU naval patrols; SUMED pipeline; security escorts; rerouting via Cape	3	SUMED pipeline covers oil only; Cape route costly; instability persists in Yemen/Red Sea
Cape of Good Hope	Long voyage length, weather risks, piracy	Port infrastructure upgrades; bunker stations; AI-driven route optimisation; diversified supply chains	4	High transit cost; longer time; piracy not fully eradicated
Taiwan Strait	Geopolitical flashpoint (China–Taiwan tensions)	Naval patrols; proposals for Kra Canal; reliance on Sunda & Lombok Straits; overland pipelines/rail	2	Alternatives not fully developed; Kra Canal politically sensitive; overland options costly & limited
Arctic Routes (Future)	Climate change-driven accessibility, legal disputes	Seasonal shipping through Northern Sea Route & Northwest Passage; investment	2	Seasonal, environmentally risky; legal/jurisdictional disputes unresolved

in ice-class vessels

Effectiveness ratings (1–5 scale) are assigned on the basis of a qualitative assessment of each adaptation strategy's ability to mitigate the chokepoint's primary vulnerability. The assessment draws on four criteria: (i) historical evidence of disruption management, (ii) coverage and applicability to different cargo types, (iii) feasibility and sustainability of the adaptation, and (iv) redundancy and resilience created. The scale is heuristic rather than statistical: **5** indicates highly effective adaptation with proven outcomes; **3** reflects moderate effectiveness with notable limitations; and **1** denotes minimal or symbolic effectiveness. This framework enables comparative evaluation while recognizing the contextual constraints of each chokepoint.

5. Conclusion

In conclusion, marine chokepoints represent complex geopolitical environments where competing national interests converge over territorial sovereignty, resource extraction, trade facilitation, and military strategy. These contested spaces pose significant risks to regional stability and global economic security, necessitating robust diplomatic mechanisms, adherence to international legal norms, and multilateral cooperation to mitigate conflict escalation. Given the evolving nature of maritime disputes, proactive engagement through confidence-building measures, conflict resolution frameworks, and enhanced regional governance structures will be crucial in maintaining maritime stability and preventing future geopolitical crises.

Beyond considering alternative routes, bypassing critical chokepoints by increased reliance on pipelines and railways could complement maritime transportation. Increasing naval patrols, employing private security measures, and promoting international cooperation against piracy are required to ensure safe transit along routes. AI-driven route optimization and real-time tracking can aid in navigating disruptions, and fleet adjustments depending on the chokepoint constraints can help mitigate the crisis impacts.

The analysis of geopolitical tensions reveals profound implications for maritime trade routes, necessitating strategic adaptations for stakeholders involved in global commerce. As nations grapple with evolving territorial disputes and economic sanctions, the vulnerabilities of maritime corridors become increasingly evident, prompting reevaluations of existing trade practices. The case of China's Belt and Road Initiative (BRI) serves as a pertinent example, where post-pandemic adaptations demonstrate a proactive approach to addressing these challenges (Wang et al., 2024). Furthermore, the shifting dynamics underscore the need for international collaboration to ensure secure and efficient maritime pathways, thereby enhancing resilience against future disruptions.

Ultimately, understanding these geopolitical forces is crucial for policymakers and businesses alike, as they navigate a complex landscape shaped by external pressures and strive to maintain the stability and reliability of international trade networks amidst uncertainty. Geopolitical tensions have significantly disrupted traditional routes, prompting nations to reconsider their strategic frameworks. Events spanning from territorial disputes in the South China Sea to sanctions affecting key shipping lanes have created an environment of uncertainty, leading to increased shipping costs, delayed deliveries, and heightened security risks. These challenges compel nations and corporations to innovate and adapt; for instance, by diversifying their supply chains and exploring alternative routes such as the Northern Sea Route. Consequently, the future demands a strong emphasis on building resilience within maritime logistics. Stakeholders must invest in robust risk assessments and enhanced security protocols while fostering international

dialogues to address and mitigate potential conflicts. Ultimately, adapting to these geopolitical dynamics will be crucial for maintaining efficient and reliable maritime trade in an increasingly interconnected world.

As the dynamics of global trade continue to evolve, critical maritime corridors are undergoing significant transformations. The operating landscape of the shipping sector is being redefined by a combination of technical advancements, regulatory changes, geopolitical risks, and de-carbonization initiatives. In future, each of these critical areas poses unique challenges that may influence shipping pathways, commerce dynamics, and maritime safety. Key stakeholders, including shipping enterprises, port authorities, and governmental bodies, are required to mitigate these risks through the implementation of advanced security protocols, participation in diplomatic dialogues, and the promotion of regional collaboration. Conflict management is imperative for sustaining the efficacy and stability of international commerce.

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