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Contested Waterways and Blue-Water Navies: Naval Modernization and Sea-Lane Vulnerabilities in India–China Strategic Competition

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Abstract
The maritime dimension of India–China strategic competition is increasingly shaped by a paradox: the same sea lanes that enable national growth also create exposure to disruption. This paper argues that the central strategic problem is not a simple race to match hull numbers, but the interaction among naval modernization, geography, logistics, surveillance, and the concentration of trade and energy flows through a limited set of routes. India retains a significant geographic advantage in the Indian Ocean, while China is narrowing the operational gap through fleet expansion, overseas logistics access and sustained presence. India's response has therefore moved toward a combination of blue-water capability, maritime domain awareness, island infrastructure, indigenous shipbuilding and partnerships. The paper develops a vulnerability framework that distinguishes between platform strength and sea-lane resilience, and applies it to the Strait of Hormuz, Bab el-Mandeb, the Malacca approaches and the Andaman Sea. It finds that India's most consequential vulnerabilities arise from energy dependence and the high economic cost of routing disruption, while China's principal constraints remain distance, sustainment and the need to protect a long chain of overseas access points. The study concludes that credible deterrence depends less on seeking absolute maritime dominance than on building distributed surveillance, resilient logistics, anti-submarine capability, undersea awareness, and selective denial options that raise an adversary's expected cost without making commercial sea lanes unnecessarily militarized.....
Keywords: India–China rivalry; Indian Ocean; sea lines of communication; naval modernization; blue-water navy; maritime security; chokepoints; logistics.

INTRODUCTION

India and China are continental powers with increasingly maritime strategic profiles. Their economic trajectories depend on uninterrupted access to overseas markets, energy supplies and maritime logistics, yet their security calculations are increasingly shaped by the possibility that the same networks can become liabilities in crisis. The Indian Ocean is therefore not merely a theater of naval presence; it is a strategic system in which geography, commercial routing and military reach interact.

The most important analytical distinction is between naval strength and sea-lane resilience. A navy can be larger while a state remains vulnerable if its trade and energy flows are highly concentrated and if it lacks alternatives, stockpiles, surveillance depth or logistical redundancy. Conversely, a smaller navy can exert disproportionate strategic influence when geography allows it to monitor, shadow or potentially disrupt access through critical approaches. This is the core of India's maritime advantage relative to China, but it is an advantage that becomes less decisive as the People's Liberation Army Navy (PLAN) improves long-range operations and secures overseas support infrastructure [4,7].

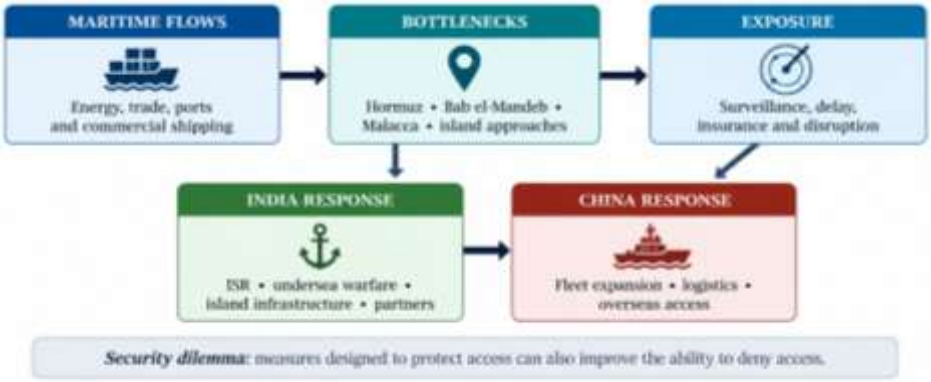

Figure 1. Maritime security is a network problem, not a hull-count problem.

Source: Author's conceptualization based on [4,5,6,7,9].

2. Research Questions and Method

The paper addresses three questions. First, how does naval modernization alter the vulnerability of Indian and Chinese sea lines of communication (SLOCs)? Second, which geographic chokepoints and logistics nodes create the greatest strategic leverage for each side? Third, what mix of naval, infrastructural and diplomatic measures can reduce vulnerability without turning commercial waterways into permanently securitized spaces?

The study uses a qualitative strategic-comparative design supported by descriptive data from official Indian and U.S. government documents, UNCTAD maritime-trade reporting, Indian energy statistics and peer-reviewed scholarship. It does not treat force size as a direct proxy for combat power, and it does not infer wartime intent from commercial port ownership alone. Instead, it triangulates four dimensions: platform capacity, geography, sustainment and network exposure. The result is an analytical framework for strategic resilience rather than a prediction of war.

Table 1. Analytical dimensions used to assess maritime vulnerability and relative naval leverage.

Analytical dimension	Indicator	Interpretive question
Platform capacity	Reported fleet levels; carriers, submarines, surface combatants	Who can generate sustained presence and undersea pressure?
Geographic leverage	Chokepoints, island positions, port access	Who can observe or constrain movement at lower cost?
Sustainment	Overseas bases, logistics agreements, replenishment	Who can keep forces on station?
Network exposure	Energy imports, trade concentration, rerouting costs	Whose economy bears greater cost from disruption?

Source: Author's framework synthesized from Koh (2019), Till (2018), U.S. Department of Defense (2024, 2025), UNCTAD (2025), and EIA (2026). See References [4], [6], [9], [17], [19], [22].

Research gap. Existing India–China naval studies often separate fleet modernization from the political economy of shipping. This paper links the two by treating maritime security as a coupled system: naval power changes the ability to observe and threaten sea lanes, while the commercial geography of those lanes changes the value and vulnerability of naval power. The empirical contribution is therefore not a new fleet forecast; it is a cross-domain comparison of platforms, chokepoints, energy dependence and sustainment.

Table 2. Evidence base, inferential use, and principal limitations.

Source class	Examples used	Role in inference	Main limitation
Indian official sources	Parliamentary reporting; Ministry of Defence / PIB	Fleet and shipbuilding trajectory	Operational readiness not fully public
Chinese/US official assessment	U.S. DoD China Military Power Report	PLAN size and modernization	Potential counting / intelligence asymmetry
Energy and trade datasets	EIA, PPAC, UNCTAD	Route and economic exposure	Rerouting behaviour changes over time
Academic literature	Naval power, seapower, strategic geography	Theory and competing interpretations	Different assumptions about intent and future access

Source: Author's synthesis of Indian official reporting, U.S. Department of Defense assessments, energy/trade datasets, and academic literature cited in References [3], [6], [9], [11], [17], [18].

3. Literature Review and Analytical Framework

Classical sea-power theory stresses command of the sea, but contemporary maritime competition is increasingly about selective control of access, information and logistics. Corbett's emphasis on the relationship between maritime operations and wider political objectives is particularly relevant because neither India nor China requires permanent command of the entire Indian Ocean to achieve strategic effects. What matters is the ability to protect own flows, deny or complicate an adversary's flows, and maintain freedom of action in a contested environment [17].

The recent literature on India–China maritime rivalry identifies a widening but uneven competition. Koh emphasizes that India's concerns center on Chinese blue-water capabilities, submarines and port access, while China remains attentive to India's strategic partnerships and potential reach into the Western Pacific [4]. Upadhyaya argues that geography still gives India an important advantage, but warns that this advantage cannot be treated as permanent because Chinese maritime power and regional relationships are evolving [7]. Mahendru and Wani similarly characterize India's modernization as increasingly tied to protecting trade and energy flows, while emphasizing the need for regional partnerships [5].

A second stream of scholarship focuses on China's maritime expansion beyond East Asia. The U.S. Department of Defense assessed the PLAN as the world's largest navy by battle-force ship count in 2024, at more than 370 platforms, with projected growth to approximately 395 in 2025 and 435 by 2030 [6]. This numerical lead should not be read as a simple measure of Indian vulnerability because distance, theatre priorities, readiness and logistics impose real constraints. Yet it does demonstrate a structural change: China increasingly possesses enough hulls to sustain distant presence while preserving substantial forces closer to home.

The analytical framework used here therefore treats naval competition as a problem of "networked seapower": the combination of platforms, sensor coverage, bases, replenishment, commercial routes and political access. A state is vulnerable when its critical maritime flows are concentrated, observable and difficult to reroute. A state is resilient when it can absorb disruption, shift routes, protect cargoes, and regenerate capability. This framework also clarifies why the Indian Ocean is both an advantage and a liability for India: geography favors India militarily, but the openness of the ocean and India's dependence on maritime commerce create incentives for extensive protection.

4. The Strategic Geography of Contested Waterways

The Indian Ocean contains multiple chokepoints, but they do not carry identical strategic weight. The Strait of Hormuz is primarily an energy vulnerability; Bab el-Mandeb links the Indian Ocean to the Red Sea and Suez corridor; the Strait of Malacca is central to East Asian energy and trade flows; and the Andaman Sea gives India an advantageous observation position over the eastern approaches to Malacca. These routes are embedded in a broader logistics geography that includes ports, naval bases, repair facilities, cable routes and air surveillance.

Table 3. Strategic relevance of major maritime nodes in the India–China competition.

Maritime node	Why it matters	India's exposure	China's exposure	Strategic implication
Strait of Hormuz	Energy export artery from Gulf	High: oil import dependence	High: imported energy flows	Diversification and escort capacity matter more than fleet size alone
Bab el-Mandeb	Indian Ocean–Red Sea/Suez connection	Medium–high	High for China–Europe flows	Rerouting can create large time and cost penalties
Malacca approaches	Major Indo-Pacific trade and energy corridor	High for regional trade	Very high for China-linked energy and trade	India's geography creates surveillance leverage
Andaman Sea	Eastern gateway toward Malacca	High strategic value, lower commercial dependence	Operational challenge for distant PLAN forces	ISR and anti-submarine capability can generate

Maritime node	Why it matters	India's exposure	China's exposure	Strategic implication
				disproportionate leverage

Source: Author's synthesis using EIA (2026) for oil chokepoints, UNCTAD (2024–2025) for maritime-route disruption, PPAC (2025) for India's oil dependence, and CSIS/academic assessments of Indian Ocean access. See References [9], [10], [11], [12], [13], [19], [20].

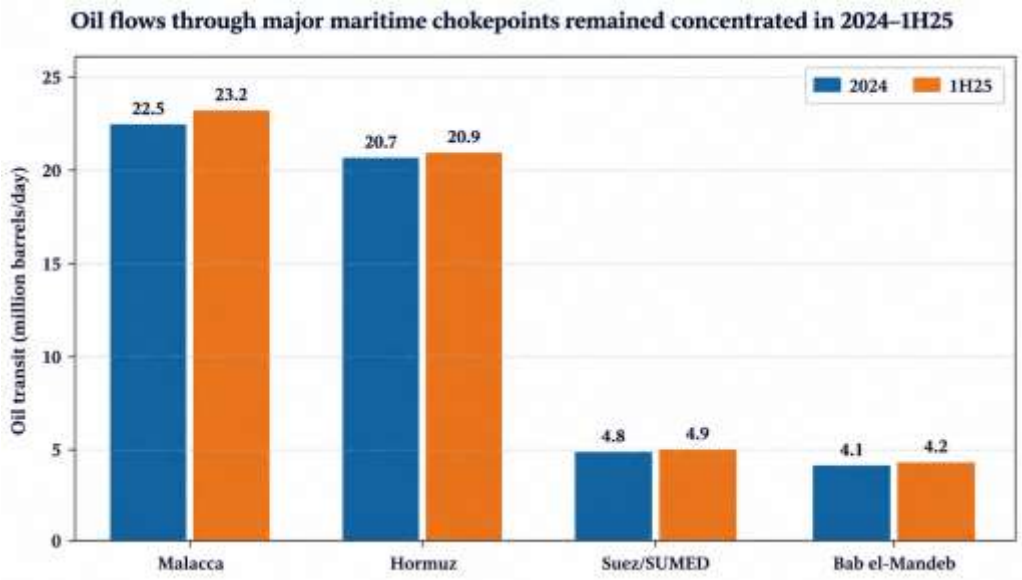

Figure 2. Oil flows through major maritime chokepoints remained concentrated in 2024–1H25.

Source: U.S. Energy Information Administration, World Oil Transit Chokepoints (2026); values shown in million barrels per day.

5. Naval Modernization: From Platforms to Persistent Presence

China's naval modernization is no longer adequately described as a coastal-defense program. The PLAN's battle-force scale, carrier program, replenishment capacity, long-range aviation and sustained anti-piracy deployments support a wider operational concept in which distant presence can be maintained for extended periods [6]. The Djibouti facility is especially significant because it addresses a central problem of blue-water operations: the tyranny of distance between East Asian home bases and Indian Ocean patrol areas. Analysts differ on how much coercive utility should be attributed to commercial port access, but there is broad agreement that logistics availability shapes what a navy can actually sustain [12,13].

India's modernization follows a different logic. The Indian Navy's geography reduces some of the distance penalty because major parts of the force operate within or near India's principal maritime theater. India's 2025 official statements reported a force level of about 140 ships and submarines as of September 2025, and the Navy has continued commissioning indigenous platforms while planning further fleet expansion [3,15]. The aim is not a symmetrical contest with the PLAN across all oceans; rather, it is to ensure credible sea control in areas of primary interest and selective sea denial beyond them.

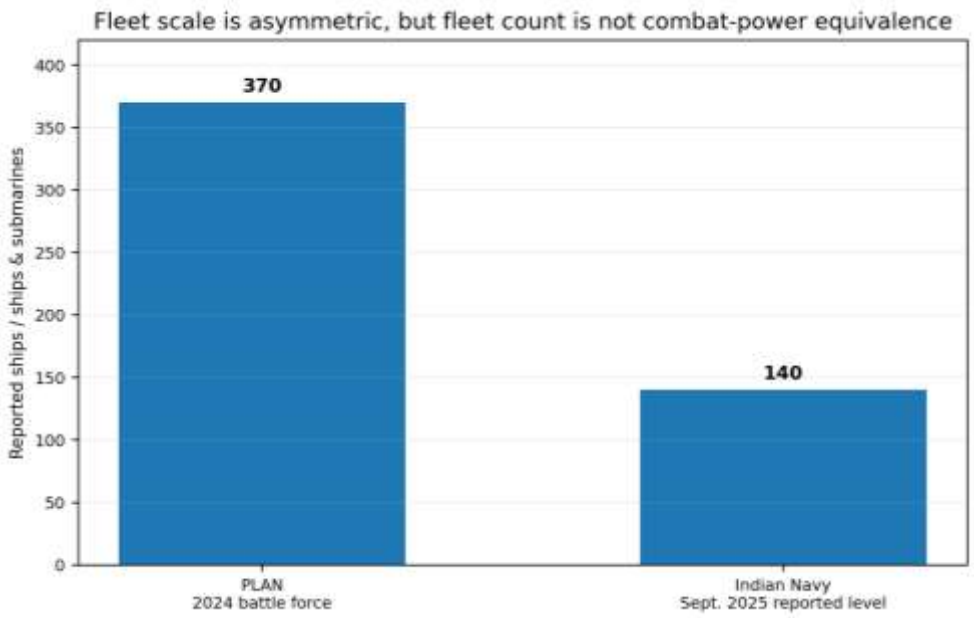

Figure 3. Reported force levels illustrate scale differences, not combat-power equivalence.

Source: U.S. Department of Defense (2024) for PLAN [6]; Parliamentary / official Indian reporting for Indian Navy [3].

Table 4. Comparative naval capabilities and the strategic meaning of the asymmetry.

Capability area	China	India	Strategic reading
Fleet scale	>370 PLAN platforms in 2024; growth projected	140 ships/submarines in Sept. 2025	China has the numerical advantage; India must exploit geography and specialization
Aircraft carriers	Growing carrier force with expanding aviation ecosystem	Two operational carriers with further carrier development	Carriers improve presence, but escort, logistics and air-wing depth are decisive
Submarines	Large nuclear and conventional inventory	Smaller but strategically important submarine force	Undersea warfare can magnify geography and impose uncertainty
Logistics	Djibouti plus access to commercial facilities and replenishment ships	Home-region proximity; expanding overseas access and partnerships	Sustainment is the bridge between platform inventory and usable power
Shipbuilding	High-volume industrial capacity	Increasing domestic construction and indigenisation	India's trajectory is improving but production scale remains the key asymmetry

Source: U.S. Department of Defense (2024, 2025) for PLAN force-development assessments; Government of India/Parliament and PIB (2025–2026) for Indian Navy fleet and modernization indicators. See References [3], [6], [15], [21], [22], [23].

6. Energy Dependence and the Political Economy of SLOC Security

Sea-lane vulnerability is ultimately a political-economy problem because disruptions are transmitted through prices, inventories and industrial activity. India's Petroleum Planning & Analysis Cell reported crude-oil imports of 242.4 million metric tonnes in 2024–25 and crude import dependency of 88.2 percent on a petroleum-

consumption basis [11]. Even when shipping remains physically open, maritime insecurity can raise freight, insurance and inventory costs. UNCTAD's 2025 maritime-transport assessment illustrates this mechanism at global scale: geopolitical rerouting produced longer voyages, higher ton-mile demand and persistent volatility in freight markets [9,10].

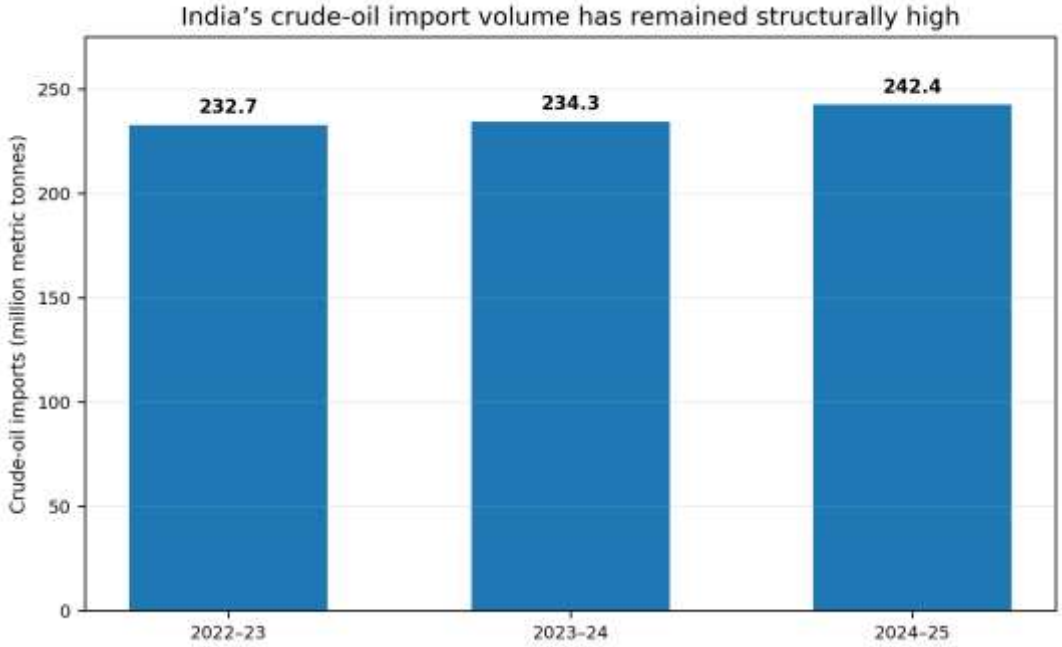

Figure 4. India's crude-oil import volume has remained structurally high.

Source: Petroleum Planning & Analysis Cell, Government of India [11].

The latest EIA chokepoint series reinforces the concentration effect. In 2024, roughly 22.5 million barrels per day of oil transited Malacca and 20.7 million barrels per day transited Hormuz; in the first half of 2025, the corresponding figures were approximately 23.2 and 20.9 million barrels per day. Bab el-Mandeb and Suez/SUMED carried smaller volumes but remained important because disruption there can force much longer voyages around the Cape of Good Hope [19]. The strategic implication is not that each chokepoint is equally vulnerable to military closure; it is that a small set of corridors has outsized influence on the time, cost and reliability of maritime energy transport.

The 2024–26 shipping environment also demonstrates that commercial route vulnerability can be produced without a formal naval blockade. Security threats around the Red Sea reduced traffic through Bab el-Mandeb and pushed ships onto longer routes, while insurance and freight costs responded to the higher risk. This is an important analytical distinction: sea-lane vulnerability should be measured by the capacity to impose economic friction as well as by the ability to physically stop shipping [9,10,20].

7. Sea-Lane Vulnerabilities: Four Mechanisms

Observation vulnerability. Concentrated commercial traffic creates predictable surveillance opportunities. Persistent maritime-domain awareness, satellites, patrol aircraft, drones and undersea sensors can transform an open ocean into a more transparent battlespace. India's Andaman and Nicobar geography is especially relevant because it sits near the eastern gateway of the Indian Ocean and offers access to the approaches toward Malacca.

Logistics vulnerability. A ship that can reach a theater is not necessarily a ship that can remain there. Replenishment, maintenance, ammunition stocks, spare parts and access to repair facilities determine operational persistence. China's overseas support architecture addresses this problem gradually; India benefits from shorter internal lines but is also attempting to build more distributed access and partnerships.

Chokepoint vulnerability. Chokepoints generate leverage because even a commercially replaceable route can impose delay when substitutes are slower or more expensive. The strategic effect can therefore be economic rather than kinetic. Rerouting around Africa during Red Sea disruptions has already demonstrated how non-military insecurity can translate into higher ton-mile requirements and cost.

Escalation vulnerability. The most dangerous scenario is not routine maritime competition but a crisis in which defensive deployments are interpreted as preparation for blockade or coercion. In such an environment, naval modernization can create a security dilemma: each side adds sensors, escorts and submarines to improve resilience, yet the same capabilities increase the other side's fear of denial operations [4,5].

8. Comparative Strategic Assessment

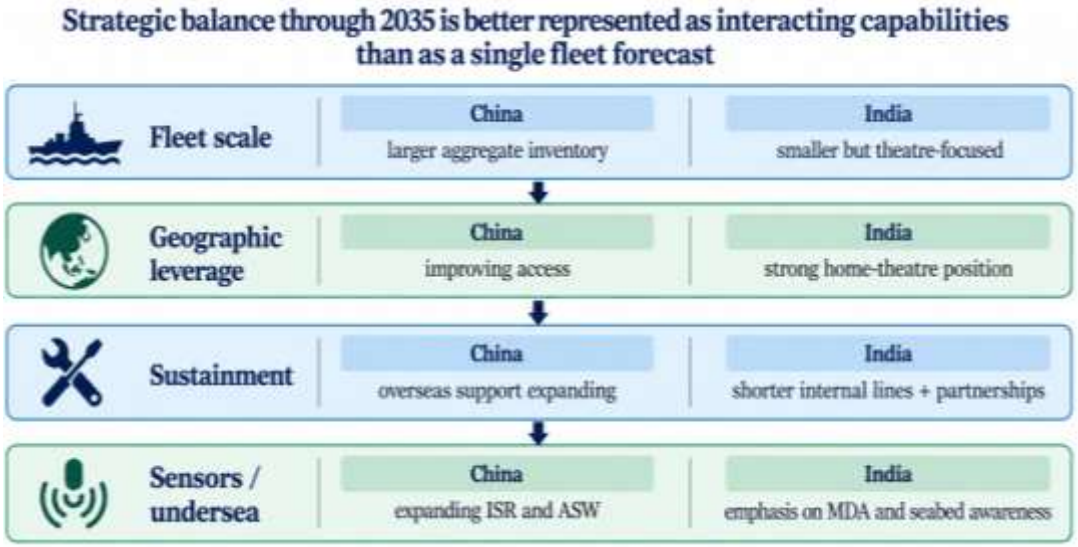

Figure 5. Strategic balance through 2035 is better represented as interacting capabilities than as a single fleet forecast.

Source: U.S. DoD 2024; Government of India / Indian Navy official capability statements; author's synthesis.

The comparison suggests a persistent asymmetry. China is likely to retain the larger navy and a larger industrial base for naval construction. India, however, can generate higher local leverage than its fleet count suggests because major parts of the Indian Ocean are closer to Indian bases and airfields. That geography creates opportunities for layered surveillance, air-sea coordination and selective sea denial. The resulting balance is therefore not binary: China can possess greater aggregate capacity while India retains substantial theatre-level leverage.

A second asymmetry concerns regeneration. China's larger industrial base can generate new hulls and replace losses or worn platforms more rapidly, while India's smaller fleet makes each high-end platform more valuable but also potentially more consequential to readiness if unavailable. India's 2025 official reporting that 52 warships planned for induction are being built domestically, alongside further orders under preparation, indicates that shipbuilding capacity is being treated as a strategic capability in its own right [21]. The relevant benchmark is therefore not the number of ships in a single year, but the ability to design, build, repair, refit and sustain a force continuously.

Table 5. Relative advantages and the resulting strategic interaction.

Variable	China's relative advantage	India's relative advantage	Net strategic effect
Aggregate hull numbers	High	Moderate	Favors China over time
Indian Ocean geography	Limited	High	Favors India in primary theatre
Distant sustainment	Improving	Moderate	Gap is narrowing
Energy-flow exposure	High	High	Mutual vulnerability creates deterrence as well as risk
Maritime-domain awareness near India	Growing	High potential	Competition is increasingly sensor-driven

Variable	China's relative advantage	India's relative advantage	Net strategic effect
Alliance / partner network	Expanding	Expanding with stronger operational partnerships	Neither side has uncontested regional alignment

Source: Author's comparative synthesis based on References [3], [4], [6], [7], [9], [11], [13], [17], [19], [22].

8.1 From Chokepoints to Resilience: A Transmission Model

Table 6. Transmission chain from maritime disruption to strategic and economic effects.

Stage of disruption	Typical maritime trigger	First-order effect	Second-order strategic effect	Resilience buffer
Detection	ISR gap, ambiguous contact, submarine uncertainty	Higher uncertainty around vessel movement	Commercial actors delay or reroute; naval forces must widen surveillance	Persistent MDA, satellites, MPA, unmanned sensors
Interdiction risk	Threats to shipping or naval escort	Insurance, routing and escort requirements rise	Higher delivered energy/freight costs; reduced tempo	Escorts, convoy options, alternative ports and routes
Route displacement	Temporary chokepoint closure or high-risk zone	Longer sailing distance	Fuel/time costs and fleet-demand increase	Diversified suppliers, strategic stocks, alternate corridors
Sustained pressure	Prolonged maritime contest	Port/repair/logistics demand rises	Readiness and economic resilience become intertwined	Fuel storage, repair capacity, dispersed logistics
Political escalation	Visible military signalling or coercive action	Diplomatic and market uncertainty	Alliance alignment and crisis-management pressures increase	Communication channels, rules of engagement, multilateral coordination

Source: Author's analytical model drawing on UNCTAD's evidence on route disruption and rerouting, EIA chokepoint analysis, and naval-logistics literature. This table is an analytical framework, not a historical event dataset. See References [9], [10], [17], [18], [19], [20], [22].

A deeper reading of maritime vulnerability suggests that chokepoint control should not be treated as a simple binary question of whether India can 'close' a waterway. In practice, the strategic effect of maritime pressure is transmitted through several linked channels: detection, delay, rerouting, insurance repricing, fuel and freight costs, port congestion, and political signalling. The same physical disruption can therefore produce very different strategic outcomes depending on the resilience of the affected economy and the availability of alternative routes. This transmission logic also clarifies why the India–China competition cannot be reduced to aircraft-carrier counts. A navy can generate political leverage without permanently denying passage if it can impose uncertainty, force precautionary routing, consume escorts, or compel commercial actors to price in higher risk. Conversely, a state with strong geographic position can lose leverage if its surveillance picture is weak, its ports cannot sustain high-tempo operations, or its energy system lacks redundancy. Maritime strategy therefore connects military capability to commercial and logistical resilience rather than treating them as separate policy domains.

The Indian Ocean is particularly suitable for this networked interpretation. India sits close to the western and eastern approaches through which energy and merchandise move, while China's economic model is exposed to long-distance sea transport and imported energy. Yet this does not mean India possesses costless coercive power. Any attempt to disrupt commercial shipping would have economic spillovers, diplomatic costs, and escalation

risks. The more credible objective is selective denial against hostile military activity, combined with persistent monitoring and protection of ordinary commerce.

9. Policy Implications for India

Prioritize undersea awareness over prestige platforms alone. Distributed sensors, maritime patrol aircraft, unmanned systems and seabed awareness can impose strategic uncertainty at lower cost than attempting to match every major PLAN platform.

Build logistics resilience as deliberately as combat capability. Fuel storage, repair capacity, ammunition dispersal, secure data links and politically reliable access arrangements determine whether naval presence can be sustained during prolonged crisis.

Protect chokepoints without over-militarizing them. India should invest in persistent monitoring and coalition maritime-security mechanisms that improve commercial safety while retaining selective denial options for high-end contingencies.

Exploit the Andaman and Nicobar position as a networked surveillance hub. The strategic value lies less in turning the islands into a single fortress and more in integrating airfields, sensors, unmanned systems and undersea surveillance into a wider regional architecture.

Link maritime modernization to economic resilience. Strategic reserves, diversified energy sourcing, alternate shipping routes and resilient ports reduce the payoff that an adversary would obtain from maritime disruption.

Use partnerships to multiply, not outsource, maritime capability. Information-sharing, exercises and coordinated surveillance can create network effects, but India should retain sovereign access to critical data and domestic repair capacity.

9.1 Priority Capability Portfolio, 2026–2035

Table 7. Priority capability portfolio for India, 2026–2035.

Priority area	2026–2030 focus	2030–2035 focus	Why it matters
Maritime-domain awareness	Integrate coastal, island, satellite, MPA and unmanned feeds	Persistent undersea and seabed awareness	Improves detection and reduces adversary freedom of action
Undersea warfare	Conventional submarines, ASW aviation, fixed/mobile sensors	More capable unmanned and seabed systems	Can raise uncertainty without matching surface-fleet mass
Logistics and sustainment	Fuel, ammunition, repair, spares, dispersed access	Resilient regional support network	Turns fleet inventory into sustained operational availability
Island infrastructure	Runway, communications, shelters and distributed sensors in Andaman & Nicobar	Networked multi-domain operating architecture	Converts geography into persistent surveillance leverage
Industrial depth	Shorten build cycles; improve engines, sensors, weapons and maintenance	Higher-rate production and exportable systems	Reduces mobilisation and replacement constraints
Regional partnerships	Information-sharing, exercises, HADR and maritime security	Interoperable surveillance and logistics arrangements	Multiplies presence without outsourcing sovereignty

Source: Author's strategic sequencing based on the capability and vulnerability evidence discussed in Sections 4–8, supported by Government of India modernization statements and naval-logistics literature. This is a policy prioritization matrix, not a government planning document. See References [3], [15], [17], [21], [22], [23].

For India, the most defensible modernization strategy is not to replicate the full structure of Chinese naval power. It is to concentrate marginal resources where geography converts investment into disproportionate strategic effect. The priority portfolio below translates that logic into a sequencing framework.

10. Discussion and Conclusion

The central lesson of the India–China maritime competition is that sea power should be measured by usable strategic effect rather than inventory alone. China's navy is larger and becoming more capable of sustained operations beyond the western Pacific. India nevertheless retains a powerful geography-based advantage in the Indian Ocean, especially around the approaches linking the Andaman Sea, Arabian Sea and wider chokepoint system. The contest is therefore best understood as a struggle over access, persistence and resilience.

The most plausible long-term equilibrium is neither Chinese maritime dominance nor Indian uncontested sea control. It is a form of competitive coexistence in which both navies can operate widely but must account for surveillance, missiles, submarines, logistics constraints and political signalling. In such a system, the side that can preserve commercial flows under pressure and continue generating credible military options will possess greater strategic resilience than a side that merely fields more platforms.

India's principal task is consequently to convert geographic advantage into repeatable operational advantage. That requires sustained investment in undersea warfare, maritime-domain awareness, logistics, indigenous shipbuilding, secure communications, island infrastructure and regional maritime partnerships. China's principal challenge is the inverse: turning numerical and industrial advantages into dependable, politically sustainable access across a dispersed Indian Ocean geography. The interaction of these two trajectories is likely to shape Asian maritime security for years to come.

The strategic objective should nevertheless remain resilience rather than permanent closure. India benefits from open commercial seas and from its role as a net security provider, and excessive militarization of normal trade routes could impose self-harm through higher transaction costs and regional distrust. The most sustainable doctrine is therefore selective denial against coercive military threats combined with persistent protection of commercial flows, supported by redundancy in energy imports, shipping routes, ports and logistics.

Study Limitations

Publicly available fleet numbers are not directly comparable because China and India use different counting conventions and because readiness, deployment status, crew training and mission configuration are opaque. Forecasts of future fleets are planning assumptions rather than guaranteed outcomes. The paper also does not attempt to model wartime losses, classified intelligence, or real-time operational deployment patterns. The vulnerability scores are analytical devices designed to structure comparative reasoning, not probabilistic forecasts...

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