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Conference Paper

PROJECTING FUTURE CHALLENGES IN MARITIME SECURITY

Amarulla Octavian
Badan Riset dan Inovasi Nasional Republik, Jakarta, Indonesia

Abstract.
As the largest archipelagic nation, Indonesia possesses vast maritime potential essential to national development and regional stability. However, these potential faces increasing disruption from a constellation of maritime security challenges, including non-state criminal activities, the emergence of hybrid warfare involving artificial intelligence, and ecological degradation driven by pollution and climate change. The analysis applies qualitative content methods to examine the strategic concept of geomaritime resilience as a multidimensional response framework. By reviewing policy documents, institutional assessments, and academic sources, the study classifies maritime threats into traditional and contemporary categories and evaluates governance responses at both national and regional levels. The findings reveal that national maritime security efforts remain constrained by resource limitations, operational fragmentation, and legal jurisdictional gaps. In contrast, regional cooperation provides a more adaptive and integrated pathway to shared threats. The concept of geomaritime is advanced as both an analytical lens and policy mechanism, integrating geoeconomic logic with sustainable marine governance. Strengthening legal frameworks, enhancing intersectoral collaboration, and expanding investment in marine conservation technologies emerge as critical strategies to reinforce collective maritime security and sustainability across the Indo-Pacific.

Keywords: ecological degradation, geomaritime resilience, hybrid warfare, Indo-Pacific, maritime security

Corresponding Author:
Amarulla Octavian
Email: amarulla.octavian@gmail.com

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Introduction

As the world's largest archipelagic state, Indonesia possesses extensive maritime resources that surpass its terrestrial wealth, positioning the country to derive strategic benefits from the sustainable use of its marine domain (1). This geomaritime advantage includes essential resources comprising food, medicinal compounds, clean water, and renewable energy, with recent technological advancements enabling the extraction of drinking water and hydrogen from seawater, as well as energy generation from wave motion, tides, and ocean currents. Nevertheless, Indonesia's maritime territory faces growing pressure from a range of traditional and contemporary security threats (2). Conventional risks include piracy, smuggling, maritime terrorism, illegal immigration, and illegal unreported and unregulated (IUU) fishing, many of which continue despite ongoing multilateral efforts (3). Concurrently, the emergence of hybrid warfare, involving unmanned systems driven by artificial intelligence, introduces complex geopolitical risks and calls for urgent development of international regulatory mechanisms (1). Environmental degradation, accelerated by marine pollution and climate change, has further contributed to biodiversity loss and emerging biosecurity concerns, including the possible release of ancient pathogens. Institutional responses remain fragmented, with limited integration of marine conservation within national security strategies, underdeveloped systems for ecological monitoring, and inadequate levels of public awareness. These challenges underscore the urgent need to strengthen geomaritime resilience by advancing integrated governance, promoting scientific innovation, and enhancing cross-sector collaboration to secure Indonesia's maritime future.

Literature Review

Theoretical Studies

The evolving dynamics of global politics have introduced new paradigms in the pursuit of national interests. Contemporary geopolitics increasingly moves beyond reliance on military power and instead prioritises strategic applications of political and economic influence. This transformation has led to the development of geoeconomics (4), , a framework that emphasises the optimisation of natural resources to improve societal welfare while maintaining long-term ecological and economic sustainability. Accordingly, the concept of geomaritime has emerged as a contemporary extension of geopolitical thought within the maritime sphere. Geomaritime reflects a strategic perspective in which maritime spaces and marine resources are understood as sources of both economic leverage and national resilience. The concept integrates the logic of geoeconomics with the principles of ocean sustainability, encouraging the responsible

use of marine resources alongside the preservation of ecosystem integrity. As a theoretical construct, geomaritime expands the scope of national power by incorporating marine-based capacities into broader geopolitical strategy. It connects natural resource governance, economic diplomacy, and environmental stewardship, offering a comprehensive framework for advancing national objectives through maritime innovation and sustainable ocean management.

Empirical Studies

Indonesia's maritime domain faces an increasingly complex range of security threats, encompassing both traditional risks and emerging challenges. Recent assessments highlight the urgent need for integrated and adaptive maritime governance to respond effectively to these pressures (2). Field observations and national security reports consistently identify non-state criminal activities including piracy, smuggling, illegal immigration, maritime terrorism, and illegal unreported and unregulated (IUU) fishing as persistent threats. Despite ongoing cooperation among naval forces, coast guards, and international policing agencies, empirical evidence indicates that existing mechanisms remain inadequate in reducing the frequency and severity of maritime crime (3). In addition, state-based security dynamics are now shaped by the evolution of hybrid warfare. Empirical developments in defence technology confirm the integration of conventional warships with unmanned systems supported by artificial intelligence (5). These hybrid deployments, observed through maritime exercises and strategic manoeuvres, present escalating risks for regional security and reinforce the urgent demand for international regulatory frameworks to govern the military application of artificial intelligence in naval operations.

Contemporary maritime security concerns increasingly relate to environmental degradation (6). Data collected by national monitoring agencies and marine research institutions confirm the severe impacts of anthropogenic pollution, including plastic debris and toxic materials contaminating both coastal zones and deep-sea environments. Research led by marine scientists and environmental organisations has documented significant biodiversity loss and long-term damage to benthic ecosystems. In parallel, the measurable consequences of global warming, including rising sea levels and accelerated ice melt, have raised serious concerns over the potential reactivation of dormant pathogens, an area that remains under-explored. Institutional responses to these ecological threats remain fragmented. Naval and coast guard authorities continue to show limited involvement in conservation-focused missions (2), while technological innovations for real-time detection and mitigation of marine ecological harm are still lacking. Moreover, low levels of public awareness and insufficient inclusion of ocean-related content in

formal education constrain efforts to build broad-based support for marine protection and ecological resilience

Methods

This study applies a qualitative content analysis to systematically interpret textual materials related to maritime security, geopolitical dynamics, and environmental governance in the Indo-Pacific region (7). Data were drawn from policy documents, international agreements, institutional publications, and peer-reviewed literature published within the last decade, selected based on relevance to traditional and contemporary maritime threats, geoeconomic and geomaritime perspectives, environmental risks, and resilience strategies. The unit of analysis focuses on the application of geomaritime resilience, framed as an integrated approach combining national and regional capacities to address complex maritime challenges. The analysis also considers how hybrid warfare, artificial intelligence, and ecological degradation influence current maritime governance. Data collection and interpretation were conducted over a one-year period, with credibility ensured through source triangulation, peer validation, and expert consultation in the fields of maritime security, international law, and environmental policy.

Results and Discussion

Indonesia encounters a wide array of maritime security threats, categorised into traditional and contemporary domains (3). Traditional threats predominantly arise from non-state actors and involve piracy, smuggling, unlawful immigration, maritime terrorism, and illegal, unreported, and unregulated (IUU) fishing. Despite joint operations among naval forces, coast guards, and international policing bodies, coordination remains inadequate. Operational fragmentation, overlapping jurisdictions, and limited intelligence exchange contribute to the continued prevalence of maritime crimes, reinforcing the necessity for more institutionalised mechanisms of cooperation.

State-based challenges have intensified with the advancement of hybrid warfare strategies (1). Integration of manned naval assets with unmanned systems powered by artificial intelligence (AI) has created significant uncertainty regarding rules of engagement and legal accountability. Effective governance of AI deployment in maritime defence requires internationally endorsed legal frameworks to prevent escalation during geopolitical confrontation.

Environmental degradation has emerged as a major maritime concern (6). Accumulation of plastic waste and hazardous

materials in marine ecosystems, especially in benthic zones, has reduced biodiversity, disrupted fisheries, and introduced risks to food security. Rising sea temperatures and melting polar ice caps have compounded ecological stress, with marine scientists warning of the potential reactivation of ancient pathogens. This biosecurity dimension remains largely underexplored.

Despite the severity of environmental threats, international cooperation in maritime ecological protection remains limited (8). Most naval and coast guard forces have yet to integrate environmental monitoring and enforcement into core operational mandates. Technological innovation for detecting and mitigating ecological crimes remains underdeveloped. Public awareness concerning marine environmental conservation remains low, and many countries lack formal educational frameworks that promote ocean literacy and responsible stewardship.

Recent analyses reflect a global geopolitical shift towards political and economic influence rather than military dominance. Within this shifting paradigm, geoeconomics provides a critical framework to harness maritime assets for national welfare and development. Strategic thinking rooted in geoeconomics informs the concept of geomaritime, which integrates modern geopolitical approaches with sustainable marine resource management.

Geomaritime offers both analytical insight and policy direction. It promotes economic utilisation of maritime resources while advocating for conservation through responsible practices. This concept supports the development of international rules and institutional cooperation on ocean governance, marine protection, and maritime security. Strategic application of geomaritime thinking facilitates cooperative mechanisms to counter threats posed by state, non-state, and proxy maritime actors.

The study identifies national and regional resilience as complementary dimensions of maritime security. National resilience reflects the ability of states to confront maritime threats through internal legal, institutional, and enforcement structures. However, many states, particularly across the Global South, lack the capabilities to manage transnational challenges independently. Bilateral or ad hoc initiatives often fail to provide sustainable or scalable impact.

Regional resilience introduces an integrative response, defined by the collective ability of states within a maritime region to perceive and respond to shared threats. This approach enables joint operational preparedness, policy harmonisation, and resource sharing. Interaction between national and regional frameworks strengthens overall resilience. Where national efforts fall short, regional coordination fills the gap. This dual mechanism enhances

adaptability and provides a comprehensive strategy to maintain maritime security and sustainability within an increasingly complex geopolitical and environmental setting.

Conclusion

The Indo-Pacific region holds strategic value due to its extensive maritime domain and its role as a shared space essential to the economic, environmental, and security interests of numerous states. As maritime challenges become increasingly complex, including traditional threats, technological disruptions, and ecological degradation, ensuring regional stability requires more than isolated national responses. An integrated model of resilience that combines national capacities with regional cooperation under the geomaritime framework offers a structured and adaptive approach. This model strengthens preparedness, supports collective responses to multifaceted threats, and fosters sustainable access to marine resources for all states involved.

Realising this strategic vision depends on the central role of scientific research in guiding evidence-based policymaking. Effective collaboration among academic institutions, maritime practitioners, and policy stakeholders across national boundaries provides a critical foundation for regional resilience. Joint research, coordinated capacity-building programmes, and systematic knowledge exchange contribute to a coherent maritime governance structure grounded in sustainability, cooperation, and mutual accountability. By advancing these initiatives, Indo-Pacific nations can enhance their ability to manage maritime security challenges within an increasingly dynamic geopolitical and ecological environment.

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