

Risk-Based Defense Planning in Archipelagic States: Strategic Analysis, Methodological Framework, and Technological Integration in the Indo-Pacific

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Abstract: The volatile security environment of the Indo-Pacific demands that defense institutions adopt adaptive planning approaches beyond conventional threat-based models. This qualitative study examines Risk-Based Defense Planning (RBDP) implementation in archipelagic states, which face distinctive security challenges from dispersed territories, extensive maritime boundaries, and persistent sea blindness. Through systematic literature review and comparative analysis of defense planning frameworks in Indonesia and the Philippines, the study evaluates risk assessment methodologies including Multi-Criteria Decision-Making approaches specifically Fuzzy Analytic Hierarchy Process and Failure Mode and Effects Analysis for objective defense resource prioritization. The analysis also examines NATO's Risk-Based Framework for Strategic Planning as a reference model. Findings reveal three key patterns: (1) archipelagic states are shifting toward risk-oriented defense strategies, evidenced by the Philippines' Comprehensive Archipelagic Defense Concept and Indonesia's Global Maritime Fulcrum vision; (2) emerging technologies – Maritime Domain Awareness systems, unmanned vehicles, and low-earth orbit satellites are critical for situational awareness and risk mitigation; and (3) effective RBDP requires integration of military and non-military policies within total defense frameworks, supported by regional cooperation. The study contributes a synthesized RBDP framework for archipelagic contexts and offers policy recommendations for addressing hybrid threats, maritime security challenges, and climate-related risks. Limitations include the focus on two case countries and reliance on secondary sources.

Keywords: Archipelagic Defense Planning, Maritime Domain Awareness, Multi-Criteria Decision-Making, Risk-Based Defense Planning, Strategic Defense Planning

A. Introduction

The transformation of the global security environment in the last decade has forced defense institutions to abandon traditional static planning models (Sani et al., 2025). Risk-based defense planning emerged as a response to the complexity of the

environment characterized by high uncertainty, where threats are no longer monolithic but hybrid and multidimensional (Ainie et al., 2022). Unlike threat-based planning that focuses on “who” the enemy is, or capability-based planning that focuses on “what” can be done, RBDP emphasizes the “effect of uncertainty on objectives (Wildan Akbar Hashemi Rafsanjani et al., 2025). The current dynamics of the Indo-Pacific region are marked by increasing rivalry among major powers, tensions in the South China Sea, and the proliferation of multidimensional threats that are hybrid.

The uncertainty faced by defense planners is often epistemic, that is, uncertainty arising from a lack of knowledge, not merely statistical variation or aleatory (Gusriandari et al., 2024). Therefore, RBDP requires an analytical framework that is valid, verified, consistent, and transparent to support executive decision-making that is fiscally and strategically accountable (Saputro, 2021). Integrating risk management from the early stages of planning enables organizations to allocate resources efficiently, ensuring that critical areas receive attention proportional to the level of threat and potential impact (Kurnia et al., 2023). In this high-uncertainty condition, Risk-Based Defense Planning (Risk-Based Defense Planning or RBDP) emerges as a strategic response that emphasizes the effects of uncertainty on achieving state sovereignty objectives. For archipelagic states like Indonesia and the Philippines, geography is a determining factor that presents unique defense challenges (Juliana & Saputro, 2022).

Regions like in Philippines and Indonesia face extraordinary logistical challenges due to the dispersion of thousands of islands with very long coastlines (Amanda & Saputro, 2023). The sea in archipelagic countries has a dual role; it is a connector that facilitates trade and prosperity, yet at the same time becomes a barrier and a pathway of vulnerability to external threats as well as natural disasters (Sa'bani et al., 2025). The dispersion of thousands of islands and coastlines that are very long creates the phenomenon of “sea blindness”, where monitoring of sea areas continuously becomes very difficult to carry out. In addition, the existence of strategic straits (chokepoints) such as the Malacca Strait, Sunda, and Lombok demands strict surveillance because of their role as global trade routes as well as points of vulnerability to external threats (Harefa et al., 2025). Therefore, defense planning in archipelagic countries must be able to manage risks arising from the vastness of the maritime jurisdiction compared to the limitations of available resources.

At the regional level, a paradigm shift is beginning to be seen through the concept of more active territorial defense. The Philippines, for example, has launched Comprehensive Archipelagic Defense Concept (CADC) to leverage the archipelagic geography as a military advantage through forward defense (Saputro, 2022). Meanwhile, Indonesia through the vision of World Maritime Axis (Global Maritime Fulcrum) and the doctrine of Sishankamrata seeks to integrate military and non-military forces to safeguard national interests at the crossroads of two oceans (Sodik,

2018). However, the implementation of these strategies often faces constraints from defense budget limitations that are still below 1% of GDP, thus requiring strict priority mechanisms in resource allocation. To address subjectivity in strategic decision-making, the use of multi-criteria analytical methodology (MCDM) becomes very crucial.

The integration of methods such as Fuzzy AHP and Failure Mode and Effects Analysis (FMEA) has proven effective in minimizing bias and handling data uncertainty in risk assessment of defense (Tedyansyah et al., 2025). This methodology enables planners to evaluate the level of severity, probability of occurrence (occurrence), and detection capability (detection) against various threat spectra more accurately (Danio et al., 2025). Through this systematic study, it is hoped that a comprehensive defense planning framework can be found, which is capable of aligning strategic analysis, methodological sharpness, and technological superiority to ensure the stability and sovereignty of archipelagic states in the Indo-Pacific era.

The theoretical framework of this study is grounded in International Security Theory, particularly Structural Realism and Neoliberalism, to explain state behavior amid growing strategic uncertainty in the Indo-Pacific region (Susanti et al., 2025). Structural Realism views military capability and defense modernization as rational instruments for ensuring state survival, deterring aggression, and maintaining the regional balance of power within an anarchic international system (Nurjanah et al., 2025). From this perspective, defense modernization in archipelagic states such as Indonesia represents a strategic response to regional security dilemmas and evolving threats. In contrast, Neoliberalism emphasizes international institutions and security cooperation based on calculations of absolute gains, including burden sharing, technology transfer, and defense assistance. These perspectives are complemented by the evolution of defense planning paradigms from Threat-Based Planning to Capabilities-Based Planning and Risk-Based Defense Planning (Narahara et al., 2024). While Threat-Based Planning focuses on identifiable adversaries and anticipated conflict scenarios, CBP prioritizes the development of flexible capabilities to address multiple contingencies (Nadia et al., 2025). RBDP further advances this paradigm by placing uncertainty and its potential effects on strategic objectives at the center of defense decision-making, thereby providing a more adaptive approach to complex and unpredictable security environments.

The distinctive geographical and operational characteristics of archipelagic states are further examined through the concepts of Archipelagic Defense and Maritime Domain Awareness (Wicaksono, 2020). The Comprehensive Archipelagic Defense Concept (CADC) emphasizes the utilization of archipelagic geography as a strategic advantage through forward defense and the protection of critical maritime chokepoints, while the dispersion concept highlights the distribution of military forces across multiple islands to enhance resilience and operational survivability despite increasing logistical complexity (Darmawan, 2023). MDA provides a conceptual foundation for

developing comprehensive situational awareness of maritime activities that may affect national security and economic interests. The integration of low-earth orbit satellites, space-based surveillance, unmanned aerial vehicles (UAVs), and unmanned surface vehicles (USVs) is increasingly important for overcoming limitations in monitoring vast maritime territories (Keristanta Ginting & Statistika STIS, 2024). To enhance objectivity in defense risk prioritization, the Multi-Criteria Decision-Making (MCDM) perspective incorporates the Analytic Hierarchy Process (AHP), Failure Mode and Effects Analysis (FMEA), Fuzzy Logic, and Shannon Entropy. These approaches facilitate systematic criterion weighting, risk assessment based on severity, occurrence, and detection, the management of uncertainty in expert judgments, and objective determination of strategic priorities in defense resource allocation.

Based on this theoretical synthesis, the study addresses two research questions: (1) How can Risk-Based Defense Planning (RBDP) be implemented to address strategic uncertainty and the distinctive geographical and maritime security challenges faced by archipelagic states? and (2) How can an integrated RBDP framework incorporate objective risk-prioritization methodologies, emerging defense technologies, and total defense mechanisms to strengthen the resilience and sovereignty of archipelagic states?

B. Methods

This study adopts a qualitative comparative case study with a policy analysis approach to examine the implementation of Risk-Based Defense Planning (RBDP) in archipelagic states. Indonesia and the Philippines were selected as comparative cases because both countries possess extensive maritime territories, face similar hybrid security challenges, and have recently introduced defense modernization policies emphasizing maritime defense and capability transformation (Gusriandari et al., 2024). The study focuses on the 2020–2025 period, during which strategic competition in the Indo-Pacific significantly influenced national defense planning. The research follows a four-stage analytical framework consisting of (1) policy and literature review, (2) expert validation, (3) risk prioritization using Multi-Criteria Decision-Making (MCDM), and (4) synthesis of the Risk-Based Defense Planning framework. The systematic literature review serves to identify defense planning concepts, defense policies, capability development priorities, and strategic risks discussed in previous studies and official defense documents. These findings provide the preliminary analytical categories used throughout the subsequent stages of the research.

Primary data were obtained through semi-structured interviews with military officers, defense planners, maritime security experts, academics, and representatives of the defense industry. Informants were selected using snowball sampling because of their direct knowledge of defense planning and maritime security issues (Danio et al., 2025). The interviews were designed not only to validate the risks identified from

the literature but also to explore expert perspectives regarding threat likelihood, operational impact, capability gaps, and technological requirements for future defense planning.

The literature review and interview findings were integrated through a Multi-Criteria Decision-Making (MCDM) procedure to reduce subjectivity in strategic risk prioritization. Rather than functioning as an independent quantitative analysis, Fuzzy Analytic Hierarchy Process (Fuzzy AHP) was employed as a decision-support technique within the qualitative policy analysis. Fuzzy AHP was used to determine the relative importance of defense risk criteria based on expert judgments expressed through linguistic variables and converted into triangular fuzzy numbers. The evaluation criteria consisted of Severity (strategic impact on national defense), Occurrence (probability of threat occurrence), and Detection (the capability to detect or anticipate the threat). Shannon Entropy was subsequently applied to support objective criterion weighting and minimize evaluator bias.

The weighted criteria were then incorporated into Failure Mode and Effects Analysis (FMEA) to calculate the Risk Priority Number (RPN) for each identified defense risk. The RPN values enabled the ranking of military, non-military, and hybrid threats according to their relative strategic importance (Maolana & Wicaksana Prakasa, 2023). Subsequently, Capabilities-Based Planning (CBP) was applied to assess whether existing defense capabilities adequately addressed the highest-priority risks identified through the Fuzzy AHP-FMEA process. This integration allowed strategic risks to be systematically linked with defense capability requirements and resource allocation priorities.

Data analysis proceeded through five sequential stages: (1) identification and classification of defense risks from documentary sources and expert interviews; (2) validation of identified risks through expert triangulation; (3) weighting of evaluation criteria using Fuzzy AHP and Shannon Entropy; (4) prioritization of defense risks using FMEA and Risk Priority Number analysis; and (5) synthesis of policy recommendations through comparative analysis of Indonesia and the Philippines, supported by international best practices such as NATO's Risk-Based Framework for Strategic Planning. This sequential analytical process demonstrates how qualitative evidence, expert judgment, and structured decision analysis were integrated to construct the proposed Risk-Based Defense Planning framework. To enhance methodological rigor, credibility was established through data triangulation, comparing findings from defense policy documents, international defense databases, academic literature, and expert interviews. Dependability was strengthened by maintaining a transparent analytical procedure for coding, weighting, and risk prioritization (Alfarizi et al., 2025). In addition, the Consistency Ratio (CR) of the AHP pairwise comparison matrix was evaluated to ensure acceptable consistency of expert judgments before calculating the final risk priorities.

C. Results and Discussion

1. Results

Theme 1. Evolution of Defense Strategy in Archipelagic States

The findings demonstrate a significant transformation in the defense strategies of archipelagic states, particularly Indonesia and the Philippines, from conventional Threat-Based Planning toward Risk-Based Defense Planning (RBDP). The Philippines has institutionalized the Comprehensive Archipelagic Defense Concept (CADC), emphasizing forward defense, sea denial, and the protection of strategic maritime chokepoints. Meanwhile, Indonesia continues to strengthen its maritime-oriented defense posture through defense modernization and the Sistem Pertahanan dan Keamanan Rakyat Semesta (Sishankamrata), integrating military, reserve, and supporting components within the Total Defense framework (Shidqi Divreda Sulaeman et al., 2024). Both countries recognize that contemporary security challenges require adaptive capability development rather than reliance on conventional territorial defense alone.

Theme 2. Risk Identification and Prioritization

The study identified seven principal categories of defense and maritime security risks affecting archipelagic states through the analysis of policy documents and expert interviews. These risks encompass military, non-military, and hybrid threats with varying strategic implications for sovereignty, maritime security, and national resilience.

Table 1. Major Defense and Maritime Security Risks in Archipelagic States

Threat	Category	Strategic Risk	Main Actors	Required Response
Maritime Terrorism	Non-conventional	Disruption of strategic sea lanes and energy supply	Navy, Police, Maritime Security Agency	Intelligence, port security, and coordinated patrols
Armed Robbery at Sea	Non-military	Shipping and maritime trade disruption	Navy and Maritime Security Agency	Joint patrols and regional cooperation
Weapons and Goods Smuggling	Hybrid	Domestic instability and border vulnerability	Navy, Customs, and Police	Border surveillance and law enforcement
Illegal Fishing	Non-military	Economic losses and food security threats	Navy, Fisheries Authority, Maritime Security Agency	EEZ surveillance and law enforcement

Maritime Boundary Disputes	Strategic/Military	Sovereignty disputes and regional tensions	Navy and Ministry of Foreign Affairs	Military presence and defense diplomacy
Military Incursion	Military	Threat to territorial integrity	Armed Forces	Forward deployment and territorial defense
Cyber and Economic Threats	Hybrid	Disruption of critical systems and national resilience	Military and Civil Institutions	Integrated national defense response

The findings indicate that maritime boundary disputes, military incursions, cyber threats, maritime terrorism, illegal fishing, and transnational smuggling represent interconnected strategic risks rather than isolated security issues. Their multidimensional characteristics require integrated defense planning that simultaneously considers operational capability, institutional coordination, and resource allocation.

Theme 3. Methodological Integration through Fuzzy AHP-FMEA

The integration of Fuzzy Analytic Hierarchy Process (Fuzzy AHP) and Failure Mode and Effects Analysis (FMEA) provided a structured mechanism for defense risk prioritization (Datwurina & Rizkiana, 2022). Expert judgments were converted into triangular fuzzy numbers to accommodate uncertainty before calculating criterion weights based on Severity, Occurrence, and Detection. The weighted criteria were subsequently incorporated into the FMEA procedure to calculate the Risk Priority Number (RPN) for each identified defense risk. The analysis indicates that surveillance gaps, logistics delays, and detection failures constitute the highest operational priorities requiring immediate policy attention (De Castro, 2025). Furthermore, the application of the Pareto Principle revealed that a relatively small number of high-priority risks account for most overall defense risk exposure, thereby supporting more efficient resource allocation.

Theme 4. Technology Integration for Maritime Domain Awareness

The findings emphasize that technological integration is essential for overcoming maritime surveillance limitations in archipelagic environments. Maritime Domain Awareness (MDA) systems combine coastal radar, Automatic Identification System (AIS), satellite surveillance, and integrated command-and-control platforms to generate comprehensive maritime situational awareness. Emerging technologies including Low Earth Orbit (LEO) satellites, Synthetic Aperture Radar (SAR), Unmanned Aerial Vehicles (UAVs), Unmanned Surface Vehicles (USVs), and Unmanned Underwater Vehicles (UUVs) significantly enhance the detection of dark vessels and expand surveillance coverage across dispersed maritime territories.

Theme 5. Implementation Constraints and Challenges

Despite technological advancements, the implementation of Risk-Based Defense Planning faces several structural challenges. The findings identify three dominant constraints: limited fiscal resources for defense modernization; dependence on imported defense technologies; and institutional fragmentation among military, maritime, and civilian agencies. Regional cooperation initiatives, including the Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA) and the Boe Declaration, partially mitigate these limitations by strengthening information sharing and maritime security cooperation among Indo-Pacific states.

2. Discussion

Theoretical Implications: Structural Realism and Neoliberalism

The findings reinforce the relevance of Structural Realism, which argues that states adapt their defense capabilities in response to changes in the external security environment. Indonesia's maritime defense modernization and the Philippines' adoption of CADC illustrate rational strategic responses to increasing geopolitical competition and maritime security uncertainty in the Indo-Pacific (Hudaya & Putra, 2018). At the same time, the importance of regional initiatives such as IPMDA demonstrates that Neoliberal Institutionalism also provides a valid explanatory perspective, as security enhancement increasingly depends upon institutional cooperation, information sharing, and collective burden-sharing mechanisms. Consequently, Risk-Based Defense Planning in archipelagic states should balance autonomous defense capability development with regional security collaboration.

Comparative Analysis with International Frameworks (NATO Risk-Based Framework for Strategic Planning)

The results are consistent with NATO's Risk-Based Framework for Strategic Planning (RBFSP), which integrates strategic risk assessment into long-term capability development and resource allocation (Hubler et al., 2022). Similar to the NATO approach, the proposed RBDP framework emphasizes systematic risk identification, capability prioritization, and adaptive decision-making under uncertainty. However, this study extends existing international frameworks by incorporating the distinctive characteristics of archipelagic states, including dispersed islands, extensive maritime jurisdictions, strategic sea lanes, and persistent maritime surveillance limitations (Ifaka et al., 2022). These geographical conditions require a stronger emphasis on maritime domain awareness, distributed force posture, and logistics resilience than conventional continental defense planning models.

Synthesis: An Integrated Risk-Based Defense Planning Framework for Archipelagic States

One of the principal contributions of this research is the development of an integrated Risk-Based Defense Planning framework specifically designed for archipelagic environments (Ifaka et al., 2022). The framework synthesizes five interrelated components: Strategic risk identification; structured risk prioritization through Fuzzy AHP-FMEA; capabilities-based planning; technology-enabled maritime domain awareness; and adaptive policy implementation supported by regional cooperation. Rather than treating these components independently, the proposed framework integrates them into a continuous decision-support cycle that enables defense planners to align strategic risks with capability development and resource allocation priorities.

Integration of Total Defense Mechanisms

The findings also demonstrate that effective Risk-Based Defense Planning requires the integration of military and non-military institutions within a Total Defense framework. Indonesia's Sishankamrata provides an institutional foundation for coordinating the Armed Forces, ministries, maritime agencies, law enforcement organizations, local governments, and strategic industries. Accordingly, Total Defense should be understood not merely as national mobilization but as an integrated governance mechanism combining strategic intelligence, interoperable technologies, inter-agency coordination, and evidence-based resource prioritization (Aslam, 2022). This broader interpretation strengthens national resilience against hybrid and multidimensional security threats.

Study Limitations and Implications

This study has several limitations. First, the comparative analysis is restricted to Indonesia and the Philippines, limiting the generalizability of the findings to other archipelagic states. Second, the study primarily relies on qualitative policy analysis and expert judgment, while the Fuzzy AHP-FMEA approach serves as a decision-support tool rather than a fully quantitative optimization model. Third, rapidly evolving defense technologies and geopolitical dynamics may influence future defense planning priorities beyond the temporal scope of this study. Despite these limitations, the study contributes both theoretically and practically by proposing a structured Risk-Based Defense Planning framework tailored to the unique security characteristics of archipelagic states (Bhumkar et al., 2025). The findings also provide practical guidance for policymakers in integrating strategic risk assessment, capability development, maritime surveillance technologies, and Total Defense mechanisms into future defense planning processes.

The application of the Multi-Criteria Decision-Making (MCDM) framework shows

that the integration of Fuzzy Analytic Hierarchy Process (Fuzzy AHP) and Failure Mode and Effects Analysis (FMEA) provides a systematic mechanism for assessing defense risks. Risk factors were evaluated according to severity, occurrence, and detection, while fuzzy logic was used to accommodate uncertainty in expert judgments. The prioritization process identified logistics delays, surveillance gaps, and detection failures as critical operational risks. The application of the Pareto Principle further indicated that a limited number of critical risks accounted for a substantial proportion of total defense risk exposure.

The findings also identify technology integration as a major component of maritime risk mitigation. Maritime Domain Awareness (MDA) systems integrate coastal radar, Automatic Identification System (AIS), and satellite-based surveillance to develop an integrated operational picture (Allodi & Massacci, 2017). The combination of Low Earth Orbit (LEO) satellites, Synthetic Aperture Radar (SAR), and AIS improves the identification of dark vessels, while UAVs, USVs, and UUVs expand surveillance coverage across geographically dispersed maritime areas. However, the findings reveal three major implementation constraints: limited fiscal capacity, dependence on foreign defense technologies, and institutional fragmentation between military and civilian maritime agencies (Maolana & Wicaksana Prakasa, 2023). Regional mechanisms, including the Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA) and the Boe Declaration, were also identified as supporting instruments for information sharing and regional maritime security cooperation.

D. Conclusions

Based on the comprehensive analysis, this study conclusively establishes that Risk-Based Defense Planning (RBDP) has become increasingly critical for archipelagic states like Indonesia and the Philippines, which face complex and uncertain security dynamics in the Indo-Pacific. Both nations have progressively shifted from internal security-oriented approaches toward active, maritime-centric territorial defense, reflected in the Comprehensive Archipelagic Defense Concept (CADC) and Indonesia's maritime defense orientation. The implementation of Fuzzy AHP-FMEA and Capabilities-Based Planning (CBP) provides a systematic basis for managing uncertainty, reducing subjectivity in risk assessment, and prioritizing limited defense resources according to strategic risk severity and likelihood. Effective RBDP requires transitioning from conventional threat-based approaches toward adaptive, risk- and capability-based decision-making, supported by technological integration particularly Maritime Domain Awareness (MDA) through LEO satellites, SAR, unmanned systems, and AI-based data fusion—to overcome sea blindness and surveillance limitations. Regional cooperation through burden-sharing, intelligence exchange, and capacity building remains essential, while Indonesia's Sishankamrata framework requires stronger inter-agency coordination and digital interoperability. However, limited fiscal capacity and dependence on foreign defense technologies remain major structural constraints, necessitating domestic defense industry

strengthening and long-term policy coherence. Practically, archipelagic states should institutionalize RBDP as a core framework for defense policy formulation, capability development, and resource allocation. Governments must prioritize integrated MDA investment, AI-based surveillance, and unmanned systems to reduce sea blindness. Indonesia requires stronger institutional coordination among TNI, Bakamla, ministries, and the domestic defense industry within the Sishankamrata framework. Multi-year defense financing, domestic technology development, and regional intelligence-sharing cooperation should be expanded, supported by an integrated national defense risk database and periodic assessments. For future research, it is recommended to expand RBDP application to a broader range of archipelagic states to test generalizability across diverse geopolitical contexts. Empirical validation through larger expert samples, operational scenarios, and longitudinal data is essential. Exploring AI, machine learning, digital twins, and predictive analytics for real-time risk assessment would advance dynamic defense planning. Comparative studies on military-civilian coordination, domestic defense industry resilience, and regional cooperation are also needed to develop a more adaptive, technologically integrated, and evidence-based RBDP model for future multidimensional and hybrid threats.

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