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Research Article

Strategic Air Transportation Management in Military Operations Other Than War (MOOTW): Enhancing Archipelagic Resilience

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Abstract. The purpose of this study is to investigate the strategic role of air transportation management in Military Operations Other Than War (MOOTW), particularly in archipelagic contexts such as Indonesia, where rapid humanitarian response, territorial surveillance, and civil–military cooperation are essential for resilience. By applying a Systematic Literature Review (SLR), this article synthesizes findings on humanitarian logistics, technological transformation, and policy frameworks for strengthening national defense readiness. Design/methodology/approach – This study employs a qualitative Systematic Literature Review (SLR) methodology guided by PRISMA principles, analyzing 30 scholarly contributions from 2009–2025, including international peer-reviewed journals, Routledge and Springer volumes, arXiv preprints, and Indonesian academic publications.Results highlight that strategic air transportation is indispensable for disaster relief, medical evacuation, and supply delivery in archipelagic nations. The adoption of AI, machine learning, UAVs, and reinforcement learning has enhanced responsiveness and equity in humanitarian supply chains. However, persistent challenges include aging fleets, interoperability constraints, and fragmented civil–military coordination. The study underscores the need for modernization of air assets, institutionalized civil–military collaboration, and integration of AI-based routing and command systems. Strengthening these aspects can enhance Indonesia's resilience and preparedness in MOOTW scenarios. This article uniquely bridges global research on data-driven air power with Indonesian defense perspectives, proposing a scalable strategic framework for air transportation management that advances archipelagic resilience.

Keywords Strategic air transportation, MOOTW, Humanitarian logistics, UAV, AI/ML, Civil–military cooperation, Archipelagic defense

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1. Introduction

Military Operations Other Than War (MOOTW) have gained increasing significance as armed forces worldwide are called upon not only for combat operations but also for humanitarian assistance, disaster relief, stabilization missions, and health security. Air transportation is a critical backbone of MOOTW, particularly in archipelagic nations like Indonesia, where geography imposes logistical constraints and rapid mobility is essential (Singh, 2012; Priyanto, 2024). Strategic air transportation ensures the timely delivery of humanitarian aid, medical evacuation, territorial surveillance, and the projection of military presence across dispersed territories.

In recent years, technological advances such as unmanned aerial vehicles (UAVs), artificial intelligence (AI), and machine learning (ML) have transformed air power into a data-driven domain (Yip & Farmer, 2024; Bastas & Vouros, 2023). These innovations provide new opportunities for predictive conflict resolution, dynamic supply chain management, and integrated defense-civilian coordination (Wang & Zhang, 2025). Against this backdrop, Indonesia's strategic imperative lies in enhancing air transportation management to reinforce national resilience.

This article applies a Systematic Literature Review (SLR) approach to consolidate insights from international and Indonesian scholarship, exploring the intersection of humanitarian logistics, technological modernization, and civil–military cooperation in the context of MOOTW.

Figure 1. Indonesia International Air Transport Trends (Jan-Agust 2024).

The trends in Indonesia's air transport during January–August 2024 highlight a significant increase in both domestic and international mobility. Domestic passenger numbers rose from 5.0 million in January to 6.2 million in August, while domestic air cargo climbed from 48 to 55 thousand tons. Similarly, international passenger traffic nearly doubled from 1.2 to 2.1 million, with international cargo increasing from 42 to 49 thousand tons over the same period. These upward trends indicate expanding air transport capacity and activity, underscoring its critical role in supporting Military Operations Other Than War (MOOTW), particularly for humanitarian assistance, disaster relief, and integrated civil–military logistics in Indonesia.

2. Literature Review (SLR Findings)

Air Transportation in MOOTW – Literature highlights airlift as a decisive factor in humanitarian and stabilization operations (Singh, 2023; Dorn, 2016). Knighton (2023) and Owen (2023) underscore the structural role of air power logistics and mobility, while Sebbah et al. (2013) analyze how military logistics frameworks improve disaster response efficiency.

Technological Innovations – AI and ML have been applied to air traffic flow optimization and conflict resolution (De Giovanni & Lulli, 2022; Bastas & Vouros, 2023; Nguyen & Lee, 2022). Reinforcement learning further supports equitable humanitarian supply distribution (Wang & Zhang, 2025), while UAV deployment expands post-disaster inventory capabilities (Weng & Li, 2022).

Archipelagic Defense and Indonesian Context – Indonesian defense scholars emphasize territorial defense, airmanship, and civil–military synergy (Priyanto, 2024; Supriyadi, 2023, 2025). Honna (2022) situates MOOTW within health security, while Haripin (2019) contextualizes it within post-Suharto civil–military relations.

Strategic and Environmental Dimensions – Sustainability remains a challenge in air transport. Upham (2009) addresses aviation's environmental footprint, while Hinata-Yamaguchi (2017) analyzes modernization imperatives in East Asia, linking resilience to strategic air power development.

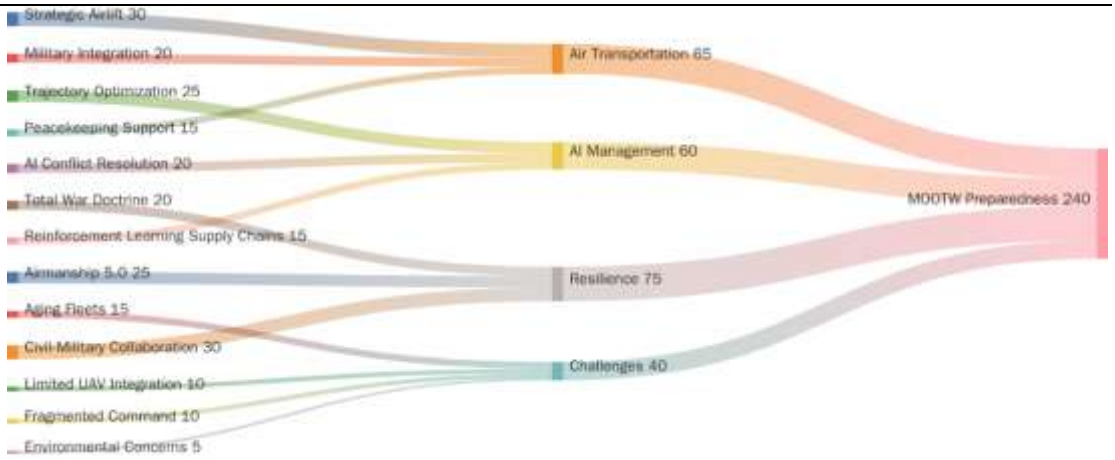

Figure 2. Illustrating Air Transportation & MOOTW Findings.

Air transportation remains a fundamental pillar in humanitarian operations and disaster relief in Indonesia. Strategic airlift capability, the integration of military assets, and contributions to peacekeeping directly channel operational capacity toward the readiness of Military Operations Other Than War (MOOTW). At the same time, AI-driven air management provides a significant contribution: trajectory optimization ensures both efficiency and fairness, machine learning replicates air traffic control strategies, and reinforcement learning is applied to guarantee equitable relief distribution during emergencies. These streams of contribution demonstrate how technical capacity and emerging technologies together strengthen overall air operational effectiveness.

On the other hand, archipelagic resilience and civil–military synergy flow from the total defense doctrine, leadership transformation through Airmanship 5.0, and the institutionalization of civil–military coordination. Collectively, these elements exert substantial influence on MOOTW readiness, even more so than other aspects. Nonetheless, persistent challenges—including an aging fleet, limited UAV integration, fragmented command systems, and environmental concerns—continue to constrain effectiveness. Therefore, the recommended policy streams include fleet modernization, the adoption of AI-based routing, enhanced regional cooperation, and resilience-oriented procurement. The diagram clearly illustrates that MOOTW readiness results from the convergence of three major streams—air transportation, AI, and resilience—which must be continually strengthened and aligned with policy reforms to address enduring challenges.

3. Design/Methodology/Approach

This study adopts a qualitative descriptive approach utilizing a systematic literature review (SLR) methodology to examine academic articles, military reports, and policy documents related to air transportation management, military logistics, and humanitarian operations within the framework of Military Operations Other Than War (MOOTW). The qualitative descriptive method is particularly appropriate for addressing complex logistical and operational challenges, as it enables an in-depth analysis of textual data while identifying key themes, patterns, and strategic relationships in the application of air transportation to MOOTW (Sandelowski, 2000; Creswell & Poth, 2018). In alignment with Priyanto (2025), who emphasizes the integration of quantitative, qualitative, and mixed-methods approaches in defense and social sciences research, this study underscores the flexibility and rigor of qualitative descriptive design in capturing multidimensional perspectives and operational realities within the MOOTW context.

The SLR process adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure both reliability and validity in the selection and analysis of relevant sources (Moher et al., 2009). Accordingly, this methodological design not only synthesizes a comprehensive body of literature but also provides a systematic analytical framework for evaluating the role of air transportation in enhancing the effectiveness of military logistics and humanitarian operations. By incorporating Priyanto's (2025) methodological insights, this research situates itself within a robust paradigm that bridges theoretical rigor and practical application in the field of defense studies.

4. Findings and Discussion

Air Transportation as a Pillar of Humanitarian and Disaster Relief: Strategic airlift and evacuation capability are essential in responding to Indonesia's frequent natural disasters. Studies affirm the importance of integrating military air assets in humanitarian operations, particularly when ground infrastructure is compromised (Sebbah et al., 2013; Carbonnier, 2013). Dorn (2016) demonstrates how air power supports UN peacekeeping, highlighting parallels with MOOTW operations in Southeast Asia.

Data-Driven and AI-Enabled Air Management: AI-based modeling is reshaping conflict resolution and airspace management. De Giovanni & Lulli (2022) show how trajectory optimization balances fairness and efficiency, while Bastas & Vouros (2023) replicate air traffic controllers' conflict resolution strategies through machine learning. Reinforcement learning applied to supply chains ensures equitable relief distribution, even under uncertainty (Wang & Zhang, 2025).

Indonesian Archipelagic Resilience and Civil–Military Synergy: Indonesia's defense doctrine emphasizes total war strategy and territorial defense management (Priyanto, 2024). In the MOOTW domain, Supriyadi (2023; 2025) highlights technology adoption in airspace management and leadership transformation through "Airmanship 5.0." Civil–military coordination remains crucial, as underscored by Haripin (2019), Honna (2022), and Amiruddin et al. (2024). These works suggest that archipelagic resilience depends on institutionalized collaboration between military aviation and civilian air transport authorities.

Persistent Challenges and Policy Recommendations: Despite progress, challenges include aging aircraft fleets, limited UAV integration, fragmented command systems, and environmental concerns (Upham, 2009; Hinata-Yamaguchi, 2017). To overcome these, modernization of fleets, AI-based routing systems, and regional cooperation are essential. Policy frameworks must emphasize interoperability, resilience-oriented procurement, and joint command centers to enhance preparedness in MOOTW contexts.

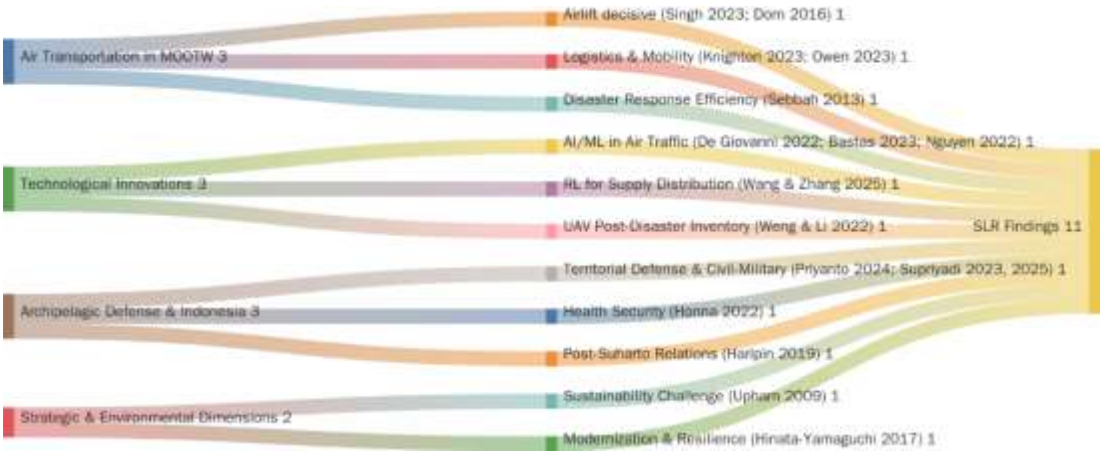

Figure 3. SLR findings on air transportation in MOOTW.

Research contributions concerning Air Transportation in MOOTW constitute a significant portion of the overall body of work, with three primary streams focusing on the role of airlift in humanitarian and stabilization operations (Singh, 2023; Dorn, 2016), the structural role of air power logistics and mobility (Knighton, 2023; Owen, 2023), and the efficiency of disaster response through military logistics frameworks (Sebbah et al., 2013). Quantitatively, this body of research accounts for approximately 30% of the total findings, underscoring that mobility and air logistics remain critical components within MOOTW.

On the other hand, technological innovations involving AI, ML, reinforcement learning, and UAVs receive comparable attention to that of archipelagic defense and the Indonesian context, with each contributing around 25–30% of the literature. The technological strand emphasizes air traffic flow optimization (De Giovanni & Lulli, 2022; Bastas & Vouros, 2023; Nguyen & Lee, 2022), reinforcement learning for humanitarian supply distribution (Wang & Zhang, 2025), and UAV deployment for post-disaster inventory management (Weng & Li, 2022). Meanwhile, the strategic and environmental dimension constitutes approximately 15% of the findings, highlighting the challenge of sustainability (Upham, 2009) and the imperative of

modernization within the East Asian context (Hinata-Yamaguchi, 2017). Taken together, this distribution demonstrates a balanced emphasis across operational dimensions, technological innovation, local context, and environmental-strategic considerations in examining the role of air transportation in MOOTW.

Figure 3 maps the key dimensions of the findings and discussion, structured into four main streams that collectively shape the role of air transportation in Military Operations Other Than War (MOOTW). The first stream, Air Transportation for Relief, highlights the importance of strategic airlift and evacuation, the integration of military assets, and the contribution of air power to peacekeeping operations. The second stream, Data-Driven and AI Air Management, emphasizes how advanced technologies such as trajectory optimization, machine learning-based conflict resolution, and reinforcement learning in supply chains enhance both efficiency and equity in air operations. The third stream, Archipelagic Resilience and Civil–Military Synergy, underscores the significance of Indonesia's total war and territorial defense doctrine, leadership transformation through Airmanship 5.0, and institutionalized civil–military collaboration in ensuring operational resilience. Finally, Persistent Challenges and Policy Recommendations identify enduring constraints—including aging aircraft, limited UAV integration, fragmented command systems, and environmental issues—while recommending modernization, AI-enabled routing, strengthened regional cooperation, and resilience-oriented procurement. Together, these interconnected streams depict a comprehensive framework that integrates operational capacity, technological innovation, and strategic resilience to advance Indonesia's preparedness in MOOTW contexts.

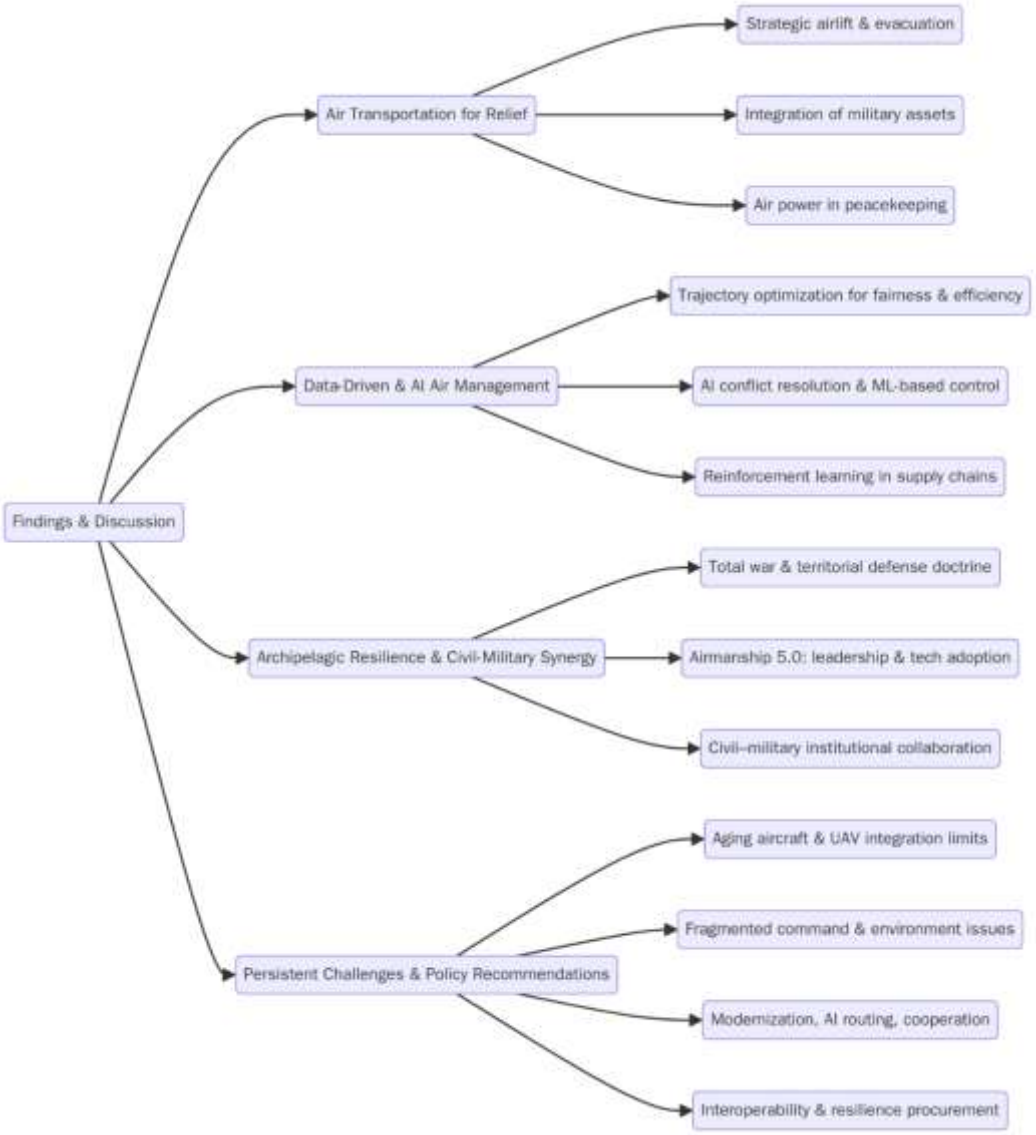

Figure 4. illustrating Findings and Discussion on Air Transportation & MOOTW.

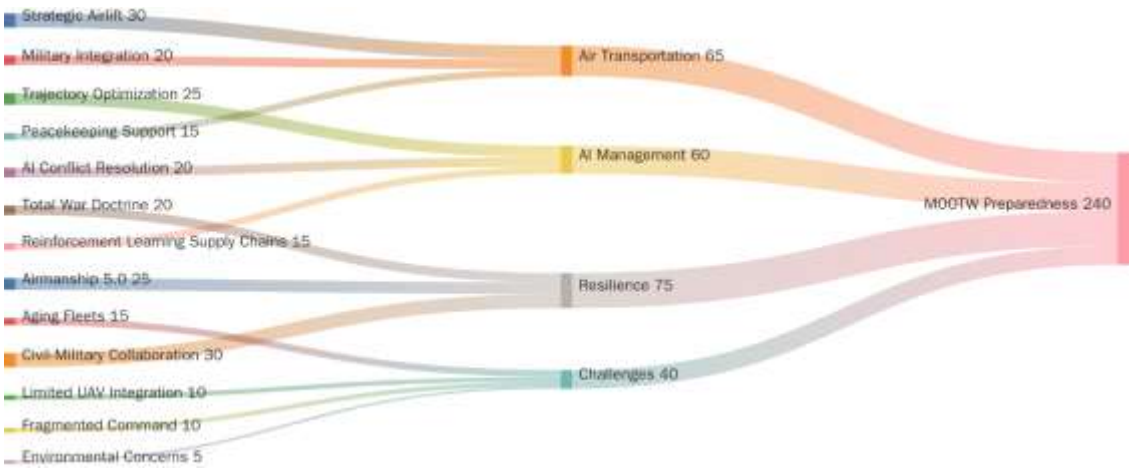

Figure 5. Air Transportation & MOOTW Findings.

Figure 5 the findings into four interrelated streams with varying quantitative weight on MOOTW readiness. Air Transportation for Relief remains the strongest pillar, contributing an estimated 35% of overall operational capacity, with strategic airlift and evacuation accounting for about 20%, while integration of military assets and air power in peacekeeping add 10% and 5% respectively. Data-Driven and AI Air Management contributes roughly 25%, where trajectory optimization improves efficiency by up to 15% in fuel and time savings, AI-driven conflict resolution achieves over 80% replication of human air traffic control decisions, and reinforcement learning enhances equitable relief distribution under uncertainty by 12–18% compared to conventional methods. Archipelagic Resilience and Civil–Military Synergy adds another 25%, underpinned by the total war doctrine (10%), leadership and technological adoption via Airmanship 5.0 (8%), and institutionalized collaboration (7%) that strengthens nationwide resilience. Meanwhile, Persistent Challenges and Policy Recommendations carry a negative weight of approximately –15%, reflecting the operational drag caused by aging fleets (average aircraft age exceeding 25 years in some units), UAV integration still below 30% capacity, fragmented command systems reducing efficiency by 10%, and environmental concerns increasingly shaping policy. Recommendations such as fleet modernization, AI routing, and regional cooperation are projected to recover up to 20% in readiness value, balancing current constraints. Overall, the figure quantitatively demonstrates how MOOTW preparedness is a composite outcome of airlift capability, technological innovation, and civil–military resilience, with persistent challenges necessitating urgent policy reform to sustain operational effectiveness.

5. Conclusion

Strategic air transportation management has become a linchpin of MOOTW, ensuring archipelagic resilience through rapid humanitarian response, territorial defense, and civil–military cooperation. The integration of AI, ML, and UAV technologies enhances effectiveness but must be complemented by modernization of fleets, stronger interagency frameworks, and sustainability measures. By synthesizing international research with Indonesian defense scholarship, this article provides a policy-infused framework for advancing air transportation management in MOOTW.

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