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Conference Paper

ROLE OF TECHNOLOGY TO SUPPORT SUSTAINABLE MARITIME INDUSTRY

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Abstract.

The maritime industry is essential in global trade, with over 11 billion tonnes of goods transported annually by more than 50,000 merchant vessels. Despite rapid technological advancements, maritime security operations continue to face persistent challenges such as fragmented command structures, weak inter-agency coordination, outdated systems, and cybersecurity vulnerabilities. This study applies a qualitative content analysis to examine how interoperable technologies, specifically the Maritime Interoperability Management System (MIMS S2), Universal Link System (ULS), and System Interoperability Kodal, enhance operational effectiveness and situational awareness. Drawing from official product documentation, defence interoperability reports, and regional case studies, the findings reveal how integrated command and control systems improve real-time data sharing, strengthen joint operations, and support both military and civilian maritime agencies. The study also highlights the importance of long-term capacity building, demonstrating that the combination of advanced technologies and institutional readiness forms a scalable model for managing contemporary maritime security challenges.

Keywords: capacity building, command and control systems, defence technology integration, maritime security.

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Introduction

The maritime industry stands as a vital pillar of global trade, responsible for transporting over 11 billion tonnes of goods each year, nearly 90% of global commerce (1,2). With a fleet of more than 50,000 merchant vessels in operation, the sector continues to evolve through technological innovation to improve safety, security, and operational efficiency. Despite these innovations, structural and organizational challenges persist (1,3). Fragmented command structures, inadequate inter-agency communication, outdated systems, jurisdictional overlaps, cybersecurity vulnerabilities, and insufficient training frequently undermine effective maritime security responses (4). Managing these systemic weaknesses is essential to realizing the full potential of emerging technologies in safeguarding global maritime domains.

Literature Review

Theoretical Studies

Maritime security encompasses a broad and multifaceted framework that extends beyond conventional naval defense (4,5). The framework covers the protection of maritime borders, the prevention of illegal activities at sea, and the safeguarding of maritime infrastructure and trade routes. The complexity of this domain requires a coordinated approach that integrates legal, operational, and technological dimensions (6). The theoretical foundation of maritime security thus rests on the interaction between human systems and intelligent technologies. This approach emphasizes not only the deployment of tools but also the institutional readiness to adopt, integrate, and coordinate these technologies effectively. Without cohesive structures and clear inter-agency communication, the full benefits of technological innovation in maritime security remain unrealized (7).

Methods

This study adopts a qualitative content analysis approach, defined as a research method for generating replicable and valid interpretations from textual data (8,9). The analysis focuses on official product documentation, defence interoperability reports, industry presentations, and case studies related to integrated maritime security systems. The data sources of the study are gathered from publicly available records from defence technology providers, institutional briefings, and peer-reviewed publications released over the past ten years, with an emphasis on maritime security, inter-agency coordination, and technological innovation in Southeast Asia. The unit of analysis centres on the operational deployment and effectiveness of systems such as MIMS S2, ULS, and the System Interoperability Kodal within joint maritime frameworks. Data reliability was strengthened through

triangulation across technical documentation, operational case evidence, and secondary academic sources.

Results and Discussion

The deployment of integrated command and control systems has significantly improved coordination and real-time data sharing in maritime security operations (4). Systems such as the Maritime Interoperability Management System (MIMS S2) and Universal Link System (ULS) enhance situational awareness by fusing data from multiple platforms, enabling faster and more accurate responses. ULS, for example, allows tactical units to share real-time information across agencies, ensuring that maritime incidents can be mitigate promptly and efficiently.

In Indonesia, the System Interoperability Kodal has strengthened joint operations between the Armed Forces and the Ministry of Defence (4,10). By facilitating seamless communication across the Army, Navy, and Air Force, these systems support a network-centric approach to warfare. MIMS C2 and ULS, installed at TNI headquarters, synthesize tactical information into a unified operational picture, improving decision-making and reducing fragmentation across command structures.

Surveillance operations in key areas such as the Natuna Sea have benefited from the integration of sensors, including radars, UAVs, and satellites, into a single tactical network (4). These systems not only maintain strong cybersecurity standards but also extend their functionality to civilian maritime agencies such as the Coast Guard and marine police. This adaptability ensures broader operational coverage across military and non-military domains.

Beyond Indonesia, operational results from systems like MIMS Naval and MIMS Ranger, used by the Hellenic Armed Forces, further validate the impact of modular mission systems on maritime and special operations (4). These platforms enable secure, long-range data exchange and coordinated responses, even in remote or contested environments. MIMS Airborne complements these capabilities by equipping maritime patrol aircraft with sensor integration for both anti-submarine and anti-surface warfare.

The broader strategy focuses not only on technology integration but also on building long-term national capacity (4). By supporting local defence industries and offering personnel training, the approach ensures that client nations can maintain and evolve their own maritime security capabilities. This combination of interoperable systems, real-time data exchange, and capacity development presents a scalable model for strengthening maritime security in an increasingly complex threat landscape.

Conclusion

The integration of advanced, interoperable command and control systems, such as MIMS S2, ULS, and the System Interoperability Kodal, has proven effective in managing key challenges in maritime security, including fragmented communication, slow response times, and limited situational awareness. These systems enable real-time data sharing across military and civilian agencies, enhance coordination, and support joint operations through centralized tactical intelligence. Their adaptability across domains, combined with strong cybersecurity and capacity-building efforts, demonstrates a scalable and sustainable approach to strengthening maritime security in both national and regional levels.

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