

Critical Role of Maritime Infrastructure in Indonesian Defense Logistics Management towards the World Maritime Axis

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Abstract

Indonesia has ambitious goals to become a global maritime axis by harnessing its potential maritime resources. Maritime infrastructure and defense logistics management are crucial factors in achieving this objective. Strong maritime infrastructure supports defense logistics, troop mobility, and readiness in facing threats. As the largest archipelagic nation, Indonesia must overcome funding challenges and the complexity of maritime infrastructure development. Defense logistics management requires modern ports and efficient supply chains. Security challenges must also be addressed to safeguard strategic facilities and respond to threats. Maritime infrastructure also impacts economic growth. This study analyzes the role of maritime infrastructure in defense logistics management, identifies challenges, and considers the use of floating concrete as a solution. A Systematic Literature Review method is employed to gather literature. Challenges encompass geographical, financial, technical, regulatory, and environmental aspects. Strategies involving increased investment, long-term planning, coordination, security, and human resource development are needed. Floating concrete technology is proposed to strengthen maritime infrastructure and support the vision of a Global Maritime Axis. The success of defense logistics management and the maritime axis requires strategic collaboration and the implementation of appropriate solutions.

Keywords : *Maritime Infrastructure, defense logistics management, Global Maritime Axis, floating concrete.*

INTRODUCTION

Indonesia, as a nation surrounded by oceans and abundant marine resources, has an ambitious goal to position itself as a global maritime axis. In order to achieve this objective, the role of Maritime Infrastructure and defense logistics management becomes crucial. A robust and efficient Maritime Infrastructure serves as the foundation for the desired global maritime axis strategy of Indonesia (Anwar, 2018). This infrastructure plays a central role in supporting national defense logistics, securing maritime territories, facilitating troop and equipment mobility, and enhancing readiness to face emergencies and security threats.

As the world's largest archipelagic nation, Indonesia holds significant potential in utilizing the seas as vital trade routes. However, the development of adequate Maritime Infrastructure to support defense logistics cannot be neglected given the complexity of challenges. One of the main challenges is funding. Constructing strong and modern Maritime Infrastructure requires substantial investment, both in the initial development phase and for sustainable maintenance (Subekti, n.d.). Therefore, the government must allocate sufficient resources and seek potential investment partners to support the necessary Maritime Infrastructure projects.

In Japan, the implementation of floating concrete technology becomes an interesting innovation to enhance Maritime Infrastructure (Isobe, 1999). This technology can be used to build more flexible docks and naval bases, especially in areas with challenging marine topography. The application of floating concrete can reduce construction costs and expedite the infrastructure development process along Japan's coastline bordering the ocean. By leveraging

floating concrete technology, Japan can enhance its maritime defense readiness while optimizing the use of available resources and budgets. This could serve as inspiration for Indonesia to explore similar innovations in its efforts to strengthen Maritime Infrastructure.

In the context of defense logistics management, efficient and effective supply chain management plays a crucial role. Modern ports with advanced loading and unloading facilities and other supporting infrastructure will streamline the transportation and distribution processes of goods, both domestically and internationally. This will have a positive impact on the timing of supplying military inventory and equipment to strategic locations across Indonesia (Sulistiyono, 2018). Reliable Maritime Infrastructure will also optimize the use of defense assets, including warships and naval air bases, thereby enhancing military presence in strategic areas. The development of Maritime Infrastructure is not exempt from security challenges. In the face of increasingly complex maritime security threats, safeguarding strategic facilities such as ports and military bases becomes imperative (Connelly, 2015). Adequate Maritime Infrastructure development will allow Indonesia to intensify maritime patrol and surveillance operations to prevent arms smuggling and other illicit activities, and to effectively respond to various threats in national waters (Ali et al., 2021).

Beyond its strategic benefits for defense, strong Maritime Infrastructure will also support Indonesia's economic growth. With reliable infrastructure, Indonesia can strengthen maritime connectivity through more efficient international trade routes (Anwar, 2018). Modern ports and integrated logistics systems will enhance the flow of goods and vessels in Indonesian waters, thereby positively impacting the national economy (Ksatrya, 2019). The aim of this research is to analyze the role of Maritime Infrastructure in supporting the effectiveness of Indonesia's defense logistics management, identify key challenges in maritime infrastructure development, and analyze the potential use of floating concrete technology as a solution. This research is expected to make a valuable contribution to developing a strong and sustainable Indonesian maritime axis strategy.

RESEARCH METHODS

The literature review in this research employs the Systematic Literature Review (SLR) method. The Systematic Literature Review (SLR) method is a systematic and structured approach to compile and analyze literature relevant to a specific research topic or research question. This method is designed to provide a comprehensive and objective overview of the existing literature, while considering rigorous research standards. (Purnomo & Usman Husaini, 2008). Literature search is conducted using relevant keywords related to the research question. The keywords used are Maritime Infrastructure, defense logistics management, world maritime axis, floating concrete. Article searches are conducted in both English and Indonesian languages, utilizing data obtained from journals and research articles from the years 2011 to 2023. The authors conducted data source searches across various databases, including the use of Google Scholar and Sciedirect.

RESULT AND DISCUSSION

Schematic or Diagram (PRISMA)

Chart 1 describes the article selection using the Preferred Reporting Systematic Reviews and Meta-analysis (PRISMA) guidelines. From the initial search, 70 articles from 2011-2023 were found. After the screening process, 7 articles were selected. Subsequently, these 7 articles were evaluated and synthesized in the final report of the literature review.

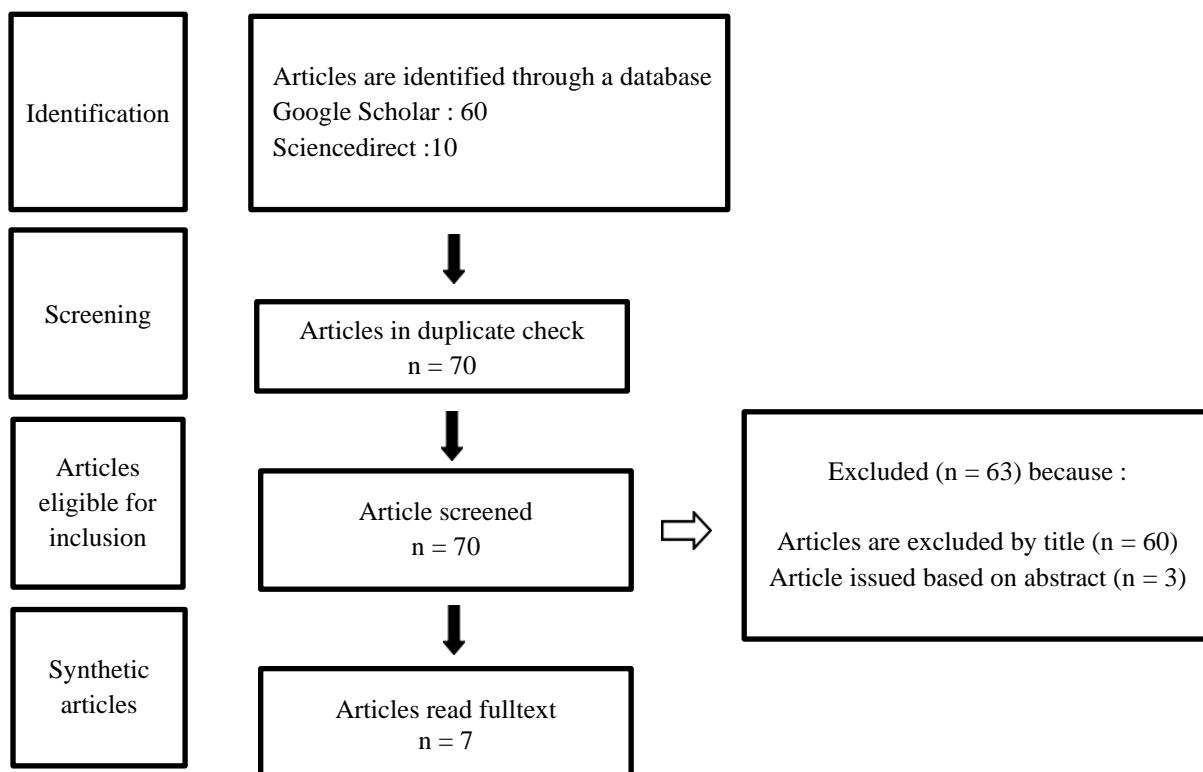


Chart 1. PRISMA Diagram

The researchers conducted a selection process on the obtained articles and performed data extraction on each article acquired from each database. The results of the articles were reviewed regarding the critical role of Maritime Infrastructure in Indonesian defense logistics management towards the world maritime axis.

Table 1. Articles Related to the critical role of Maritime Infrastructure in Indonesian defense logistics management towards the world maritime axis

Title and Researchers	Purpose	Result
Pengelolaan Kemaritiman Menuju Indonesia sebagai Poros Maritim Dunia (Kadar, 2015)	To reexamine Bakamla's position in Indonesia's maritime security management as a path towards the world's maritime axis.	The main constraint in maritime affairs is the lack of infrastructure that needs to be improved by the government. Good infrastructure will enhance services and improvements are also needed in the law enforcement system through strengthening competent institutions at sea. With adequate infrastructure and a strong legal enforcement system, Indonesia's maritime sector can develop and realize the aspirations of becoming a global maritime axis.
Peran Kemaritiman Indonesia Di Mata Dunia (Ismail & Kartika, 2019)	To understand the maritime role on the World Stage through a vision to address our maritime issues, such	Every state institution must have a vision and mission outlined in maritime and marine policies. This will impact various aspects such as the economy, politics, socio-culture, law, defense, and security. Therefore, the maritime and marine sector becomes the main focus in national

	as security and economic challenges.	development. Indonesia remains committed to becoming a global maritime axis in order to strengthen Indonesia's maritime role in the world.
Indonesian National Power to Achieve the Global Maritime Fulcrum (Saragih et al., 2018)	To describe Indonesia's national strength, which has significant potential to become the world's maritime axis.	To make Indonesia a global maritime axis, the modernization of port systems according to international standards is necessary. This will ease port access for international shipping and enhance services in accordance with international standards. To realize Indonesia's dream of becoming the Global Maritime Axis, the fulfillment of the 5 Pillars is required, especially in maritime economy and naval defense to uphold sovereignty. Indonesia's favorable geopolitical, geostrategic, and demographic conditions, coupled with abundant natural resources, create a significant potential for achieving GMF.
Pengembangan Infrastruktur Pelabuhan Dalam Mendukung Pembangunan Berkelanjutan (Adris.A.Putra & Djalante, 2011)	To analyze the port infrastructure and formulate port development strategies.	The research results indicate that the Bungkutoko Kendari Port needs to improve its operations. The average docking time for ships is 36.48 hours, and the average stay time is 85.41 hours. The utilization of the docks is only 56.50%, and the warehouses/fields are underutilized due to truck issues. An additional container dock is needed. Container transportation is slow, causing dissatisfaction among the community regarding ship arrival times and commodity distribution. The docks and fields are critical due to the increasing maritime transportation traffic over the past 5 years. Development should encompass infrastructure, government investment, capacity, and improved road access.
Kebijakan Maritim Dalam Mewujudkan Negara Kesatuan Republik Indonesia Sebagai Poros Maritim Dunia (Pangemanan, 2019)	To realize Indonesia as a global maritime axis, we need to understand the maritime policies and law enforcement that support it.	Indonesia's maritime policy aims to realize the vision and mission of the maritime sector with key principles such as the archipelagic outlook, sustainable development, blue economy, integrated management, participation, equality, and equitable distribution. The pillars of this policy encompass the management of maritime resources, defense, security, law enforcement, maritime governance and institutions, maritime economy and infrastructure, welfare, marine environmental management, maritime culture, and diplomacy. The law supports these policies in making Indonesia the world's maritime axis through defense, security, law enforcement, and enhanced maritime safety.
Peran TNI AL Dalam Mendukung	To discuss the role of the Indonesian Navy	The Indonesian Navy (TNI AL) supports the World Maritime Axis through its conventional,

Terwujudnya Indonesia Sebagai Poros Maritim Dunia Perspektif Manajemen Pertahanan (Haras, 2017)	in realizing the World Maritime Axis.	non-conventional, and diplomatic roles. In the contemporary context, TNI AL also plays a role through Maritime Security Operations (OMSP). The main challenges include budget, personnel, and defense equipment. However, TNI AL remains a key force for the fifth pillar of the World Maritime Axis. Cooperation with foreign Navies supports its role in realizing that vision.
Industri Pertahanan Indonesia Dalam Membangun Kekuatan Maritim Nasional (Herbanu & Soediantono, 2018)	To explain that Indonesia's maritime defense can be built through the intensification of various aspects related to the fulfillment of national maritime strength elements towards the global maritime sphere.	Indonesia, which possesses an extensive maritime territory, needs to focus on maritime defense to ensure its territorial sovereignty and positive image on the global stage. The development of the maritime defense industry becomes crucial in this objective, involving the expansion of maritime infrastructure and the enhancement of human resources related to the maritime sector. This will support Indonesia's vision as the World Maritime Axis and build a sustainable maritime defense capability.

Source : Data Processed by Researchers, 2023

The Role of Maritime Infrastructure in Indonesia's Defense Logistics Management towards Achieving the Vision of Becoming the World Maritime Axis

Maritime infrastructure plays a crucial role in realizing Indonesia's vision as the World Maritime Axis and in managing defense logistics. In this context, efficient and reliable maritime infrastructure will provide vital support for the smooth procurement, management, and distribution of defense logistics resources across the vast Indonesian waters. With modern ports, docks, and advanced supporting facilities, this infrastructure will facilitate various logistic activities quickly and timely, ultimately maintaining readiness and reliability in national defense. Furthermore, the presence of optimal maritime infrastructure will drive fast mobility in deploying troops, equipment, and military weaponry, effectively addressing security challenges in Indonesia's maritime region. Additionally, superior and efficient maritime infrastructure will have a positive impact on building Indonesia's image as the World Maritime Axis, actively participating in the international maritime network and becoming a center of economic and security activities across global waters. Achieving this vision requires concrete efforts. Hence, the sustainable development of maritime infrastructure, port modernization, improved maritime accessibility, and enhanced logistic capacity are unavoidable priority steps. All stakeholders, including the government and relevant interest groups, need to commit to making this a primary agenda (Thacker et al., 2019).

In a broader context, the Vision of the World Maritime Axis represents a determination to maximize maritime potential and enhance connectivity in the Indo-Pacific region. Economically, this vision creates new opportunities for countries in the region to stimulate economic growth through trade cooperation, investment, and maritime industry development. However, the geopolitical impacts cannot be ignored; they may intensify economic competition, potentially leading to tensions and influencing regional economic dynamics. From a political perspective, the World Maritime Axis aims to strengthen political relations and diplomacy in the region, with the hope that closer political cooperation will help maintain stability and security. Yet, it's important to realize that forming new political alliances or strengthening existing ones can also alter regional political dynamics and shift existing power balances. In terms of the

military aspect, the vision emphasizes the need for a strong and controlled military presence in key maritime trade routes. However, it should be noted that increasing military capabilities and presence could potentially escalate tensions and raise the risk of military conflicts in the region. To determine whether the Vision of the World Maritime Axis is an appropriate geopolitical strategy, a deep analysis of the complex dynamics involving politics, economics, and the military is necessary. The geopolitical impact should also be further studied to understand its long-term implications in the face of geopolitical changes in the current and future Indo-Pacific region (Radjendra et al., 2022).

Nonetheless, challenges arise that can affect the achievement of the vision to become the World Maritime Axis by developing maritime infrastructure. Despite these challenges, through the implementation of proper strategies and policies, Indonesia can strengthen its maritime infrastructure to support defense logistics management and bolster its role as a reliable and influential world maritime axis. These strategies and policies need to be carefully designed to overcome obstacles such as insufficient investment, ineffective management and operationalization, as well as security challenges. By possessing strong, integrated, and secure maritime infrastructure, Indonesia can optimize the potential of maritime infrastructure to achieve the goal of becoming a world maritime axis. This will enhance efficiency in defense logistics management and simultaneously reinforce sovereignty and presence across the maritime regions worldwide (Santoso & Nafisah, 2018).

The existing maritime infrastructure in Indonesia plays a key role in supporting defense logistics management and Indonesia's vision as the world maritime axis. Therefore, it's crucial to ensure that port infrastructure, docks, maritime transport networks, and related communication infrastructure operate effectively and optimally (Ismail & Kartika, 2019). Challenges in developing and maintaining maritime infrastructure must be overcome through intelligent investment efforts, sound strategic planning, and enhanced effective coordination. With robust and efficient maritime infrastructure, Indonesia can strengthen defense logistics management and act as a reliable and influential world maritime axis.

The success of defense logistics management heavily depends on adequate maritime infrastructure security

The success of defense logistics management heavily depends on adequate maritime infrastructure security. These challenges directly impact the smoothness of defense logistics operations and Indonesia's achievement of its vision as a world maritime axis. To address these challenges, increased investment, comprehensive long-term planning, improved management and operations, as well as enhanced maritime infrastructure security are needed. In facing these challenges, cooperation and coordination among the government, private sector, and academia are of utmost importance. The synergy in strategic maritime infrastructure development will help overcome the existing challenges and drive progress in Indonesia's defense logistics management. To strengthen maritime infrastructure to support defense logistics management and propel Indonesia as a world maritime axis, several effective strategies and policies need to be implemented. These strategies are expected to address existing challenges and optimize the potential of maritime infrastructure (Mustari et al., 2018). Some worthy strategies and policies to consider include:

1) Increased Investment

Efforts to boost investment in the development, maintenance, and enhancement of maritime infrastructure are crucial steps. The Indonesian government should allocate sufficient funds to improve and build port infrastructure, docks, maritime transport networks, and communication infrastructure related to defense logistics management. The utilization of maritime transportation can support the development of the national logistics system and improve logistic services (Kundori, 2023). Adequate investment will ensure that maritime

infrastructure possesses the capacity and capability to handle the demands of complex defense logistics.

2) Comprehensive Long-Term Planning

Comprehensive long-term planning is essential to ensure the development of integrated and sustainable maritime infrastructure. This planning must consider the growth of defense logistics needs in the future, the development of new technologies, and changes in the global environment. Involving various stakeholders, such as the government, navy, defense industry, and private sector, is important in this planning (Chadhafi, 2021).

3) Enhanced Interagency Coordination

Effective coordination between the central government, local government, Indonesian Navy (TNI Angkatan Laut), and other relevant agencies plays a crucial role. Good coordination ensures alignment in the development, maintenance, and management of maritime infrastructure. Furthermore, coordination enables efficient information exchange, quick decision-making, and effective problem-solving.

4) Improved Security

Maritime infrastructure security must be a top priority. Strategies and policies focused on enhancing security in waters, ports, docks, shipping lanes, and other strategic facilities are needed. Security efforts should include strengthening surveillance, enhancing security systems, personnel training, and international cooperation to counteract threats like terrorism, piracy, and other maritime crimes (Al Syahrin, 2018).

5) Enhanced Human Resource Capacity

Enhancing human resource capacity in defense logistics management and maritime infrastructure is of utmost importance. Providing relevant training and education is necessary to improve understanding and skills in planning, building, operating, and maintaining maritime infrastructure. Quality human resources will play a crucial role in ensuring the smoothness of defense logistics operations and maximizing the potential of maritime infrastructure..

Floating Concrete as an Effective Solution to Strengthen Maritime Infrastructure and Indonesia's Defense Logistics Management towards the World Maritime Axis

In the world of construction, concrete is a frequently used material (Hamdi et al., 2022). This is due to its relatively low production cost while possessing high compressive strength. One type of concrete that garners attention is lightweight concrete, a special type of concrete with a density lower than water, allowing it to float on the water's surface (Hazairin et al., 2021). The structural advantages and versatility in form make lightweight concrete an intriguing alternative in maritime infrastructure development. These benefits can be tailored to various forms through precast techniques (Handayani, 2020). Its easier mobility also adds value to the construction process. As a result, lightweight concrete becomes an ideal choice in efficient maritime structure construction.

Infrastructure plays a crucial role in strengthening national defense and security (BPIW Ministry of Public Works and Housing, 2017). Despite the utilization of lightweight concrete technology in international defense contexts, Indonesia has not fully harnessed it, and research on lightweight concrete remains limited (Sekarningtyas et al., 2022). In World War II, lightweight concrete technology was employed in Europe, especially during the 1944 Operation Neptune or D-Day Operation (Schofield, 2001). The ambitious Mulberry Harbour project involved the use of floating concrete and pontoon bridges to construct emergency harbors on the Normandy coast in France (Blockley, 2020). The aim was to facilitate the rapid and secure landing of Allied forces and military equipment in areas lacking adequate harbor infrastructure. The use of lightweight concrete in the Mulberry Harbour project serves as a foundation for developing the potential of this technology to support Indonesia's national defense self-reliance in the maritime sector. Several potential applications include artificial island construction

(Maldives FC, 2023), offshore military bases, tactical airstrips in water bodies, tactical docks, and other maritime defense structures (Kim et al., 2016). The advantages of lightweight concrete will enhance Indonesia's defense capabilities against maritime threats and provide flexibility in supply chain management, particularly if used for defense industries like floating islands, factories, or warehouses. The flexibility of lightweight concrete allows these industrial factories or warehouses to be relocated as needed, providing adaptability in the face of changing conditions or potential threats. Lightweight concrete technology offers a significant contribution to Indonesia's maritime defense and security, as well as economic potential through local industry development. With proper implementation, lightweight concrete can realize Indonesia's vision as the World Maritime Axis.

CONCLUSION

From the above discussion, it can be concluded that maritime infrastructure plays a central role in realizing Indonesia's vision as the World Maritime Axis and in managing defense logistics. Efficient and reliable maritime infrastructure will support the smooth procurement, management, and distribution of defense logistics resources across Indonesia's waterways. With modern ports, docks, and advanced supporting facilities, this infrastructure will facilitate swift and timely logistical activities, supporting national defense and Indonesia's image as the World Maritime Axis. However, there are challenges in maritime infrastructure development, including geographical, financial, regulatory, technical, and environmental obstacles. Overcoming these requires investment, long-term planning, inter-agency coordination, enhanced security, and resource capacity building. Strategies such as increased investment, comprehensive planning, improved coordination, and enhanced maritime infrastructure security can help address these constraints.

Furthermore, the use of lightweight concrete in maritime infrastructure is an attractive alternative that can support national defense and security. The advantages of lightweight concrete in flexibility and adaptability offer significant potential in artificial island construction, offshore military bases, tactical airstrips in water bodies, and other defense structures. The development of lightweight concrete technology can enhance Indonesia's defense capabilities and support the World Maritime Axis vision. Overall, the success of defense logistics management and Indonesia's World Maritime Axis vision heavily relies on the development and management of adequate maritime infrastructure. The existing challenges can be overcome through appropriate strategies and cooperation between the government, private sector, and other stakeholders. With the implementation of suitable strategies, Indonesia can strengthen its maritime infrastructure, enhance defense capabilities, and play a reliable and influential role as a World Maritime Axis.

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