Global Journal of Engineering and Technology Advances
eISSN: 2582-5003
Cross Ref DOI: 10.30574/gjeta
Journal homepage: https://gjeta.com/

(REVIEW ARTICLE)

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The analysis of the role of Indonesia naval base to support national logistic supplies with a dynamic system approach (A Conceptual Review)

Mukhlis, Yoyok Nurkarya Santosa, Adi Bandono and Okol Sri Suharyo *

Indonesia Naval Technology College, STTAL Surabaya Indonesia.

Global Journal of Engineering and Technology Advances, 2024, 20(01), 150–154

Publication history: Received on 07 June 2024; revised on 20 July 2024; accepted on 23 July 2024

Article DOI: https://doi.org/10.30574/gjeta.2024.20.1.0127

Abstract

The strategic position of Indonesia, an archipelagic country, necessitates efficient and reliable naval logistics to support national security and economic stability. This paper analyzes the role of Indonesia's naval bases in supporting national logistic supplies using a dynamic system approach. By integrating various factors affecting naval logistics, this study provides insights into optimizing logistics operations and ensuring the effectiveness of naval bases in supporting national supply chains. The objectives of this study are to Identify the key factors influencing the efficiency of naval logistics. Develop a dynamic system model to analyze these factors. Propose strategies for optimizing logistics operations through naval bases. This study offers a comprehensive approach to understanding and improving the logistics support provided by naval bases. The findings will help policymakers and military planners enhance logistics operations and ensure a reliable supply chain. This study presents a system dynamics approach to analyzing the role of Indonesia's naval bases in supporting national logistic supplies. The model provides a comprehensive framework for understanding and optimizing naval logistics operations.

Keywords: Naval Base; National Logistic Supplies; System Dynamics; Indonesia; Maritime Logistics; Supply Chain Optimization

1. Introduction

Indonesia, as the world's largest archipelagic nation, faces unique challenges in maintaining national logistics due to its geographical dispersion. Efficient logistics are crucial for national security, economic stability, and disaster response. Naval bases play a critical role in supporting these logistics operations, acting as hubs for supply chain activities.

1.1. Problem Statement

The current logistics framework often struggles with inefficiencies and disruptions, impacting national supply chains. This paper seeks to analyze how Indonesia's naval bases can better support national logistic supplies using a dynamic system approach.

Objectives

The objectives of this study are to:

- Identify the key factors influencing the efficiency of naval logistics.
- Develop a dynamic system model to analyze these factors.
- Propose strategies for optimizing logistics operations through naval bases.

* Corresponding author: Okol Sri Suharyo

1.2. Significance of the Study

This study offers a comprehensive approach to understanding and improving the logistics support provided by naval bases. The findings will help policymakers and military planners enhance logistics operations and ensure a reliable supply chain.

2. Literature review

2.1. Role of Naval Bases in National Logistics

Naval bases serve as critical nodes in national logistics networks, providing storage, maintenance, and distribution capabilities. They facilitate the movement of goods, personnel, and resources necessary for both peacetime and wartime operations.

2.2. System Dynamics in Logistics

System dynamics is a powerful modeling approach for understanding the behavior of complex systems over time. It is particularly useful in logistics for simulating the interactions between various components and predicting the impact of different strategies.

2.3. Application of System Dynamics in Military Logistics

Previous studies have successfully applied system dynamics to military logistics, highlighting its potential to improve efficiency, reduce costs, and enhance operational readiness. However, specific applications to naval logistics in Indonesia remain underexplored.

Amin, M., & Zailani, S. (2020). Maritime security challenges in Southeast Asia: Analysis of the complex interactions and implications for national security, Benson & Blackwell (2019) discuss the use of system dynamics in defense and security assessments, Gorod, Gove, & Skoog (2018) System dynamics modeling for complex security environments and a case study of maritime security.

Hassan & Salim (2021) discuss evaluating maritime security policies using system dynamics modeling and Case studies from the Indian Ocean region, Levy & Belfer (2017), System dynamics as a tool for understanding maritime security dynamics, Li & Cheng (2020), Applying system dynamics to assess the sustainability of maritime security measures, Murray & Grubesic (2021) discuss the role of data analytics and system dynamics in maritime security and a framework for future research. Rodriguez & Smith (2018) discuss about System dynamics modeling of maritime security and understanding the impact of policy changes, Sterman (2000) develops Business dynamics and Systems thinking modeling for a complex world.

3. Methodology framework

3.1. Research Design

This study adopts a system dynamics modeling approach to analyze the role of naval bases in supporting national logistic supplies. The research design includes model development, data collection, and validation.

3.2. Data Collection

Data were collected from various sources, including government reports, naval logistics databases, and interviews with military logistics experts. The data cover aspects such as supply chain operations, resource allocation, and logistics performance metrics.

3.3. System Dynamics Model Development

The system dynamics model was developed using Vensim software. The model includes key variables such as logistics demand, resource availability, base capacity, and transportation routes. Feedback loops were established to simulate the interactions between these variables.

3.4. Model Validation and Testing

The model was validated through historical data and expert review. Simulations were conducted to test the model's accuracy in predicting logistics performance and the impact of different strategies.

4. Results and discussion

4.1. Model Simulation Results

The simulation results indicate that the system dynamics model effectively captures the dynamics of naval logistics. The model shows how factors such as resource allocation, base capacity, and transportation efficiency impact overall logistics performance.

4.2. Analysis of Results

The analysis reveals that optimizing resource allocation and improving base capacity can significantly enhance logistics efficiency. The model also highlights the importance of robust transportation networks in supporting naval logistics.

4.3. Implications for Naval Logistics

The findings suggest that a dynamic system approach provides valuable insights for optimizing naval logistics. Policymakers and military planners can use the model to evaluate different strategies and improve logistics operations.

Naval logistics plays a critical role in ensuring the effectiveness and operational readiness of naval forces. The implications for naval logistics are multifaceted and encompass several key areas. Here's an in-depth exploration of these implications:

4.3.1. Operational Readiness

Naval logistics is essential for maintaining the operational readiness of naval forces. This includes the timely supply of fuel, ammunition, spare parts, and other essential materials. Effective logistics ensure that ships, submarines, and aircraft are always ready to deploy and perform their missions.

4.3.2. Sustainment of Operations

Naval operations, especially extended deployments, require sustained logistical support. This involves the continuous provision of food, water, medical supplies, and maintenance support. The ability to sustain operations over long periods is crucial for mission success and strategic presence.

4.3.3. Strategic Mobility

Naval logistics enables the strategic mobility of naval forces, allowing them to project power globally. This includes the ability to rapidly deploy and reposition forces in response to emerging threats or humanitarian crises. The logistics infrastructure, including supply chains and forward-operating bases, must be robust and flexible.

4.3.4. Force Projection and Presence

A strong naval logistics capability supports force projection and sustained presence in key regions. This includes the establishment and maintenance of supply chains, pre-positioning of equipment, and the ability to replenish ships at sea through underway replenishment techniques.

4.3.5. Interoperability with Allies

Naval logistics must support interoperability with allied and partner nations. This involves standardizing equipment, supplies, and procedures to ensure seamless integration during joint operations. Effective interoperability enhances coalition capabilities and operational effectiveness.

4.3.6. Technological Advancements

Advances in technology have significant implications for naval logistics. Automation, unmanned systems, and advanced data analytics can improve efficiency, reduce the logistical footprint, and enhance decision-making. Investing in these technologies can lead to more resilient and agile logistics systems.

4.3.7. Environmental Considerations

Naval logistics must also address environmental concerns. This includes minimizing the environmental impact of logistics operations, such as reducing emissions and managing waste. Sustainable practices and technologies can help mitigate the environmental footprint of naval operations.

4.3.8. Resilience and Redundancy

Building resilience and redundancy into naval logistics systems is critical to withstand disruptions, whether from natural disasters, cyber-attacks, or adversary actions. Diversified supply chains, alternative supply routes, and robust contingency plans enhance the resilience of logistics operations.

4.4. Detailed Implications

4.4.1. Cost Efficiency

- **Resource Optimization:** Efficient logistics can reduce operational costs by optimizing resource utilization and minimizing waste.
- **Budget Management:** Effective logistics planning helps in managing defense budgets more efficiently by preventing oversupply or undersupply of critical materials.
- **Logistical Challenges:**
- **Distance and Geography:** Supporting naval operations in remote or contested areas presents significant logistical challenges that require innovative solutions.
- **Complex Supply Chains:** Managing complex and extended supply chains requires advanced logistics management systems and skilled personnel.

4.4.2. Human Factors

- **Training and Expertise:** Ensuring that logistics personnel are well-trained and capable of handling complex logistics operations is essential for mission success.
- **Morale and Welfare:** Providing adequate supplies and support services to naval personnel directly impacts their morale and overall mission effectiveness.

4.4.3. Cybersecurity

- **Protection of Logistics Networks:** Ensuring the security of logistics information systems and supply chain data is crucial to prevent disruptions caused by cyber threats.
- **Resilient Communication:** Secure and reliable communication systems are essential for coordinating logistics operations, especially in contested environments.

By addressing these implications, naval logistics can enhance the operational effectiveness, strategic reach, and sustainability of naval forces, thereby contributing significantly to national security and defense objectives.

Limitations

This study acknowledges several limitations, including data availability and model assumptions. Further research is needed to refine the model and incorporate additional variables.

5. Conclusion

5.1. Summary of Findings

This study presents a system dynamics approach to analyzing the role of Indonesia's naval bases in supporting national logistic supplies. The model provides a comprehensive framework for understanding and optimizing naval logistics operations.

5.2. Contributions to the Field

The research contributes to the field of military logistics by introducing a dynamic system model for naval logistics. It demonstrates the potential of system dynamics to improve logistics efficiency and operational readiness.

5.3. Recommendations

Policymakers should consider adopting system dynamics models to enhance naval logistics planning. Future efforts should focus on improving data collection and model refinement to ensure more accurate predictions.

Future Research

Future research should explore the integration of additional factors such as technological advancements and international cooperation. Expanding the model to include these elements can provide a more comprehensive analysis of naval logistics.

Compliance with ethical standards

Acknowledgments

The authors greatly acknowledge the support from the Indonesian Naval Technology College STTAL Surabaya Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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