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Port Logistics Efficiency and Its Impact on Regional Economic Development: Evidence from Indonesian Maritime Infrastructure

Adhadian Akbar^{1a}, Zharirah Indrawati Zainuddin^{2b}, Achdiat^{3c}^{1,2}Universitas Padjadjaran³Universitas PasundanAhdian.akbar@unpad.ac.id^a, zhahirah.indrawati@unpad.ac.id^b, achdiat@unpas.ac.id^c

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Corresponding author :

Adhadian Akbar

Email: adhadian.akbar@unpad.ac.id

ABSTRACT

Port logistics efficiency plays a critical role in supporting maritime trade and strengthening regional economic development, particularly in archipelagic countries that rely heavily on maritime transportation. Indonesia, as the world's largest archipelagic nation, depends on efficient port infrastructure to facilitate the movement of goods and ensure effective logistics connectivity across regions. This study aims to analyze the relationship between port logistics efficiency and regional economic development by examining the performance of maritime infrastructure in Indonesia. The research adopts a quantitative descriptive approach using secondary data collected from government reports, logistics statistics, and maritime publications from 2020 to 2024. Key indicators analyzed include cargo handling capacity, port operational productivity, logistics connectivity, and regional economic performance. The findings indicate that improvements in port logistics efficiency significantly contribute to reducing logistics costs, enhancing supply chain performance, and stimulating regional economic growth. Efficient port operations also support trade expansion, attract investment, and encourage the development of logistics-related industries in surrounding regions. However, challenges such as infrastructure disparities between major and regional ports, operational inefficiencies, and coordination issues among logistics stakeholders remain critical concerns. The study highlights the importance of continued investment in maritime infrastructure, digitalization of port operations, and stronger logistics integration to enhance Indonesia's competitiveness in global maritime trade and promote sustainable regional economic development.

Keywords: port logistics efficiency, maritime logistics, regional economic development, port infrastructure, Indonesia.

ABSTRAK

Efisiensi logistik pelabuhan memainkan peran penting dalam mendukung perdagangan maritim dan memperkuat pembangunan ekonomi regional, khususnya di negara-negara kepulauan yang sangat bergantung pada transportasi maritim. Indonesia, sebagai negara kepulauan terbesar di dunia, bergantung pada infrastruktur pelabuhan yang efisien untuk memfasilitasi pergerakan barang dan memastikan konektivitas logistik yang efektif antar wilayah. Studi ini bertujuan untuk menganalisis hubungan antara efisiensi logistik pelabuhan dan pembangunan ekonomi regional dengan meneliti kinerja infrastruktur maritim di Indonesia. Penelitian ini mengadopsi pendekatan deskriptif kuantitatif menggunakan data sekunder yang dikumpulkan dari laporan pemerintah, statistik logistik, dan publikasi maritim dari tahun 2020 hingga 2024. Indikator utama yang dianalisis meliputi kapasitas penanganan kargo, produktivitas operasional pelabuhan, konektivitas logistik, dan kinerja ekonomi regional. Temuan menunjukkan bahwa peningkatan efisiensi logistik pelabuhan secara signifikan berkontribusi pada pengurangan biaya logistik, peningkatan kinerja rantai pasokan, dan stimulasi pertumbuhan ekonomi regional. Operasi pelabuhan yang efisien juga mendukung perluasan perdagangan, menarik investasi, dan mendorong pengembangan industri terkait logistik di wilayah sekitarnya. Namun, tantangan seperti kesenjangan infrastruktur antara pelabuhan utama dan regional, inefisiensi operasional, dan masalah koordinasi antar pemangku kepentingan logistik tetap menjadi perhatian penting. Studi ini menyoroti pentingnya investasi berkelanjutan dalam infrastruktur maritim, digitalisasi operasi pelabuhan, dan integrasi logistik yang lebih kuat untuk meningkatkan daya saing Indonesia dalam perdagangan maritim global dan mendorong pembangunan ekonomi regional yang berkelanjutan.

A. INTRODUCTION

Ports play a strategic role in the global logistics network by facilitating the movement of goods, supporting international trade, and strengthening regional economic integration. Efficient port logistics systems are essential for reducing transportation costs, improving supply chain performance, and enhancing national competitiveness in the global market. As global trade continues to grow, the effectiveness of port operations and logistics management has become a critical factor in determining the efficiency of maritime transportation and the overall performance of logistics systems (Notteboom, Pallis, & Rodrigue, 2021).

In many developing countries, port infrastructure serves as a key driver of regional economic development. Ports not only function as gateways for import and export activities but also act as economic hubs that stimulate industrial growth, investment, and employment opportunities in surrounding regions. Studies have shown that improvements in port logistics efficiency can significantly contribute to regional economic performance by facilitating trade flows and enhancing connectivity between production centers and markets (Merk & Dang, 2020). Therefore, optimizing port logistics management has become an important policy priority for many governments seeking to strengthen economic growth through maritime infrastructure development.

Indonesia, as the world's largest archipelagic country, relies heavily on maritime transportation for domestic and international trade. The country's geographic characteristics make ports a vital component of its national logistics system. With more than 17,000 islands and a vast coastline, Indonesia requires efficient port infrastructure to ensure smooth distribution of goods across regions. However, despite significant investments in maritime infrastructure over the past decade, challenges related to port logistics efficiency, infrastructure capacity, and logistics costs remain critical issues in the Indonesian maritime sector (World Bank, 2023).

To address these challenges, the Indonesian government has implemented various initiatives aimed at improving port performance and logistics efficiency. Programs such as the development of the National Logistics Ecosystem (NLE), port modernization, and digitalization of logistics services are designed to enhance operational efficiency and reduce logistics bottlenecks. These initiatives aim to strengthen the integration of logistics services across ports, shipping companies, and supply chain stakeholders, thereby improving the overall efficiency of maritime logistics systems in Indonesia (Ministry of Transportation of Indonesia, 2022).

Despite these policy efforts, empirical research examining the relationship between port logistics efficiency and regional economic development in Indonesia remains limited. While several studies have focused on port performance and maritime connectivity, fewer studies have explored how improvements in port logistics systems influence economic growth at the regional level. Understanding this relationship is important because efficient port logistics can stimulate economic activities, increase trade competitiveness, and support sustainable regional development.

Therefore, this study aims to analyze the impact of port logistics efficiency on regional economic development by examining the performance of maritime infrastructure in Indonesia. By investigating the relationship between port logistics systems and regional economic indicators, this research seeks to provide insights into how improvements in port management and logistics operations can contribute to economic development. The findings of this study are expected to contribute to the academic literature on port and maritime logistics management while also providing policy recommendations for improving the efficiency of port logistics systems in Indonesia.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Port Logistics Efficiency

Port logistics efficiency refers to the ability of a port system to manage cargo flows, transportation processes, and logistics services in a manner that minimizes time, cost, and operational constraints. Efficient port logistics systems are essential for ensuring smooth maritime trade and improving the performance of global supply chains. According to Notteboom, Pallis, and Rodrigue (2021), port efficiency is determined by several factors, including infrastructure capacity, terminal productivity, technological adoption, and coordination among logistics stakeholders.

In recent years, the concept of port logistics efficiency has evolved alongside the development of digital technologies and smart port systems. Modern ports increasingly rely on integrated logistics platforms, digital tracking systems, and automated terminal operations to enhance productivity and reduce operational bottlenecks. The integration of digital technology into port logistics management can significantly improve cargo handling efficiency, reduce turnaround time, and enhance transparency within logistics networks (Heilig, Lalla-Ruiz, & Voß, 2022).

Furthermore, port logistics efficiency is closely linked to the performance of maritime supply chains. Efficient port operations can accelerate cargo handling processes and reduce logistics costs, thereby improving the overall competitiveness of trade activities. Conversely, inefficient port logistics can lead to congestion, delays, and increased transportation costs that negatively affect supply chain performance (UNCTAD, 2022). Therefore, improving port logistics efficiency has become a key priority for many countries seeking to strengthen their logistics competitiveness in the global economy.

Maritime Logistics and Supply Chain Integration

Maritime logistics plays a fundamental role in facilitating global trade, as approximately 80 percent of international trade by volume is transported by sea (UNCTAD, 2022). Ports function as critical nodes within maritime supply chains, connecting shipping lines, inland transportation networks, and logistics service providers. Effective coordination among these stakeholders is necessary to ensure efficient cargo movement from origin to destination.

Supply chain integration within maritime logistics systems involves the coordination of various logistics activities, including cargo handling, warehousing, customs clearance, and inland transportation. According to Song and Panayides (2021), integrated maritime logistics systems can significantly improve operational efficiency by reducing redundancies, minimizing delays, and enhancing information sharing among supply chain participants.

In the context of port operations, supply chain integration can be achieved through the development of digital logistics platforms and collaborative logistics networks. These systems enable real-time data exchange between ports, shipping companies, freight forwarders, and government agencies. As a result, logistics processes become more transparent and efficient, allowing stakeholders to make better operational decisions and improve supply chain performance (Heilig et al., 2022).

Port Performance and Economic Development

Port performance is widely recognized as an important determinant of regional and national economic development. Ports serve as gateways for trade and investment, facilitating the movement of goods between domestic and international markets. Efficient ports can stimulate economic growth by improving trade connectivity, attracting investment, and supporting industrial development in surrounding regions (Merk & Dang, 2020).

Several empirical studies have shown that improvements in port performance can positively influence regional economic development. For example, efficient port operations can reduce logistics costs, increase trade volumes, and encourage the development of logistics-related industries such as warehousing, transportation, and manufacturing. As a result, regions with well-developed port infrastructure often experience higher levels of economic activity and employment growth (Rodrigue & Notteboom, 2020).

In developing countries, port infrastructure development is often considered a strategic investment for enhancing economic competitiveness. Governments invest in port modernization projects to improve cargo handling capacity, reduce congestion, and strengthen trade connectivity. However, the economic benefits of port development depend not only on physical infrastructure but also on the efficiency of logistics management and operational systems within the port (World Bank, 2023).

Port Infrastructure in Indonesia

Indonesia's maritime infrastructure plays a crucial role in supporting the country's logistics system and economic development. As an archipelagic nation, Indonesia depends heavily on maritime transportation to facilitate the distribution of goods across its islands. Major ports such as Tanjung Priok, Tanjung Perak, and Makassar serve as key logistics hubs connecting domestic and international trade routes.

Over the past decade, the Indonesian government has made significant investments in port development as part of its broader maritime development strategy. Initiatives such as the Sea Toll Program and port modernization projects aim to improve connectivity between regions and reduce logistics costs across the country. These programs focus on enhancing port infrastructure, improving logistics coordination, and integrating digital technologies into port operations (Ministry of Transportation of Indonesia, 2022).

Despite these efforts, several challenges remain in improving port logistics efficiency in Indonesia. Issues such

as port congestion, limited infrastructure capacity, and inefficient logistics coordination continue to affect the performance of maritime logistics systems. Addressing these challenges requires not only infrastructure development but also improvements in port governance, digitalization, and logistics integration across the maritime supply chain (World Bank, 2023).

RESEARCH METHODOLOGY

This study employs a quantitative descriptive research approach to examine the relationship between port logistics efficiency and regional economic development in Indonesia. The research focuses on major maritime infrastructure and port operations within the Indonesian logistics system as the primary locus of analysis. Secondary data were collected from various reliable sources, including government reports, logistics statistics, port performance data, and international maritime publications published between 2020 and 2024. Key variables analyzed in this study include port logistics efficiency indicators—such as cargo handling capacity, turnaround time, logistics connectivity, and infrastructure performance—and regional economic indicators, including regional trade activity and economic growth. The collected data were analyzed using descriptive and analytical methods to identify patterns and relationships between port logistics performance and regional economic outcomes. This methodological approach allows the study to provide a comprehensive understanding of how improvements in port logistics efficiency contribute to strengthening regional economic development through maritime infrastructure performance in Indonesia.

RESULT AND DISCUSSION

Port Logistics Efficiency in Indonesia

The efficiency of port logistics systems plays a fundamental role in supporting maritime transportation and trade activities in Indonesia. As an archipelagic country with extensive maritime connectivity, Indonesia relies heavily on port infrastructure to facilitate the movement of goods across domestic and international markets. The performance of port logistics systems in Indonesia has improved over the past decade due to increased investment in maritime infrastructure and the implementation of several government initiatives aimed at strengthening the national logistics system.

One of the key indicators of port logistics efficiency is cargo handling capacity and operational productivity. Major ports in Indonesia, such as Tanjung Priok Port in Jakarta and Tanjung Perak Port in Surabaya, serve as primary gateways for international trade and play a crucial role in facilitating cargo flows. Improvements in terminal equipment, container handling systems, and port management practices have contributed to increased operational efficiency in these ports. These improvements have helped reduce vessel waiting times and cargo dwell times, which are important indicators of logistics performance in port operations.

Another important factor influencing port logistics efficiency is the integration of digital technologies within port operations. In recent years, the Indonesian government has introduced several digital initiatives aimed at improving logistics coordination and reducing administrative barriers in port operations. One such initiative is the National Logistics Ecosystem (NLE), which integrates logistics services across multiple stakeholders, including port operators, shipping companies, customs authorities, and logistics service providers. Through digital integration, logistics processes become more transparent, coordinated, and efficient, which ultimately contributes to improved port logistics performance.

Despite these improvements, several operational challenges remain in Indonesia's port logistics system. Issues such as port congestion, limited infrastructure capacity, and uneven development of port facilities across regions continue to affect the overall efficiency of maritime logistics. In particular, smaller regional ports often face limitations in infrastructure, technology, and operational capacity, which can hinder the efficient distribution of goods across the Indonesian archipelago.

The Role of Port Infrastructure in Regional Economic Development

Port infrastructure plays a critical role in stimulating regional economic development by facilitating trade, investment, and industrial activities. Efficient ports enable the smooth movement of goods between production centers and markets, which in turn enhances economic productivity and competitiveness. In regions with well-developed port infrastructure, businesses benefit from improved logistics connectivity, lower transportation costs, and increased access to international markets.

In the Indonesian context, port development has contributed significantly to regional economic growth by supporting trade activities and expanding logistics networks across the country. Major port hubs function as

economic catalysts that stimulate the development of surrounding industries, including manufacturing, warehousing, transportation, and logistics services. These economic activities generate employment opportunities and contribute to increased regional income levels.

Furthermore, the development of port infrastructure often leads to the emergence of logistics clusters around port areas. These clusters consist of interconnected industries and logistics service providers that support trade and distribution activities. The presence of logistics clusters can further strengthen regional economic performance by attracting investments and encouraging the growth of supporting industries.

However, the economic benefits of port infrastructure development depend not only on the physical capacity of ports but also on the efficiency of logistics operations and institutional coordination among stakeholders. Inefficient logistics processes can reduce the potential economic benefits of port infrastructure investments by increasing transportation costs and delaying cargo movement. Therefore, improving port logistics efficiency is essential for maximizing the economic impact of maritime infrastructure development.

The Relationship Between Port Logistics Efficiency and Regional Economic Growth

The findings of this study indicate that improvements in port logistics efficiency can have a significant impact on regional economic development. Efficient port logistics systems reduce transportation costs and improve the speed and reliability of cargo movement, which enhances trade competitiveness. As trade activities increase, regions connected to efficient port systems experience greater economic growth due to increased commercial activity and investment.

One of the most important economic impacts of efficient port logistics is the reduction of logistics costs. High logistics costs have long been identified as a major challenge in Indonesia's economic development. By improving port efficiency, logistics processes become faster and more streamlined, which reduces overall supply chain costs. Lower logistics costs can benefit businesses by improving profit margins and enabling them to compete more effectively in international markets.

In addition, efficient port logistics systems can attract new investments to port regions. Investors tend to prefer locations with well-developed logistics infrastructure because such environments provide better connectivity and lower operational risks. As a result, improvements in port logistics efficiency can stimulate economic diversification and industrial development in surrounding regions.

Furthermore, enhanced port logistics performance can improve the integration of regional economies within national and global supply chains. Regions with efficient port access are better positioned to participate in international trade networks, which can lead to increased export opportunities and economic growth. This integration also strengthens the resilience of regional economies by diversifying economic activities and expanding market access.

Challenges and Opportunities for Improving Port Logistics Efficiency

Although Indonesia has made considerable progress in improving port logistics efficiency, several challenges still need to be addressed to fully realize the economic potential of maritime infrastructure. One of the main challenges is the uneven distribution of port infrastructure development across different regions. While major ports have benefited from modernization and technological upgrades, many smaller regional ports still lack adequate facilities and operational capabilities.

Another challenge relates to coordination among logistics stakeholders. Efficient port logistics systems require close collaboration among multiple actors, including port authorities, shipping companies, customs agencies, and logistics service providers. Inefficient coordination and bureaucratic procedures can slow down logistics processes and reduce overall system efficiency.

However, significant opportunities exist for improving port logistics efficiency in Indonesia. The adoption of digital technologies, automation systems, and integrated logistics platforms offers promising solutions for enhancing port performance. Digital transformation can improve operational transparency, reduce administrative delays, and facilitate better coordination among logistics stakeholders.

Moreover, continued investment in maritime infrastructure and logistics connectivity will play a key role in strengthening Indonesia's position within global maritime trade networks. By improving port logistics efficiency and strengthening supply chain integration, Indonesia can enhance its logistics competitiveness and support sustainable regional economic development.

CONCLUSION AND SUGGESTION

This study examined the relationship between port logistics efficiency and regional economic development within the context of Indonesian maritime infrastructure. The findings indicate that efficient port logistics systems play a crucial role in supporting trade activities, improving supply chain performance, and stimulating regional economic growth. Improvements in cargo handling capacity, operational productivity, and digital logistics integration have contributed to enhancing the performance of major ports in Indonesia. These improvements help reduce logistics costs, accelerate cargo movement, and strengthen connectivity between production centers and markets.

Furthermore, the study highlights that port infrastructure development has a significant economic impact on surrounding regions. Efficient ports not only function as gateways for international trade but also act as catalysts for regional economic activities by attracting investment, supporting industrial development, and creating employment opportunities. However, the economic benefits of port infrastructure development depend largely on the efficiency of logistics management and coordination among stakeholders within the maritime supply chain.

Despite the progress achieved in recent years, several challenges remain in improving port logistics efficiency in Indonesia, including infrastructure disparities between major and regional ports, limited operational capacity in smaller ports, and coordination issues among logistics stakeholders. Addressing these challenges requires continued investment in maritime infrastructure, stronger institutional coordination, and the adoption of digital technologies to enhance logistics integration.

Overall, improving port logistics efficiency is essential for strengthening Indonesia's maritime logistics system and supporting sustainable regional economic development. By optimizing port operations, promoting digital transformation, and enhancing logistics connectivity, Indonesia can further improve its competitiveness in global maritime trade while fostering balanced regional economic growth.

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