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RESEARCH ARTICLE

Effectiveness of Sea Toll Road in Logistics Distribution in Coastal Area of Sorong Regency

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ABSTRACT

The Sea Toll Program is one of the strategic policies of the Indonesian government that aims to improve connectivity between regions, incredibly remote and coastal areas. The main objective of the study is to evaluate the effectiveness of the Sea Toll Road program in improving logistics distribution in the coastal regions of Sorong Regency. The main focus of this study is on the efficiency of delivery time, distribution costs, and the impact on the local economy. The methods used include quantitative and qualitative analysis based on field data, stakeholder interviews, and secondary data from reports from related agencies. The study results show that the Sea Toll has increased the speed of logistics distribution in coastal areas, significantly reduced the cost of transporting goods, and opened wider market access for local communities. The leading logistics commodities distributed in the loading and unloading process are from the Mining and Energy sector by 34%. This is followed by construction and transportation, which account for 27%. Distribution has decreased the delivery time of goods by 30%, reduced logistics costs by up to 20%, and increased distribution volume by up to 50%, so the effectiveness of logistics distribution can be considered high. However, several challenges remain, such as limited port infrastructure, less than optimal shipping frequency, and lack of coordination between the central and regional governments. In conclusion, although the sea toll positively impacts logistics distribution in Sorong Regency, further infrastructure and operational management improvements are needed to achieve optimal effectiveness.

INTRODUCTION

The Indonesian government launched the Sea Toll Road program as part of its maritime axis vision. It aims to improve island connectivity, especially in remote and underdeveloped regions like Sorong Regency. This region, located in the eastern part of Indonesia, has historically faced challenges in logistics distribution due to its geographic isolation and limited transportation infrastructure. High logistics costs and inefficiencies in the supply chain have hindered economic growth, restricted access to essential goods, and exacerbated social inequalities in coastal areas. The Sea Toll Road initiative was expected to lower transportation costs, enhance logistics efficiency, and promote regional development. It intended to create a more balanced and integrated national supply chain by connecting significant and minor feeder ports. In Sorong Regency, this program was implemented to improve the flow of goods, reduce price disparities, and boost economic activity.

Despite introducing the Sea Toll Road in Sorong Regency, several challenges remain. The logistics distribution in coastal areas continues to face bottlenecks, and the program's desired outcomes have not been fully realized—problems such as infrastructure limitations, high operational costs, limited economic impact, and inefficiencies from coordination. Many coastal areas still lack the port and road infrastructure to support efficient logistics. While transportation routes have been established, operational costs remain high, particularly in handling and storage. The program's contribution to economic growth in Sorong Regency has been questioned, with some areas seeing minimal improvement in goods distribution and market access. Weak coordination between local governments, port authorities, and private stakeholders has led to the underutilization of available logistics routes. Given these persistent issues, evaluating whether the Sea Toll Road program effectively achieves its objectives in the logistics distribution of Sorong Regency's coastal areas is necessary. The main aim of the study is to evaluate the effectiveness of the Sea Toll Road program in improving logistics distribution in the coastal regions of Sorong Regency. By addressing these aims, the study hopes to contribute to the broader discourse on regional logistics development and provide a roadmap for enhancing maritime connectivity in underdeveloped areas of Indonesia.

The Sea Toll Route, or "Tol Laut," in 2021 continued to be a key infrastructure initiative under the Indonesian government's vision to strengthen maritime connectivity, particularly in the country's more remote and underdeveloped regions. Launched as part of President Joko Widodo's broader maritime axis strategy in 2015, the Sea Toll program is designed to lower the cost of goods distribution, address logistical disparities between regions, and promote economic development in outer islands and coastal areas. Expansion of Routes By 2021, the Sea Toll program had expanded significantly, with more ships, routes, and feeder ports integrated into the system. The Indonesian Ministry of Transportation managed the development of these routes, focusing on creating efficient and regular shipping lines that connect major hub ports like Tanjung Priok in Jakarta with remote and outer islands in eastern Indonesia, such as Papua, Maluku, and Nusa Tenggara. The number of routes had increased from 6 in 2016 to 30 by 2021. These routes were established to ensure that goods could move consistently from western Indonesia (the primary production and consumption centers) to the more remote eastern regions, where logistical costs had historically been much higher due to geographic isolation and underdeveloped infrastructure. By 2021, the Sea Toll Road had significantly improved logistics and reduced transportation costs for Indonesia's remote and underdeveloped regions. However, challenges remained, particularly in fully optimizing the routes, addressing infrastructure bottlenecks, and improving stakeholder coordination. Despite these hurdles, the Sea Toll Road continued to play a crucial role in Indonesia's maritime connectivity strategy, with the potential to drive further economic development and reduce regional inequalities.

The effectiveness of the Sea Toll program in eastern Indonesia provides insights from various academic, governmental, and policy reports, highlighting the program's contributions and limitations. The Sea Toll initiative, aimed at reducing logistics costs and improving connectivity in remote regions like Papua, Maluku, and Nusa Tenggara, has been both praised for its achievements and critiqued for its ongoing challenges. Several studies have noted a reduction in logistics costs as one of the primary successes of the Sea Toll program. For instance, a survey by Santosa et al. (2019) examined the impact of the Sea Toll on inter-island connectivity and found that the program had successfully reduced logistics costs by creating more regular and reliable shipping schedules. Before the program, shipping to eastern Indonesia was irregular, resulting in high prices for goods. The Sea Toll helped alleviate these disparities by stabilizing supply lines and enabling a more consistent flow of goods between western and eastern Indonesia. Another study by the Indonesian Ministry of Transportation (2020) also observed that logistics costs for essential commodities, such as rice and construction materials, had significantly decreased in regions like Papua and Maluku, directly benefiting local populations. The Sea Toll has also improved port infrastructure in Indonesia's eastern provinces. According to a report by the Indonesian National Development Planning Agency (BAPPENAS, 2021), investments in port facilities, particularly in Bitung, Ambon, and Sorong, have facilitated increased cargo handling

capacity. This has enabled better access to essential goods in previously isolated regions, contributing to economic activities and improving market access for small businesses. In the study conducted by Pratama (2020), the author emphasized that the Sea Toll program helped reduce the price disparities of essential goods between Java and eastern Indonesia, making products more affordable for residents of remote islands. This improvement in accessibility has also allowed local producers to connect with larger markets, creating economic opportunities that were previously inaccessible.

Despite these positive outcomes, several studies highlight ongoing challenges that affect the overall effectiveness of the Sea Toll program in the eastern regions. A survey by Fathurrahman and Anwar (2020) pointed out that while the program succeeded in delivering goods to eastern ports, return trips from these regions often experienced underutilization. Ships were not fully loaded on the return journey, resulting in operational inefficiencies and higher logistics costs. This imbalance can be attributed to the limited production and export capacity of remote regions, which affects the economic viability of the Sea Toll in the long term. Similarly, a paper by Suhendra (2021) found that the expected financial benefits, such as increased employment opportunities and enhanced local business activity, had not fully materialized. Although the Sea Toll program improved the distribution of goods, it had not yet stimulated the desired economic development in some parts of eastern Indonesia. The paper suggests that complementary policies are required in addition to improving logistics, such as fostering local industries and encouraging regional trade. In a review of the Sea Toll program's implementation, Wahyudi et al. (2019) highlighted coordination issues between different government agencies and private sector stakeholders as a key barrier to the program's full effectiveness. Poor coordination between local governments, port authorities, and logistics providers often led to delays, inefficiencies, and higher costs, limiting the program's overall impact on local economies. Moreover, the study by BAPPENAS (2021) also noted gaps in policy implementation, particularly the lack of a well-defined strategy for integrating the Sea Toll with other modes of transport, such as road and rail networks. This has led to logistical bottlenecks once goods reach coastal ports, as distribution to inland areas remains inefficient. This gap reduces the program's ability to optimize its logistics potential in eastern Indonesia fully.

The Sea Toll program is central to Indonesia's effort to improve maritime connectivity between its islands, especially in underdeveloped eastern regions like Papua, Maluku, and Nusa Tenggara. Since its launch, numerous studies have evaluated the program's effectiveness in enhancing inter-island transportation, reducing logistics costs, and integrating remote regions into the national economy. Many studies have reported improvements in maritime connectivity in eastern Indonesia due to the Sea Toll program. For instance, Prasetyo et al. (2020) survey highlighted that the Sea Toll Road has strengthened maritime routes, particularly by increasing the frequency of shipping services to remote regions. The study indicated that in areas like Maluku and Papua, where shipping lines were previously inconsistent, the Sea Toll has ensured more regular schedules, allowing for better transportation of goods and improved access to supplies.

Similarly, Sari et al. (2019) found that the Sea Toll program increased connectivity between major hub ports like Makassar and Bitung and smaller ports in eastern Indonesia. This hub-and-spoke model has facilitated more efficient movement of goods from the economically dominant western regions to the underdeveloped eastern areas, thus fostering greater regional integration. One of the significant outcomes noted in the literature is the reduction in transportation costs due to improved connectivity. Wicaksono (2019) analyzed the impact of the Sea Toll on logistics costs and found that, as maritime routes became more reliable, the cost of transporting goods to eastern Indonesia decreased substantially. This was particularly beneficial for businesses that relied on regular goods shipments, as the previously high shipping costs to remote areas had acted as a significant barrier to economic activity. A government report by the Indonesian Ministry of Transportation (2021) echoed these findings, noting that the Sea Toll had lowered transportation costs by reducing the monopoly of private shipping companies, which had

previously controlled shipping lines to remote regions—introducing government-subsidized shipping routes provided competition, helping lower logistics costs for producers and consumers.

While the Sea Toll has improved connectivity, several studies have pointed out persistent infrastructure challenges limiting the program's effectiveness. Handayani (2020) emphasized that many ports in eastern Indonesia still lack the facilities to handle large cargo volumes efficiently. Ports in regions like West Papua and Maluku face difficulties due to limited berthing spaces, outdated equipment, and insufficient storage facilities. As a result, the increased connectivity through the Sea Toll has not fully translated into efficient logistical operations in some remote areas. Similarly, Fadhilah and Sari (2021) noted that larger hub ports such as Bitung and Sorong have seen infrastructure improvements, but smaller feeder ports still struggle with inadequate facilities. These limitations affect the turnaround time for ships, leading to delays and inefficiencies in the distribution process. This highlights the need for complementary investments in port infrastructure to maximize the benefits of improved maritime connectivity. The relationship between connectivity improvements and economic growth is another key area of focus in the literature. Fahmi and Basri (2018) conducted a study on the financial impact of the Sea Toll in eastern Indonesia, concluding that improved maritime connectivity has contributed to increased economic activity in some regions. For example, areas like Maluku and East Nusa Tenggara experienced a boost in local businesses as the costs of transporting goods from and to these areas decreased, making their products more competitive in national markets.

However, not all studies are optimistic about the economic impact of the Sea Toll. Rahman (2019) argued that while connectivity has improved, it has not yet fully translated into sustainable economic growth for many regions in eastern Indonesia. The study found that areas with poor infrastructure and low economic development continue to face challenges in utilizing improved connectivity to foster local industries. This suggests that while maritime connectivity is crucial, it must be paired with broader economic policies and investments to achieve long-term regional development. Another challenge frequently cited in the literature is the underutilization of return trips from eastern Indonesia to the more industrialized western regions. Syamsuddin and Irawan (2020) pointed out that while the Sea Toll program has successfully delivered goods to remote areas, return trips often carry much lighter loads due to limited production and export activities in these regions. This cargo flow imbalance reduces the shipping routes' economic viability and limits the Sea Toll's full potential to integrate eastern Indonesia into national and global supply chains. Similarly, Tanjung and Prasetya (2021) found that the lack of locally produced goods for export from eastern Indonesia meant that ships often returned empty or partially loaded to western ports. This underutilization problem underscores the need for policies that focus on boosting local industries and creating export-ready goods to ensure that improved maritime connectivity benefits both inbound and outbound logistics. Several studies have discussed the policy and coordination issues that hinder the program's connectivity objectives. Wahyudi et al. (2019) identified a lack of coordination between central and local governments as a significant obstacle to the Sea Toll's success. While the central government has heavily invested in maritime infrastructure, local governments in some regions have been slow to develop complementary infrastructure or to integrate the Sea Toll into local economic plans. Furthermore, Haryanto (2020) pointed out that policies related to the Sea Toll have often been disjointed, with different agencies overseeing different aspects of the program, leading to inefficiencies. The study recommended that better coordination between national and regional authorities and public and private sector stakeholders would be essential for fully realizing the Sea Toll's potential to improve connectivity.

The literature on the connectivity of the Sea Toll program in eastern Indonesia shows a complex picture of progress and challenges. On one hand, the program has undeniably improved maritime connectivity, reduced transportation costs, and facilitated greater regional integration. On the other hand, infrastructural limitations, economic imbalances, and policy coordination issues

continue to hamper the program's full potential. For the Sea Toll to have a lasting impact on the connectivity of eastern Indonesia, further investments in infrastructure, stronger local economic policies, and better intergovernmental coordination will be necessary.

RESEARCH METHODOLOGY

The concept of effective "Sea connectivity" involves regularly scheduled shipping from West to East Indonesia and is expected to reduce the high cost of inter-island transportation within the country (even in some instances, it tends to be higher than shipping goods abroad). However, its reliability or availability is still minimal. The research location is focused on the sea toll service at Sorong Port by involving observation and interview methods with the part of Sorong Port that serves logistics distribution. The document collection process will be complemented by in-depth interviews, which are a process of information for research purposes using face-to-face questions and answers between the interviewer and the subject or person being interviewed, with or without using interview guidelines, where the interviewer and informant are involved in an extended social life. Thus, the uniqueness of in-depth interviews is their involvement with informants. This is not done with a strict structure but informally and in a friendly atmosphere. The primary purpose of conducting interviews is to present the current construction in the context of individuals, events, activities, organizations, feelings, motivations, responses or perceptions, levels, and forms of involvement (Sutopo, 2002). In-depth interviews were conducted with several informants selected purposively. Namely, the Head of the Harbor, Directors, Coastal communities limited only to the Aimas District Community, and several parties authorized in the logistics distribution process. In addition, respondents are expected to be able to describe the conditions, challenges, and obstacles in implementing an integrated system in logistics distribution. Figure 2 shows the flow chart methodology of research focusing on sea toll roads.

RESULT AND DISCUSSION

Sorong Port has a Main class or National class port type. Regarding technical aspects, Sorong Port is a natural port because there is no need to build a breakwater to ensure the safety of ships when loading and unloading. As the results of interviews and observations in the field, it was stated that data on Sorong Port activities related to the number of ship visits and the number of loading and unloading from 2018 - 2022 were used as basic data for projections using growth analysis for 2023 - 2027, the results showed that the growth in the number of ship visits and unloading activities increased while the number of loads decreased. These results do not show the effectiveness of the sea toll port, which is expected to be able to distribute agricultural, forestry, and fishery products to coastal areas and their surroundings, which will be challenging to reach using land routes. As a conventional port, Sorong Port must also make maximum efforts to manage every container that piles up in the open yard (stacking area). This is because the stacking area is not separate from passenger loading and unloading activities, resulting in less effective loading and unloading activities at the pier and vice versa. The types of commodities distributed throughout the Sorong district can be seen in Figure 3.

Figure 3. The Types of Commodities in Sorong Port

In Figure 3, it is explained that the primary logistics commodities distributed in the loading and unloading process are from the Mining and Energy sectors by 34%. This is followed by construction and transportation, which account for 27%. Construction material commodities play an important role in logistics distribution to coastal areas because they are one of the benchmarks in sustainable development. Agricultural materials, such as food and staple foods, are essential commodities in distribution using seaports. This supports the potential for distribution to remote areas inaccessible by land. The challenges found from the results of observations refer to the lack of facilities and infrastructure to support this logistics distribution, so people tend to choose the movement of sea toll roads in waiting for ships to unload and turn goods for loading and distribution. Therefore, reading from the commodity data and ship routes moving in Sorong Port makes this port one of the transportation gateways that can serve the flow of goods to increase the income of the Sorong Regency Community and its surroundings. This also supports government programs in terms of equitable development. The functioning of the sea toll road in Sorong Regency has led to significant economic growth in coastal communities. This is explained by Fareh & Alkama (2022), who states that investment in infrastructure has a broad reach on the community's financial stability and refers to the feasibility of infrastructure integrity as a suggestion for improving a region's reputation.

Sorong Port, located in West Papua, plays a key role in facilitating the distribution of commodities within Indonesia, particularly as part of the Sea Toll program. The commodities handled at Sorong Port include necessities for the local population and resources for regional industries. Sorong Port is a critical node in connecting eastern isolated areas of Indonesia with larger, more industrialized centers, ensuring the supply of basic needs and facilitating resource exports. The Sea Toll program in Papua is crucial in improving the logistics and distribution of essential commodities. With its challenging geography and remote areas, Papua relies heavily on maritime transportation to supply goods. The Sea Toll initiative helps connect Papua with other regions of Indonesia, reducing transportation costs and ensuring the steady flow of vital goods to and from the province. Figure 4 shows the fluctuation of goods and logistics through sea toll in eastern Indonesia.

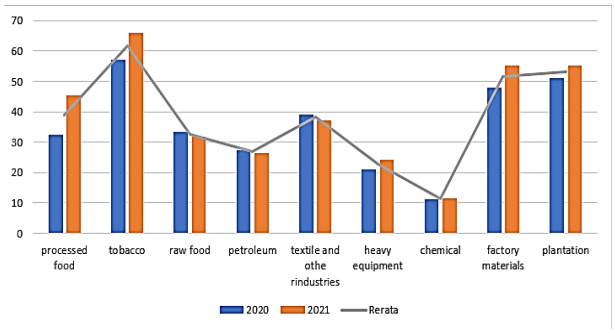

Figure 4. The Observation Results of Commodities

Observing commodities transported through the Sea Toll in Papua involves tracking and analyzing the types, volumes, and flow of goods that move via maritime routes under the government's subsidized shipping program. By examining how the Sea Toll operates in Papua, particularly in remote coastal areas, researchers and policymakers can assess the initiative's effectiveness in improving logistics and economic development in the region. The sea toll provides a comprehensive picture of the characteristics of commodities and cargo transported; 10 (10) cargo variables that are most frequently distributed were selected.

Based on Figure 4, the selected commodities are goods that invariably affect the daily social life of the community. The characteristics of goods have different delivery times according to the validity period of the material in open spaces. This dramatically affects the potential preference for alternative modes of transportation. The higher the level of urgency of a commodity, the faster the time required for distribution. Observing the strengths of using the Sea Toll in Papua reveals several key advantages that improve logistics, economic growth, and regional development. These strengths have been identified through monitoring how the Sea Toll program operates and the benefits it brings to the isolated and geographically challenging areas of Papua. The Sea Toll's subsidized shipping rates have reduced the high costs of transporting goods to Papua, a region traditionally facing higher prices due to its distance and challenging geography. This has made it more affordable to transport essential commodities, reducing prices for consumers.

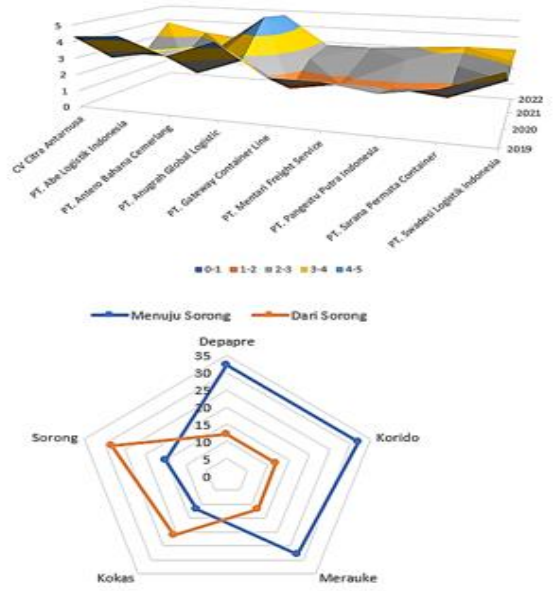

Figure 5. The Results of Mapping of Cargo Demand and Freight Transportation at Sorong Port 2023

Figure 5 explains that cargo mapping in the eastern part of Indonesia, particularly under the Sea Toll program, provides valuable insights into the flow of goods and logistical efficiency across the region. Innovative logistics tools, such as AI-based demand forecasting and automated scheduling, can optimize shipping routes and schedules, reducing fuel consumption and labor costs. Alshdadi et al. (2024) support this result by stating that through IoT sensors and data analytics, stakeholders can monitor cargo conditions, such as temperature and humidity for perishable goods, and adjust logistics strategies based on real-time data. With a reliable and efficient shipping network, goods can move faster to remote regions, improving local supply chains, stabilizing prices, and supporting economic development across archipelagic areas of Indonesia. This mapping involves tracking the distribution routes, volumes, types of commodities, and transportation frequency from and to various ports. The eastern part of Indonesia, which includes Papua, Maluku, and East Nusa Tenggara, has been a key focus of the Sea Toll initiative due to its geographical challenges and historically limited infrastructure. The most significant form of cargo service is port-to-port, with a percentage of 34.50%. Port to port is the process of sending goods from the port of origin to be sent to the destination port. Next is port-to-door service at 26.90%. Port-to-door is the process of sending goods from the origin port to the destination warehouse. Percentage Diagram (%) The following service form is the door-to-port at 22.22%, and the last door-to-door at 16.36%. Each service form follows the pattern of origin and destination of cargo movement. Port-to-port services tend to have a broad reach, covering domestic, export, and import activities. Port-to-door services tend only to follow the specific movement of imported goods. Door-to-port services tend to follow the particular movement of export goods. Meanwhile, door-to-door services tend to follow the pattern of domestic goods movement activities. One of the significant strengths of the Sea Toll program is its ability to connect remote and isolated regions in Papua to the rest of Indonesia. The program has helped link smaller, less accessible ports in Papua with more significant, better-developed hubs, ensuring that goods can reach even the most remote communities.

CONCLUSION

The Sea Toll program has positively impacted logistics distribution in Sorong by improving connectivity, reducing transportation costs, and increasing the availability of essential goods. It has facilitated the steady supply of basic commodities, construction materials, and fuel, crucial for local development. However, challenges remain, including infrastructure limitations at smaller ports and an imbalance between inbound and outbound cargo volumes. The program's effectiveness could be further enhanced by addressing these logistical challenges and promoting local production to optimize outbound cargo flow. Although the Sea Toll positively impacts logistics distribution in Sorong Regency, further infrastructure and operational management improvements are needed to achieve more optimal effectiveness.

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