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Commodity-Based Analysis of Sea Toll Utilization: A Case Study of Salt and Seaweed Distribution in Sabu Raijua

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Abstract

The distribution of superior commodities from the archipelago is often constrained by limited infrastructure and high logistics costs. To address these challenges, the government launched the *Sea Toll* program to reduce price disparities and expand market access for local products. However, the effectiveness of the *Sea Toll* in remote areas still fluctuates, particularly in supporting the sustainability of strategic commodity supply chains. This study analyzes the dynamics of salt and seaweed distribution during the period 2020–2025 using a mixed methods approach. The results indicate that since 2021, seaweed distribution has been entirely dependent on non-*Sea Toll* vessels, with fluctuating volumes and portions of the output distributed informally, including through bartering with rice or direct shipment to Makassar. Conversely, salt distribution has been relatively more stable and made significant use of the *Sea Toll* in 2022 (42.7%) and 2025 (39.3%), although its contribution declined in 2023–2024. The determining factors for these differing distribution patterns include production scale, storage capacity, logistics infrastructure, and the participation of local actors such as local governments and private sectors. The study concludes that the effectiveness of the *Sea Toll* is strongly influenced by commodity characteristics and local supply chain structures. Policy recommendations include route adjustments, strengthening logistics infrastructure, empowering farmer institutions, and promoting product downstreaming to increase added value.

Keywords: Sea Toll; commodity distribution; salt; seaweed; Sabu Raijua; Maritime logistics

INTRODUCTION

Indonesia, as an archipelagic country, faces serious challenges in the distribution of goods, especially in the disadvantaged, frontier, and outermost (3T) regions. High logistics costs, irregular shipping schedules, and limited port infrastructure and land transportation contribute to wide price disparities between regions. To overcome this problem, the government launched the Sea Toll program, which is expected to reduce distribution costs, strengthen connectivity, and open market access for regional leading commodities (Mamonto et al., 2024; Ratnawati et al., 2025; Sofiyandi et al., 2023).

Sabu Raijua Regency, one of the small islands in East Nusa Tenggara Province, has strategic potential in salt and seaweed commodities (Cottier-Cook et al., 2021; Do Bagus & Hanaoka, 2023; Fauzi et al., 2024; Kurniawan, 2024). Sabu salt is known for its high quality, while seaweed serves as an important raw material for the food and pharmaceutical industries. However, the distribution of these two commodities still faces various obstacles. Data from 2020–2025 show an inconsistent distribution pattern: the utilization of the Sea Toll for salt fluctuated from 75.6% (2022) to only 10.1% (2024) before increasing again to 47.7% (2025). Seaweed distribution is almost entirely dependent on non-Sea Toll vessels, with only 49 tonnes recorded in 2020 and none between 2021 and 2025.

These conditions raise an important question: to what extent is the Sea Toll program able to support the distribution of superior commodities on small islands such as Sabu Raijua? Why does its utilization fluctuate across the years, and what factors most determine its success or failure? These questions form the basis of this research. Specifically, this study aims to (1)

describe the dynamics of salt and seaweed distribution in Sabu Raijua Regency during 2020–2025, (2) identify the driving and inhibiting factors for the use of the Sea Toll through fishbone analysis, and (3) formulate strategies for optimizing the distribution of superior commodities using a SWOT approach. The purpose of this research is to provide a comprehensive evaluation of the effectiveness of the Sea Toll program in distributing leading commodities in archipelagic regions and to generate evidence-based strategic recommendations for improving maritime logistics policies (Amin et al., 2021; Bose, 2012; Primadi & colleagues, 2021; Tohir, 2022). The results are expected to serve as a reference for local governments in strengthening distribution connectivity and empowering local businesses, while contributing to the development of maritime logistics literature from a commodity-based and local context perspective.

A review of previous research shows that most studies on Sea Toll implementation still focus on major ports or national-scale analyses, for example on the Surabaya–Kupang route or on the program's impact on price disparities at the macro level. Meanwhile, studies highlighting distribution dynamics on small or remote islands remain limited. Even fewer studies compare distribution patterns between commodities within a single region, even though the characteristics of local products greatly influence their alignment with the Sea Toll scheme. This gap in the literature is what this research seeks to address.

Therefore, the main contribution of this study lies in its analytical novelty—combining quantitative data on salt and seaweed distribution with qualitative methods based on fishbone and SWOT analyses to produce a comprehensive depiction of the dynamics of superior commodity distribution in Sabu Raijua. The results not only illustrate fluctuations in Sea Toll utilization but also offer concrete, context-based strategies that are relevant for strengthening distribution policies across other small archipelagos in Indonesia.

RESEARCH METHOD

This study uses *a mixed methods approach* with the aim of obtaining a comprehensive understanding of the dynamics of the distribution of superior commodities in Sabu Raijua Regency. A quantitative approach was used to analyze the distribution trend of salt and seaweed based on data on transportation volume through Sea Tolls and non-Sea Tolls during the period 2020–2025. A qualitative approach was used to explore the causative factors and distribution improvement strategies using fishbone and SWOT methods. The selection of this combined method follows Creswell's (2014) recommendation that the integration of quantitative and qualitative data is able to provide a more in-depth analysis of public policy research.

The research was conducted in Sabu Raijua Regency, East Nusa Tenggara Province, with a focus on two leading commodities, namely salt and seaweed. The research location was chosen because of its characteristics as a small island in the 3T region that has local commodity potential but faces typical distribution barriers.

The data used consisted of:

1. Primary data is in the form of field observations, interviews with relevant stakeholders (fishermen/farmers, MSMEs, port officials, trade offices, ship operators), and direct records of distribution activities at Seba Port.
2. Secondary data is in the form of official reports from the Sabu Raijua Regency Industry and Trade Office (salt SKAB recap), port operational reports from Class III Seba KUPP, as well as supporting data from BPS and the Ministry of Transportation).

Quantitative analysis was carried out through a descriptive analysis of the volume of salt and seaweed distribution per year and the percentage of use of Sea Tolls compared to non-Sea Tolls. The results are presented in the form of tables and trend graphs to show the dynamics between years.

Qualitative analysis uses two approaches:

- Fishbone Diagram (Ishikawa Analysis) to identify the root cause of the low effectiveness of the Sea Toll. The factors explored include human aspects, methods, means, materials, environment, and policies.
- SWOT Analysis to formulate a distribution optimization strategy. This analysis compares internal factors (strengths and weaknesses) with external factors (opportunities and threats) in order to develop a strategy to strengthen the role of the Sea Toll in the local context of Sabu Raijua.

The validity of the data is strengthened by source triangulation (comparing data from official reports, interviews, and field observations) and method triangulation (using quantitative and qualitative analysis). According to Miles & Huberman (1994), triangulation is an important technique to increase the validity of qualitative research results.

RESULTS AND DISCUSSION

1. Seaweed Distribution (2020–2025)

The graph of the distribution trend of seaweed commodities from Sabu Raijua Regency can be seen in Figure 1 below:

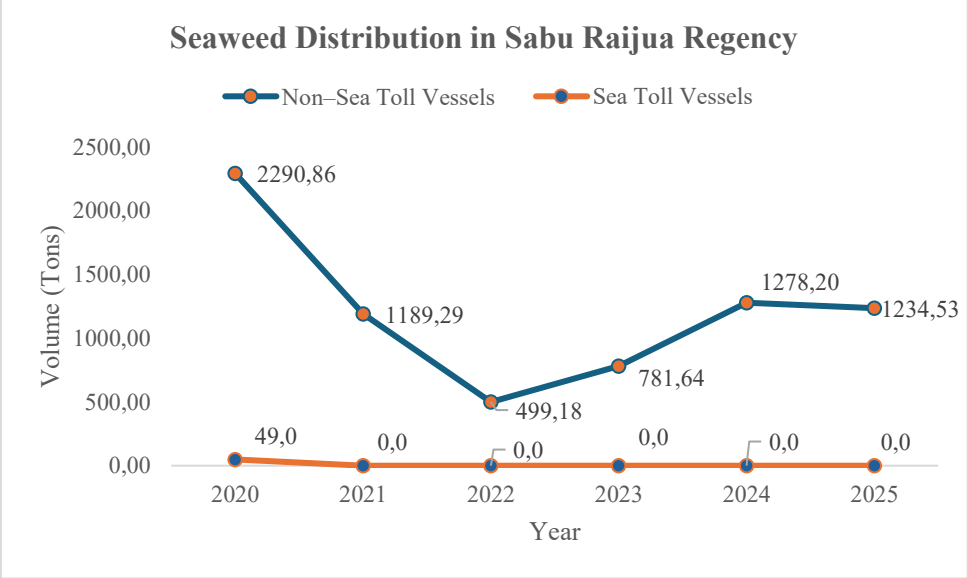

Figure 1. Seaweed Distribution in Sabu Raijua Regency

Source: Processed from KUPP Class III Seba Data and Disperindag Sabu Raijua (2025)

The distribution graph of seaweed in Sabu Raijua Regency for the 2020–2025 period shows a dominance pattern of shipments through non-Sea Toll ships, with only a small use of Sea Toll in 2020 (49 tons) and zero in 2021–2025. The volume of non-Sea Toll distribution also fluctuated, from 2,290 tons (2020) to 499 tons (2022), then increased again to more than 1,200 tons in 2024–2025.

The results of the field survey strengthen the explanation for this pattern. In 2022, many seaweed cultivation sites were damaged by environmental factors and diseases, resulting in a significant decrease in production. This condition is in accordance with the literature that emphasizes that environmental fluctuations and pest attacks are the main factors for the instability of seaweed production in Indonesia (Basyuni, 2024). In addition, most of the crops left in that period did not go into the formal distribution channel, but were sent directly to Makassar using merchant ships coming from Makassar. This direct distribution pattern shows

the preference of actors for more practical routes than using the Sea Toll which has a fixed schedule and longer procedures.

The field findings also noted that some farmers and seaweed collectors often barter with rice as a strategy to meet basic household needs. This practice of barter confirms the close link between the commodity distribution chain and the local subsistence economy. This is consistent with the analysis of Indonesia's seaweed supply chain which states that fluctuating market prices and limited access to formal markets encourage farmers to look for informal distribution channels or alternative transactions (Mulyati & Geldermann, 2016).

Thus, the fluctuations in the graph not only represent production dynamics, but also illustrate the vulnerability of the seaweed distribution system in Sabu Raijua which is greatly influenced by environmental conditions, distribution mode choices, and survival strategies of local communities. This explanation based on quantitative data and field findings provides a comprehensive overview of the limitations of the Sea Toll in serving commodities with a rapidly damaged and small-scale character such as seaweed.

2. Salt Distribution (2020–2025)

The graph of the distribution trend of salt commodities from Sabu Raijua Regency can be seen in Figure 2 below:

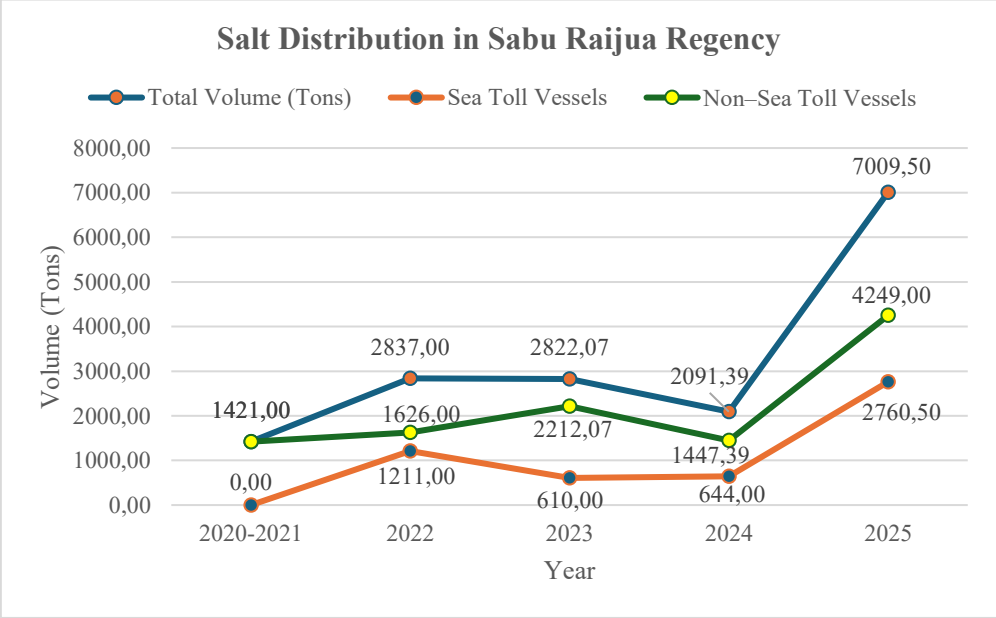

Figure 2. Salt Distribution Graph of Sabu Raijua Regency

Source: Processed from KUPP Class III Seba and Disperindag Sabu Raijua (2025)

The salt distribution graph of Sabu Raijua Regency for the 2020-2025 period shows a relatively large pattern of volume but still fluctuates. In 2020–2021, the distribution was recorded at 1,421 tons, all of which were sent via non-Sea Toll ships. The use of the Sea Toll has not occurred in this period.

Entering 2022, the total volume increased to 2,837 tons. Of these, 1,211 tons (42.7%) were transported using the Sea Toll, while 1,626 tons were sent via non-Sea Tolls. This data marks the beginning of the use of Sea Tolls in the salt distribution chain. However, 2023 showed a stagnation of total volume (2,822 tons) with a shift in moderation: non-Sea Toll ships increased to 2,212 tons, while the contribution of Sea Toll decreased to 610 tons (21.6%). The decline continued in 2024 when total volume shrank to 2,091 tons, with Sea Tolls contributing only 644 tons (30.8%). The new revival occurred in 2025, when total distribution jumped

dramatically to 7,009 tons, with 2,760 tons (39.3%) via Sea Tolls and 4,249 tons via non-Sea Tolls.

Field Findings and Interpretation

Field surveys show that the salt distribution pattern in Sabu Raijua is closely related to the pond management system. Some ponds are managed by local governments (PEMDA) with a profit-sharing scheme, where the local government receives 35% of total production. On the other hand, there are ponds managed by private companies that employ local people. This private company has even had its own transport ship since 2014, so it is able to channel salt production independently without relying entirely on the Sea Toll scheme.

The presence of private actors with self-distributed infrastructure explains why the volume of non-Sea Tolls remains dominant in the chart, although the contribution of Sea Tolls increases in certain years. Meanwhile, the management of ponds by the Regional Government with a profit-sharing system has the potential to increase the volume of salt that enters the official distribution channel, but it still depends on the readiness of the Sea Toll route and the available ship capacity.

Thus, the dynamics of salt distribution are not only influenced by production factors and ship routes, but also by the ownership and management structure of ponds. The combination of local government management schemes, private involvement, and transportation mode preferences shows that the success of the Sea Toll in Sabu Raijua is closely related to multi-actor coordination in the salt supply chain. This is in line with the findings of Fuady (2023) and Widodo et al. (2021) that the effectiveness of Sea Tolls is greatly influenced by institutional capacity and the readiness of local actors.

Comparison of Seaweed and Salt Distribution in Sabu Raijua

Analysis of the distribution graph shows that there is a striking difference between the distribution patterns of seaweed and salt in Sabu Raijua Regency. Seaweed commodities since 2021 have been completely dependent on non-Sea Toll ships, with relatively small and fluctuating volumes. Meanwhile, the salt commodity has a much larger volume of distribution, with significant but inconsistent Sea Toll involvement.

In terms of the use of the Sea Toll, salt is more "suitable" with regular distribution schemes because of its characteristics: large production volumes, high storage capacity, and relatively organized pond management structures, both by local governments with a profit-sharing system and by private companies that have their own ships. The presence of private companies since 2014 with self-distribution infrastructure also explains why non-Sea Toll routes remain dominant, although the contribution of Sea Tolls increases in certain periods.

In contrast, seaweed is small-scale, highly dependent on environmental conditions, and demands quick distribution so that quality does not decline. The absence of storage and processing facilities at the local level makes farmers prefer flexible non-Sea Toll modes. In fact, the results of field surveys show that some farmers/collectors trade seaweed for rice, or sell it directly to merchant ships bound for Makassar. This shows that seaweed does not have a strong attachment to formal distribution schemes such as Sea Tolls.

This difference emphasizes that the effectiveness of the Sea Toll is largely determined by the characteristics of the commodity and the structure of the local supply chain. Salt commodities have a great opportunity to be integrated into the Sea Toll if external factors such as route consistency, ship capacity, and port infrastructure readiness are strengthened. In contrast, seaweed requires a different approach, such as the provision of post-harvest facilities, more flexible modal integration, or processing support to add value before delivery.

Thus, the case study of Sabu Raijua shows the segmentation of commodities in the Sea Toll program: large-volume and durable commodities (salt) tend to be in accordance with the Sea Toll scheme, while perishable commodities and fluctuate production (seaweed) rely more on non-regular routes. This finding makes an important contribution to sea transportation policy in Indonesia, that distribution strategies need to consider the specific characteristics of commodities, not just add routes or sea toll fleets.

4. Causal Factor Analysis (Fishbone)

Fishbone analysis (Ishikawa) was used to trace the root of the problem of low effectiveness of Sea Tolls in the distribution of superior commodities in Sabu Raijua. From field surveys and data , six main factors were identified that affect the low effectiveness of the Sea Toll in Sabu Raijua, shown in the following Figure 3:

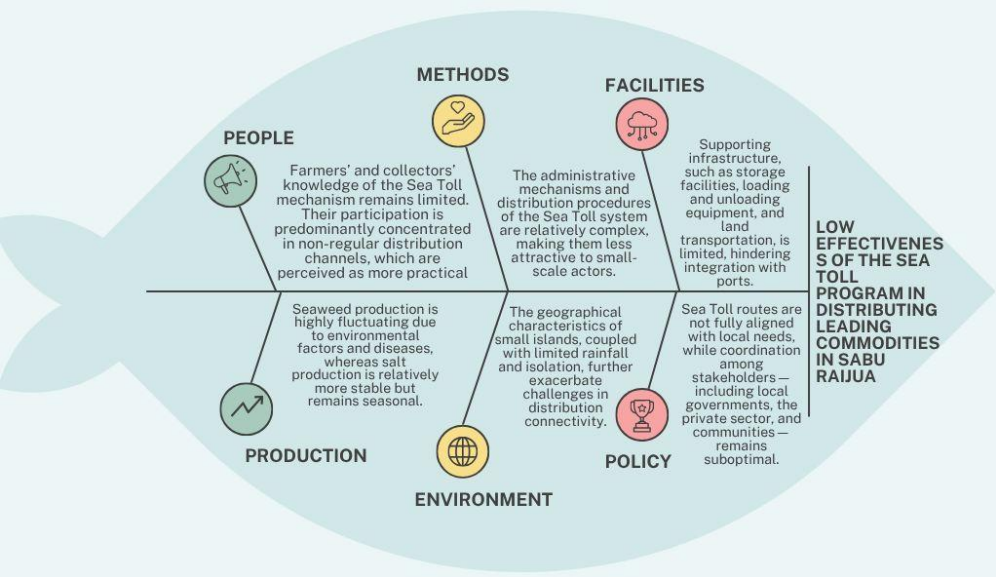

Figure 3. Fishbone Analysis of the Effectiveness of Sea Tolls in Sabu Raijua
Source: Author's Analysis Results (2025)

5. Optimization Strategy (SWOT)

The SWOT analysis was conducted to formulate a strategy to optimize the distribution of superior commodities in Sabu Raijua. The results are as follows:

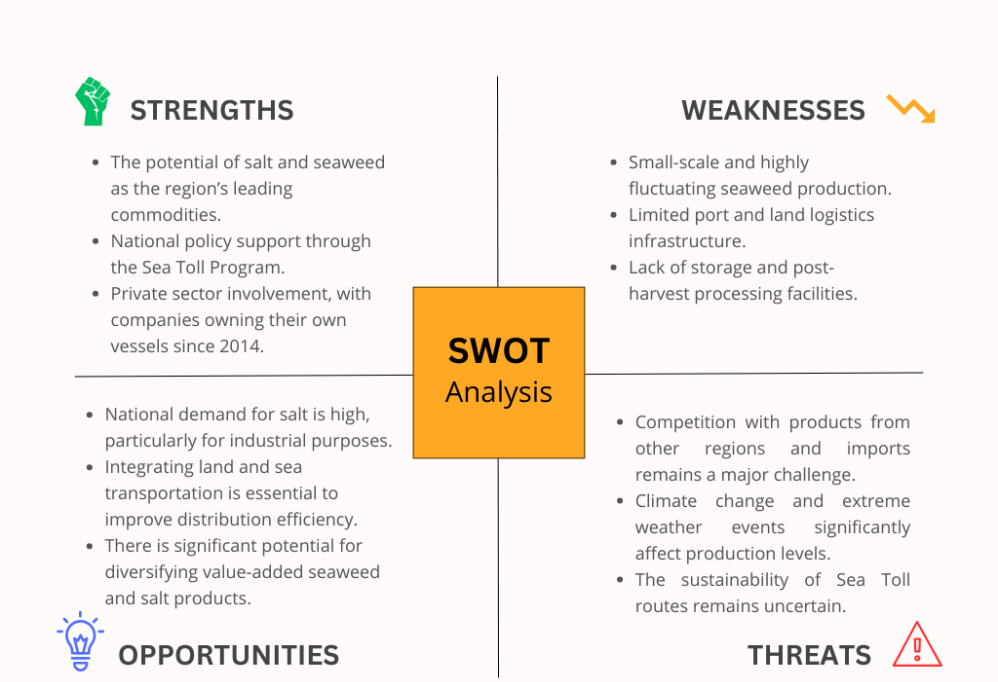

Figure 4. SWOT Analysis of Sea Toll Optimization Strategy in Sabu Raijua
Source: Author's Analysis Results (2025)

From the SWOT analysis, strategies that can be developed include: (1) strengthening integration between local governments, the private sector, and the community in distribution management; (2) providing supporting logistics infrastructure such as salt warehouses and seaweed processing units; (3) adjusting the route and schedule of the Sea Toll to better suit the needs of local production; and (4) encourage product downstream to reduce dependence on the delivery of raw materials.

CONCLUSION

The analysis of the distribution dynamics of superior commodities in Sabu Raijua Regency through the Sea Toll program (2020–2025) reveals contrasting patterns between salt and seaweed: seaweed remains dependent on non-Sea Toll vessels due to small-scale production, unstable supply, urgent delivery needs, and limited storage, while salt—though more compatible with the Sea Toll scheme—still experiences fluctuating utilization influenced by route readiness, vessel capacity, and pond management governance. Fishbone analysis identified six key factors behind low effectiveness (human, method, means, material, environment, and policy), and SWOT analysis showed that although notable strengths and opportunities exist, infrastructure limitations and external threats persist. This study underscores that evaluating Sea Toll effectiveness requires a commodity-level and local-context perspective rather than a purely macro approach, suggesting that future research should explore adaptive logistics models tailored to the specific characteristics and scales of archipelagic commodities.

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