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Fish Marketing Efficiency for Sustainable Coastal Resource Management: A Comparative Study of Tangkahan Belawan and Tanjung Balai, North Sumatra

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ABSTRACT

The capture fisheries sector plays an important role in supporting food security, coastal livelihoods, and sustainable marine resource management. One factor influencing fisheries sustainability is the efficiency of fish marketing systems, particularly post-harvest handling and distribution. This study analyses and compares fish marketing efficiency in Tangkahan Belawan and Tanjung Balai, North Sumatra Province, and examines how differences in post-harvest handling systems influence marketing performance and sustainable fisheries management. We collected data from 100 respondents, including boat owners, wholesalers, retailers, and consumers, using snowball and convenience sampling. We used descriptive qualitative and quantitative approaches to analyze marketing channels, marketing costs, marketing margins, fishers' share, and marketing efficiency across six fish commodities. The results show that fish marketing in Tanjung Balai was consistently more efficient than in Belawan, as indicated by lower marketing efficiency values and marketing costs across all commodities. Marketing costs averaged Rp7,297/kg in Belawan and Rp5,307/kg in Tanjung Balai. This difference mainly reflected Tanjung Balai's frozen fish marketing system, which reduced handling intensity, ice requirements, and distribution costs. In contrast, fresh fish marketing in Belawan required higher operational costs to maintain product quality. This study's novelty lies in showing that differences in post-harvest handling systems can affect fish marketing efficiency even when marketing channel structures are similar. Improving post-harvest handling, storage, and distribution efficiency can reduce post-harvest losses, enhance economic returns, and minimize pressure on fish resources without increasing fishing intensity. Thus, strengthening fish marketing systems through appropriate post-harvest management can complement production-oriented fisheries policies and support sustainable fisheries and coastal resource management.

Keywords: Fish Marketing Efficiency, Post-harvest Handling, Marketing Systems, Fisheries Marketing, & Sustainable Fisheries

1. Introduction

The capture fisheries sector plays a significant role in supporting food security, improving coastal communities' welfare, and contributing to regional economic development. As a maritime nation, Indonesia has substantial fisheries resources, particularly in coastal areas that function as landing and marketing centers for fishery products. In North Sumatra Province, Tangkahan Belawan and Tangkahan Tanjung Balai serve as key centers for distributing capture fisheries products along Sumatra's eastern coast.

Capture fisheries sustainability depends not only on fishing activities but also on the effectiveness of post-harvest systems, particularly fish marketing. Inefficient marketing systems can raise marketing costs, reduce the share of the final price received by fishermen (fishermen's share), and increase post-harvest losses. These conditions can reduce fishermen's economic returns and increase pressure to maintain or intensify fishing activities, potentially increasing pressure on fishery resources. Therefore, improving post-harvest and marketing efficiency is important not only for economic performance but also for sustainable fisheries management (Kruijssen et al., 2020).

Tangkahan Belawan and Tangkahan Tanjung Balai have different fish marketing characteristics. In Tangkahan Belawan, fish are predominantly marketed fresh, requiring rapid handling, continuous ice use, and intensive distribution to maintain product quality. These requirements may lead to higher operational and marketing costs. In contrast, fish in Tangkahan Tanjung Balai are predominantly marketed frozen, which provides greater stability during marketing and may reduce handling, ice, and distribution costs. These differences provide an important basis for examining how post-harvest handling systems influence fish marketing efficiency (Arista et al., 2022).

Marketing efficiency is an important indicator for evaluating the performance of fisheries marketing systems. An efficient system is generally associated with relatively low marketing costs, reasonable marketing margins, and an appropriate share of the final price received by fishermen. Previous studies have examined fisheries marketing efficiency using indicators such as marketing margins, fisher's share, marketing costs, and marketing channels. These studies have provided important insights into price distribution and the economic performance of fisheries marketing systems. However, no single indicator fully explains marketing efficiency, as post-harvest handling, storage requirements, value-added activities, and distribution costs can simultaneously influence marketing performance (Soekartawi, 2002).

Recent research on fisheries value chains further indicates that supply-chain inefficiencies, including poor coordination, high post-harvest losses, and weak governance, can reduce economic returns for small-scale fishers. Fisheries value chains involve complex interactions among multiple actors, while value addition and distribution efficiency play important roles in determining overall marketing performance. Consequently, improvements in handling, storage, and distribution systems are increasingly recognized as important pathways to enhance both economic performance and fisheries sustainability (Acharjee et al., 2021).

Despite growing attention to fisheries value chains and post-harvest management, comparative evidence remains limited on how different fish handling systems affect marketing efficiency when the basic marketing channel structure is relatively similar. In particular, the relationship between fresh and frozen fish handling systems and the combined performance of marketing margins, fisher's share, marketing costs, and marketing efficiency remains insufficiently examined in coastal fisheries in North Sumatra. This gap is important because differences in post-harvest handling may alter operational costs and distribution requirements even when the sequence of marketing actors remains relatively similar (Wibowo et al., 2024).

This study addresses this gap by comparatively analyzing fish marketing systems in Tangkahan Belawan and Tangkahan Tanjung Balai. Both locations have a similar sequence of marketing actors, boat owners, wholesalers, retailers, and consumers, but differ in their dominant post-harvest handling systems. Belawan primarily uses a fresh fish marketing system, whereas Tanjung Balai primarily uses a frozen fish marketing system. This study's novelty lies in showing how differences in post-harvest handling systems can influence marketing efficiency by affecting operational costs, handling requirements, and distribution efficiency, rather than assessing marketing performance solely through marketing margins or fishers' share.

This comparative approach provides an integrated perspective on the relationship between post-harvest handling, fish marketing efficiency, and sustainable coastal resource management. By identifying how improvements in post-harvest handling and marketing can reduce losses, increase economic returns, and improve distribution efficiency, the study highlights an alternative pathway to support fisheries sustainability without increasing fishing intensity. Therefore, this study aims to analyze and compare fish marketing efficiency in Tangkahan Belawan and Tangkahan Tanjung Balai using marketing margins, fisher's share, marketing costs, and marketing efficiency indicators, and to examine the implications of these differences for sustainable coastal resource management.

2. Methods

This research was conducted in Tangkahan Belawan and Tangkahan Tanjung Balai, North Sumatra Province, two important coastal areas that serve as landing and marketing centers for capture fisheries on the east coast of Sumatra. The locations were purposively selected based on differences in fish marketing systems: fresh fish marketing in Belawan and frozen fish marketing in Tanjung Balai.

This study used a combination of snowball and convenience sampling to reach respondents involved in the fish marketing chain. Snowball sampling identified key actors in the marketing system, starting with initial respondents such as boat owners and wholesalers, who then referred other relevant actors within the distribution network. This approach was necessary because formal, comprehensive data on marketing actors are lacking and because fisheries marketing systems are interconnected.

Meanwhile, convenience sampling was applied to select respondents who were readily accessible and willing to participate during field data collection. This method enabled efficient data collection within limited time and field constraints, particularly for retailers and consumers not formally registered in the marketing system.

Combining these two sampling techniques ensured the study captured both the structural relationships within the marketing chain and the practical realities of field conditions. The study obtained 100 respondents: 50 from Tangkahan Belawan and 50 from Tanjung Balai, including boat owners, wholesalers, retailers, and consumers.

Data were collected through field observations, in-depth interviews, documentation, and review of official documents and previous studies. Qualitative descriptive analysis described the structure of marketing channels and fish handling systems in both research locations.

Quantitative analysis was conducted in several stages. First, marketing margin was calculated as the difference between consumer price and producer price for each commodity. Second, fisher's share was calculated as the percentage of the final consumer price received by the producer. Third, total marketing costs were calculated by summing all distribution costs, including transportation, labor, storage (ice), levies, and other operational expenses. Finally, marketing efficiency was calculated by comparing total marketing costs with the total value of the marketed products.

The study then compared the calculated indicators between Tangkahan Belawan and Tanjung Balai to evaluate differences in marketing performance. This analysis identified the most efficient marketing system and assessed its implications for sustainable coastal resource management.

2.1 Marketing Margin

Marketing margin is the difference between the price the final consumer pays and the price the producer receives.

The Marketing Margin Formula is :

$$\text{Marketing Margin} = \text{Consumer Price} - \text{Producer Price}$$

Information:

Consumer Price : The final price paid by the consumer
 Producer Price : Price received by the producer

2.2 Fisher's Share

Fisher's Share (FS) is the percentage of the final price (consumer price) that the producer receives. It compares the producer's role in determining the final price and assesses the efficiency of two catchments.

The Fisher's Share formula is :

$$\text{Fisher's Share (\%)} = \left(\frac{\text{Producer Price}}{\text{Consumer Price}} \right) \times 100\%$$

Information:

Consumer Price : The final price paid by the consumer
 Producer Price : Price received by the producer

2.3 Marketing Costs

Marketing costs are all costs incurred by marketing agencies in distributing fish from fishermen (producers) to the end consumer. These costs include transportation, labor, storage, levies, and other operational costs.

The Marketing Cost Formula is :

$$MC = \sum_{i=1}^n C_i$$

Information

Consumer Price : Total marketing costs
 Producer Price : i-th marketing cost
 (transportation costs, loading and unloading, labor, storage/ice, levies, packing, and other operational costs).
 n : Total marketing cost components

2.4 Marketing Efficiency

Marketing efficiency compares marketing costs incurred with marketing margins obtained. Marketing efficiency describes the relationship between marketing costs incurred and margins earned. The goal is to determine which marketing channels are more cost-effective and efficient in moving products from fishermen to consumers.

$$EP = \frac{TC}{TPV} \times 100\%$$

Information:

TC : Total cost
 TPV : Total product value

3. Result and Discussion**3.1 Fish and Marketing Channel Structure**

At Tangkahan PPS Belawan, the fish marketing system operates through a single distribution channel involving boat owners, wholesalers, retailers, and final consumers.

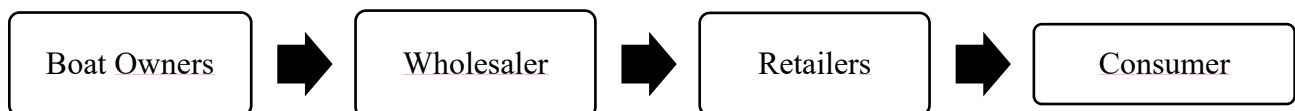


Figure 1. Fish Marketing Channels in Tangkahan PPS Belawan

Figure 1 shows that the marketing channel in Belawan consists of four marketing institutions, namely boat owners, wholesalers, retailers, and final consumers. Boat owners catch marine fish. Boat owners sell fish to wholesalers, who buy the catch and sell it to retailers, who then sell it to consumers.

The marketing channel at Tangkahan PPI Tanjung Balai describes the distribution pathway of fish catches from producers to final consumers.

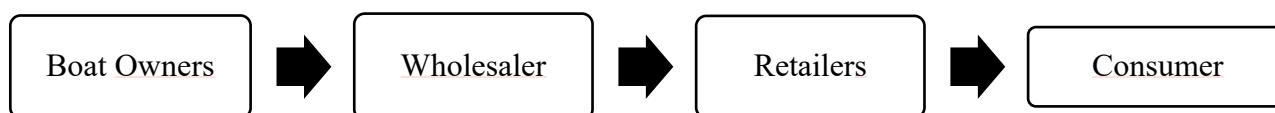


Figure 2. Fish Marketing Channels in Tangkahan PPI Tanjung Balai

Based on Figure 2, the fish marketing channel in Tangkahan PPI Tanjung Balai shows an indirect marketing pattern involving several marketing institutions. The boat owner, as the producer, sells frozen catch to wholesalers, who then distribute it to retailers before it reaches the end consumer.

Both research locations employ a single marketing channel involving boat owners, wholesalers, retailers, and consumers. Although the marketing channel structure is similar in both areas, the main difference lies in the fish handling system: fresh fish marketing in Belawan and frozen fish marketing in Tanjung Balai.

3.2. Comparative Analysis of Marketing Efficiency between Belawan and Tanjung Balai

3.2.1 Marketing Margin

Table 1. Marketing Margin in Both Tangkahan

Marketing Margin	Squid (Rp/Kg)	Mackerel (Rp/Kg)	Tuna (Rp/Kg)	Black Pomfret (Rp/Kg)	Big-eyed Fish (Rp/Kg)	Cuttlefish (Rp/Kg)
Belawan	32049	22321	16818	22581	23440	30000
Tanjung Balai	37071	24860	20000	21474	22786	40000

The marketing margin table shows the price difference between consumer and boat owners for each fish commodity. Overall, Tanjung Balai exhibits higher marketing margins than Belawan for all commodities analyzed. For example, the marketing margin for squid in Tanjung Balai is Rp37,071/kg, higher than in Belawan at Rp32,049/kg. A similar pattern is also seen for mackerel, tuna, black pomfret, bigeye, and cuttlefish. Higher marketing margins in Tanjung Balai reflect a larger price gap between producer and consumer levels. This condition is associated with freezing, storage, and value addition at the wholesaler level. However, high marketing margins do not necessarily reflect an inefficient marketing system; they must be viewed alongside marketing costs and the value of the product being marketed.

3.2.2 Fisher's Share

Table 2. Fisher's share in Both Tangkahan

Fisher's share	Squid	Mackerel	Tuna	Black Pomfret	Big-eyed Fish	Cuttlefish
Belawan	60%	55%	52%	59%	22%	60%
Tanjung Balai	54%	50%	43%	61%	24%	47%

The Fisher's share table shows the percentage of the price the vessel owner receives from the price paid by the end consumer. The analysis shows that Belawan has a relatively higher Fisher's share than Tanjung Balai for most commodities. For example, the fisher's share for squid in Belawan reaches 60%, while in Tanjung Balai it is 54%. The higher Fisher's share in Belawan indicates that boat owners receive a larger proportion of the final selling price. This is influenced by the marketing of fresh fish, which has a relatively shorter distribution chain and lower added value at the trader level. The lower fisher's share in Tanjung Balai is associated with additional freezing and distribution stages that extend the marketing chain and increase the price share captured by intermediaries.

3.2.3 Marketing Costs

Table 3. Marketing Costs in Both Tangkahan

Marketing Costs	Squid (Rp/Kg)	Mackerel (Rp/Kg)	Tuna (Rp/Kg)	Black Pomfret (Rp/Kg)	Big-eyed Fish (Rp/Kg)	Cuttlefish (Rp/Kg)
Belawan	7297	7297	7297	7297	7297	7297
Tanjung Balai	5307	5307	5307	5307	5307	5307

The marketing cost table shows that marketing costs in Belawan are higher than in Tanjung Balai for all fish commodities. Marketing costs in Belawan were recorded at Rp7,297/kg, while in Tanjung Balai they were Rp5,307/kg. This difference reflects the characteristics of fresh fish marketing in Belawan, which requires rapid handling, heavy use of ice, and daily distribution to maintain fish quality. In contrast, the frozen fish marketing system in Tanjung Balai is more stable because the product can be stored longer without intensive handling, resulting in lower marketing costs.

3.2.4 Marketing Efficiency

Table 4. Marketing Efficiency in Both Tangkahan

Marketing Efficiency	Squid	Mackerel	Tuna	Black Pomfret	Big-eyed Fish	Cuttlefish
Belawan	9%	15%	21%	13%	24%	10%
Tanjung Balai	7%	11%	15%	10%	18%	7%

The marketing efficiency table shows that Tanjung Balai's marketing efficiency is lower than Belawan's for all fish commodities. A lower marketing efficiency value indicates a more efficient marketing system. For example, squid marketing efficiency in Belawan is 9%, while in Tanjung Balai it is 7%. The same pattern is seen for mackerel, tuna, black pomfret, bigeye, and cuttlefish. The low marketing efficiency value in Tanjung Balai indicates that marketing costs are relatively small compared to the value of the products marketed.

3.2.5 Integrated Interpretation of Marketing Performance

Comparing marketing margins, fisher's share, and marketing costs shows that no single indicator is sufficient to determine overall marketing efficiency. Tanjung Balai generally records higher marketing margins, while Belawan generally provides a higher fisher's share. Nevertheless, Tanjung Balai has lower marketing costs and lower marketing efficiency values. This indicates that the economic meaning of a marketing margin depends on the functions performed and the costs incurred along the value chain.

The higher margin in Tanjung Balai is associated with the frozen fish marketing system, which incorporates freezing and storage activities into the marketing process. These activities represent additional functions performed by marketing intermediaries and may increase the difference between producer and consumer prices. The margin may therefore partly reflect the costs and value added associated with these marketing functions rather than simply indicating excessive intermediary returns.

In contrast, Belawan has a relatively higher fisher's share for most commodities because fish are marketed fresh and are sold without the same degree of processing and storage. A higher fisher's share means producers receive a larger share of the final consumer price. However, it does not automatically translate into higher overall marketing efficiency because fresh fish requires more intensive handling, ice, labor, and rapid transportation.

From a value chain management perspective, the results suggest that efficiency depends on how effectively value-adding functions such as preservation, storage, and distribution are organized. Tanjung Balai demonstrates that an additional processing function, namely freezing, can coexist with lower marketing costs when it provides greater distribution flexibility and reduces recurring handling requirements. Thus, marketing efficiency is shaped by the interaction among price distribution, operational costs, post-harvest functions, and distribution arrangements.

3.3 Fish Handling System in Marketing

Fish handling in the marketing process involves a series of activities that maintain fish quality from landing to delivery to final consumers. Appropriate handling is essential not only to preserve product quality and reduce post-harvest losses but also to maintain product value and control marketing costs throughout the distribution process.

In Tangkahan Belawan, fish are predominantly marketed fresh. Immediately after landing, fish are handled using large quantities of ice (bulk ice) to maintain freshness. The marketing process is relatively short and requires rapid distribution because fresh fish are highly perishable. Consequently, fresh fish marketing requires relatively intensive use of ice, labor, and transportation. These handling requirements increase marketing costs, as reflected in the marketing cost of Rp7,297/kg reported in this study. However, the fresh marketing system also allows boat owners to obtain a relatively higher fisher's share because fish are marketed without further freezing or storage (Ghaly et al., 2010).

In contrast, fish marketed in Tangkahan Tanjung Balai are predominantly handled frozen. After landing, fish are frozen and stored before wholesalers or retailers receive them. This system provides greater flexibility in distribution timing and reduces the risk of quality deterioration during marketing. Freezing and storage also reduce the need for intensive daily handling and continuous ice replacement. As a result, marketing costs in Tanjung Balai were lower (Rp5,307/kg), and marketing efficiency values were consistently lower than those observed in Belawan across the six commodities. Because lower marketing efficiency values indicate that marketing costs absorb a smaller proportion of product value, the results suggest that the frozen marketing system was relatively more cost-efficient than the fresh marketing system (Murniyati & Sunarman, 2000).

The comparison between the two locations shows that marketing performance cannot be evaluated solely on marketing margins or fisher's share. Although Tanjung Balai recorded higher marketing margins across all six fish commodities, Belawan generally recorded a higher fisher's share. Nevertheless, Tanjung Balai had lower marketing costs and lower marketing efficiency. This finding suggests that higher marketing margins do not necessarily indicate an inefficient marketing system, especially when the margin reflects additional marketing functions such as freezing, storage, and distribution. Similarly, a higher fisher's share does not necessarily imply greater overall marketing efficiency when the marketing system requires higher operational costs. Thus, marketing efficiency is better understood through the interaction between price distribution, marketing costs, post-harvest functions, and distribution arrangements (Yildirim, 2023).

From a value-chain perspective, the differences between Belawan and Tanjung Balai suggest that post-harvest handling systems can significantly shape marketing performance. In Belawan, the fresh-fish system depends on rapid product movement and continuous quality maintenance, increasing handling intensity and associated operational costs. In Tanjung Balai, freezing and storage provide greater temporal flexibility in distribution, allowing fish to be maintained before reaching subsequent market actors. Therefore, freezing does not function solely as a preservation technique but can also coordinate the movement of fish products along the marketing chain (Guritno et al., 2021).

These findings highlight the importance of post-harvest technology and infrastructure in improving fisheries value-chain performance. Investment in freezing facilities, cold storage, appropriate transportation, and other post-harvest infrastructure may improve distribution flexibility and reduce avoidable handling costs. However, the benefits of such investments depend on proper infrastructure management, market coordination, and distribution capacity. Therefore, post-harvest improvements should be part of an integrated marketing system rather than isolated technological interventions.

The comparison also has implications for sustainable fisheries management. Improving marketing efficiency can increase the economic value of existing catches without necessarily increasing fishing intensity. More efficient handling, storage, and distribution may reduce post-harvest losses, improve the utilization of landed fish, and strengthen economic returns along the fisheries value chain. In this context, strengthening post-harvest and marketing systems offers an alternative pathway to support coastal livelihoods and fisheries sustainability while reducing reliance on increased production (Charles, 2001).

Overall, the results provide comparative evidence of the relationship between post-harvest handling systems and fish marketing efficiency. The relatively higher efficiency observed in Tanjung Balai is associated with lower marketing costs under its frozen-fish marketing system. In contrast, Belawan's fresh fish system provides

a higher fisher's share but requires more intensive handling and higher operational costs. This comparison shows that differences in marketing efficiency are closely linked to how fish are handled, preserved, stored, and distributed, rather than determined solely by marketing-channel structure or price distribution. This integrated perspective strengthens understanding of how post-harvest management can improve fish marketing efficiency and support sustainable coastal resource management.

4. Conclusion

This study shows that differences in post-harvest handling systems are associated with differences in fish marketing performance between Tangkahan Belawan and Tangkahan Tanjung Balai. Although both locations have a relatively similar marketing channel structure, Belawan's fresh fish marketing system has higher marketing costs and higher marketing efficiency values. In comparison, Tanjung Balai's frozen fish marketing system has lower marketing costs and lower marketing efficiency values. Belawan generally provides a higher fisher's share, whereas Tanjung Balai records higher marketing margins.

The findings indicate that marketing efficiency should not be assessed using a single indicator. Marketing margin, fisher's share, marketing costs, and marketing efficiency should be interpreted together with post-harvest handling and value-added activities. This study contributes to fisheries marketing research by highlighting the importance of post-harvest handling systems in shaping marketing efficiency, even when the basic marketing channel structure is relatively similar.

From a sustainable coastal resource management perspective, improving post-harvest handling, storage, transportation, and distribution can increase economic returns and reduce post-harvest losses without necessarily increasing fishing intensity. Fisheries development policies should therefore complement production-oriented strategies with investments in post-harvest infrastructure, market coordination, and efficient distribution systems to optimize the utilization of existing catches.

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