



## Downstreaming Fishery Products Through Fish Floss Innovation for Medan Coastal Communities

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**ABSTRACT:** The dependence of fishermen and small-scale fish processing businesses on market mechanisms dominated by off-takers contributes to the high economic vulnerability of coastal communities in Medan City. Fluctuations in fresh fish prices and limited bargaining power lead to unstable household incomes. This community service program aims to implement a fisheries downstreaming strategy through the innovation of fish floss processing to increase added value and strengthen local economic resilience. The implementation methods included situational analysis, training in fish floss production, business management assistance, economic feasibility analysis (R/C Ratio, Break-Even Point, and Return on Investment), and facilitation of product legality and packaging. The results show that fish floss processing generates a net profit of IDR 21,000 per bottle, with an R/C Ratio of 1.72, a Break-Even Point of 48 bottles per month, and a Return on Investment of 52.5%. These findings indicate that the downstreaming model supported by academic mentoring is economically feasible and has strong potential to be replicated as a sustainable model for empowering coastal communities.

**KEYWORDS:** fisheries downstreaming, added value, fish floss, economic empowerment

### INTRODUCTION

Coastal communities in the Belawan region face structural problems in the fisheries trade system. Many fishermen incur losses when their catch is considered not to meet the quality standards stipulated in agreements with off-takers. In this situation, fishermen's bargaining position becomes weaker because prices are entirely determined by buyers, often at very low levels. This condition reflects the classic problem in the capture fisheries sector, which has not yet been integrated with a value-added downstream strategy (Andriyanto, A., 2025). Traditional marketing structures without product diversification tend to cause unstable incomes for fishermen (Nugroho *et al.*, 2019). In fact, post-harvest price fluctuations are a major factor contributing to the economic vulnerability of coastal households (Sianturi, A. R., *et al.*, 2024; Andriyanto, A., 2025). This situation not only reduces income but also creates social and psychological pressures. Sukmawati *et al.* (2025) emphasize the importance of fishery product diversification to increase fishermen's income through processing activities.

A similar phenomenon was also found in Neighborhood IX, Pulo Brayon Kota, West Medan District, which is known as a center for boiled fish production. Business owners often purchase fish in large quantities when prices increase for several days of processing needs. However, when market prices suddenly decline, losses become unavoidable. All business risks are borne independently by small business owners who have limited adaptive capacity. Therefore, Hilyana, S., *et al.* (2018) recommend participatory training approaches for developing food processing enterprises. Meanwhile, several studies indicate that consumer preferences for processed fish products increasingly emphasize safety, hygiene, and proper labeling. Maulina, I., *et al.* (2025) further explain the importance of legality in expanding the processed food market, including the need to analyze the R/C ratio and break-even point for seafood processing Micro, Small, and Medium Enterprises (MSMEs).

Diversification and processing of fish catches into value-added products have been proven to increase income stability and extend product shelf life (Hery Saksono<sup>1</sup>, Zulfa Nur Auliatur Nissa and Suadi Suadi, 2021). Community-based processing innovations also contribute to strengthening local economic resilience, particularly in coastal areas with limited market access

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(Prawira, W. T., Vincentia Widyasari and Adi Widyanto, 2025). In the context of empowerment, participatory approaches in developing food processing businesses are considered more effective than top-down approaches (Apriyelita, A., and Fajri Ramadhan Marviano, 2025). An integrated empowerment model that combines technical and managerial capacity building has also been shown to strengthen the competitiveness of coastal MSMEs.

The sustainability of fishery processing businesses is determined not only by production aspects but also by measurable financial management. Business feasibility analysis based on the R/C Ratio, Break-Even Point (BEP), and Return on Investment (ROI) is an important indicator in determining business development prospects (Reswita, 2014; Pasaribu, R., Rozalina & Supristiwendi, 2024 and Alvian, F. & Jufriyanto, M., 2024). The use of financial indicators in food MSMEs has been shown to improve the quality of business decision-making (Vinna, S., 2024). Furthermore, business management training contributes significantly to increasing the profitability of micro-enterprises (Guji, T. N., 2018). A study by Novaliana and Junianto (2025) and Maulita, S., Arifin, Z., Rianti, T. S. M., 2025 also shows that value-added processed food businesses in urban areas have the potential to generate a high ROI if managed systematically.

Furthermore, modern consumer preferences increasingly favor products that are hygienic, safe, and legally recognized. Implementing hygiene and sanitation standards in production is a prerequisite for building consumer trust (De Giusti, L., Aurigemma, C., Marinelli, L., Tufi, D., 2019). Halal certification issued by the Indonesian Halal Product Assurance Agency and distribution permits from the Indonesian Food and Drug Authority (BPOM) have been shown to increase market expansion and credibility for food MSMEs in Indonesia. Existing debates on private standards tend to overlook the heterogeneity of these standards, including differences in institutional structures, the actors responsible for their formulation, and the motivations behind their adoption. A clearer understanding requires recognizing the close relationship between public regulatory systems and private standards, as well as the continuous evolution of these standards in response to changing market and governance conditions (Henson, S., Humphrey, J., 2010). Moreover, strengthening the value chain through the adoption of digital marketing is an important strategy for expanding the distribution of processed fishery products (Tiago, M. T. P. M. B., & Verissimo, J. M. C., 2014).

As part of the implementation of the Three Pillars of Higher Education, the community service team initiated a fisheries downstreaming program through innovative fish floss processing. This program is designed not only to increase the economic value of fishery products but also to build managerial capacity and improve access to business legality for coastal MSMEs.

The novelty of this community service program lies in the integrated approach that combines innovation in fishery product downstreaming, quantitative financial feasibility analysis (R/C Ratio, BEP, and ROI), and assistance in product legality and packaging within a single empowerment intervention model. This approach differs from conventional fish processing programs that generally focus only on production training.

## **IMPLEMENTATION METHOD**

This community service activity was conducted on February 1, 2026, in Neighborhood IX, Pulo Brayan Kota, West Medan District, Medan City (3°36'12.805" N; 98°40'24.298" E). The program employed a participatory empowerment-based approach consisting of the following stages:

### **1. Situation Analysis**

This stage involved identifying distribution patterns, cost structures, and trade-related problems faced by boiled fish businesses in the study area.

### **2. Fish Floss Production Training**

This stage focused on the transfer of fish processing technology, including raw material selection, seasoning formulation, drying techniques, hygiene and sanitation standards, and product packaging.

### **3. Business Management Assistance**

Participants received assistance in preparing cost structures, calculating production costs, conducting business feasibility analyses (R/C Ratio, Break-Even Point, and Return on Investment), and developing marketing strategies.

### **4. Facilitation of Product Legality**

This stage included coordination with the Indonesian Food and Drug Authority (BPOM) and assistance in obtaining halal certification to improve product credibility and market access.

This participatory approach positioned the community as the main actor in the economic transformation process rather than merely as program beneficiaries. Documentation of the activities is presented in Figure 1 (group photo with fish traders) and Figure 2 (fish floss products).



**Figure 1. Group Photo after Fish Floss Production Training**



**Figure 2. Packaged Fish Floss Product (Right)**

## **RESULTS AND DISCUSSION**

The economic analysis indicates that innovative fish floss processing generates significant added value for small-scale fishery businesses. With a selling price of IDR 50,000 per bottle, a net profit of IDR 21,000 per bottle can be achieved. This profit margin is considerably higher than that obtained from conventional fresh or boiled fish sales.

Economically, this downstream processing model provides several advantages. First, the processing of fish into floss increases product shelf life, thereby reducing the risk of losses caused by spoilage. Second, processed products offer greater price stability because they are less dependent on daily fluctuations in fresh fish prices. Third, product diversification allows broader market segmentation through value-added product differentiation.

From an institutional perspective, a strategic discussion with the Head of the Indonesian Food and Drug Authority (BPOM) of North Sumatra on February 3, 2026, resulted in a commitment to provide assistance in the licensing and quality control processes in the next stage of product development. Such institutional support is important to ensure that food safety standards are met and that the products can access wider markets.

Business Feasibility Analysis. The cost structure of fish floss production is summarized in Table 1.

**Table 1. Cost Structure of Fish Floss Production**

Component	Value
Selling price per bottle	IDR 50,000
Raw fish cost (per bottle)	IDR 12,000
Additional ingredients (spices and packaging)	IDR 8,000
Labor cost	IDR 5,000
Electricity, water, and fuel	IDR 2,000
Other overhead costs	IDR 2,000
Total Production Cost (TC)	IDR 29,000
Net Profit per Bottle	IDR 21,000

Note: Cost data were compiled based on field production assistance activities. Values are presented as rounded estimates for analytical purposes.

**1. Economic Feasibility Analysis**

**a. R/C Ratio (Revenue-Cost Ratio)**

The R/C Ratio was calculated using the following formula:

$$R/C = \text{Total Revenue} / \text{Total Cost}$$

$$\text{Total Revenue} = \text{Selling Price} \times \text{Production Volume}$$

If production reaches 100 bottles: Total Revenue = 100 × IDR 50,000 = IDR 5,000,000 Total Cost = 100 × IDR 29,000 = IDR 2,900,000

$$R/C = \frac{5,000,000}{2,900,000} = 1.72$$

Interpretation:

An R/C Ratio of 1.72 indicates that every IDR 1.00 spent on production generates IDR 1.72 in revenue. Since the R/C Ratio is greater than 1, the business is considered economically feasible. This finding is consistent with the study of Andriyanto, A. (2025), Hilyana *et al.* (2018). (2018). Novaliana, R. N., & Junianto. (2025). Setiawana, A., Muzakar Isab, M. Farid Wajid (2023), which emphasized that management financial indicators are key parameters for the sustainability of food-based SMEs.

**b. Break-Even Point (BEP)**

The Break-Even Point was calculated using the following formula:

$$\text{BEP (units)} = \text{Fixed Costs} / (\text{Selling Price} - \text{Variable Cost})$$

Assumed monthly fixed costs (rent, equipment depreciation, promotion, and administrative expenses):

$$\text{Fixed Costs} = \text{IDR } 1,000,000$$

$$\text{Selling Price per bottle} = \text{IDR } 50,000$$

$$\text{Variable Cost per bottle} = \text{IDR } 29,000, \text{ then } \text{BEP} = 1,000,000 / (50,000 - 29,000) \approx 48 \text{ bottles}$$

**Interpretation:**

The business must sell approximately 48 bottles per month to reach the break-even point. This production level is considered achievable for small-scale coastal MSMEs. Similar findings were reported by Pratiwi & Siregar (2021), who showed that seafood processing businesses remain financially viable when cost structures are properly managed. Furthermore, Andriyanto, A. (2025) and Vinna, S. (2024), Sukmawati *et al.* (2025) emphasized that quantitative feasibility analysis plays an important role in guiding investment decisions for fisheries-based MSMEs.

**c. Return on Investment (ROI)**

ROI was calculated using the following formula:

$$\text{ROI} = \text{Net Profit} / \text{Total Investment} \times 100\%$$

$$\text{Net Profit for 100 bottles} = \text{IDR } 2,100,000$$

$$\text{Total initial investment (equipment and working capital)} = \text{IDR } 4,000,000$$

$$\text{ROI} = \frac{2,100,000}{4,000,000} \times 100\%$$

$$\text{ROI} = 52.5\%$$

### **Interpretation:**

An ROI of 52.5% indicates strong profitability in the initial production cycle. This suggests that the business has promising expansion potential and demonstrates a relatively high rate of return. Financial feasibility and product legality are key determinants in the market expansion of food-based MSMEs. Moreover, value-added food processing businesses offer attractive investment prospects. Furthermore, post-harvest diversification strategies, such as fish floss processing, have been shown to reduce the risk of fresh fish price fluctuations.

### **2. Added Value Through Downstream Processing**

Processing fishery products into fish floss provides several economic advantages:

- Extending product shelf life
- Reducing the risk of losses due to declining fresh fish prices
- Expanding product variety for modern markets and e-commerce platforms
- Creating product differentiation and opportunities for market penetration
- Improving community business management literacy

This approach aligns with the concept of community-based economic empowerment, which emphasizes capacity transformation rather than merely providing production assistance. Previous studies have shown that diversified fish processing can significantly increase the income of fishermen and micro-entrepreneurs (Hilyana, S., *et al.*, 2018). Diversification of fishery products has also been proven to enhance income stability among coastal households. Moreover, community-based innovation contributes to strengthening local economic resilience by creating products that adapt to changing market dynamics. In addition to increasing production capacity, this program also improves community business management literacy.

### **3. Program Impact and Sustainability**

This program demonstrates that fisheries downstreaming based on academic innovation can serve as an instrument for local economic transformation. Through a collaborative and responsive approach, the Faculty of Agriculture, Universitas Methodist Indonesia provides practical and sustainable solutions for coastal community development.

Program sustainability requires several strategic actions:

- Strengthening community production capacity
- Maintaining consistent product quality and hygiene standards
- Expanding access to microfinance
- Completing business legality, including halal certification and BPOM distribution permits

Production sanitation standards play an important role in increasing consumer trust in processed food products (De Giusti, L., Aurigemma, C., Marinelli, L., & Tufi, D., 2019). Consumer preferences in modern markets increasingly favor products that carry official certification and labeling. Although halal certification has not yet been fully implemented, accelerating this process is expected to significantly improve the performance of food SMEs. Compliance with BPOM regulations is also a crucial factor in expanding SME market access. The integration of technical, managerial, and institutional aspects in this program reflects an integrated empowerment model. Strengthening digital marketing strategies represents the next important step in expanding market reach and enhancing the fisheries value chain. (Tiago, M. T. P. M. B., Verissimo, J. M. C., 2014; Vinna, S., 2024; Novaliana and Junianto (2025) and Pasaribu, R., Rozalina, Supristiwendi, 2024).

The spirit of “Sigap dalam solusi, makmur dalam kesejahteraan (Solutions for Prosperous Welfare) serves as the moral foundation of this initiative and highlights the role of universities as agents of social change. Collaboration with the North Sumatra Food and Drug Authority (BPOM) represents a strategic effort to ensure food safety standards and expand market distribution.

### **NOVELTY AND THEORETICAL CONTRIBUTION**

The novelty of this study lies in the integration of fishery product downstreaming innovation, quantitative financial feasibility analysis, and institutional facilitation for product legality within a single community empowerment model. Previous community service programs in fisheries processing generally focus only on technical production training, while this study incorporates economic feasibility assessment and institutional linkage as part of the empowerment framework.

### **CONCLUSION**

The downstreaming of fishery products through innovative fish floss processing has been shown to increase product added value and strengthen the economic resilience of coastal communities. The feasibility analysis demonstrates that the business is economically viable, with an R/C ratio of 1.72, a break-even point (BEP) of 48 bottles per month, and a return on investment (ROI) of 52.5%. Therefore, this academic mentoring-based empowerment model has strong potential to be replicated in other coastal areas as a sustainable strategy for local economic transformation.

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## STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

In writing this article, the author used artificial intelligence-based tools in a limited and responsible manner, solely to assist with grammar checking and editorial clarity. All scientific content, including the formulation of the research problem, conceptual framework, research design, data collection and analysis, interpretation of results, and conclusions, is entirely the result of the author's own thinking, analysis, and academic responsibility.

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