

The Implementation of Innovations in the Processing of Value-Added Fishery Products Based on Karang Taruna in Supporting the Coastal Tourism Economy of Karampuang Island

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ABSTRACT

The main challenge for the partners lies in the weak integration between the fisheries sector, youth-led MSMEs, and coastal tourism. This community service project aims to empower the Karang Taruna youth organization in Karampuang Village through value-added fish processing innovations, specifically fish floss and fish sticks, which are hygienically packaged and integrated with the tourism economy. The program was implemented over six months using a participatory approach that included outreach, training, the application of appropriate technologies (spinners, vacuum sealers, meat grinders), production and marketing assistance, evaluation, and sustainability support for the 25 partner members. As a result, the partners' knowledge increased from 48.6 to 84.2 (N-Gain 0.69) and their skills from 1.97 to 3.48 (on a scale of 1-4).

INTRODUCTION

Karampuang Island is a small island area located in the coastal area of Mamuju Regency with the main potential in the form of capture fisheries resources and marine tourism. Geographically, this island is 4.1 km from the Kasiwa Fish Landing Port (PPI) and is reached by boat in about 30 minutes, while the distance from the University of Muhammadiyah Mamuju campus to PPI Kasiwa is only 1.2 km. This relatively close accessibility makes Karampuang a favorite daily tourist destination for the people of Mamuju City, especially on weekends and holiday seasons. Most coastal communities depend on the small-scale fisheries sector and tourism support activities. However, the economic improvement of the people on Karampuang Island is still relatively low, especially in the youth group. This condition even encourages most of the youth of Karampuang Island to migrate to Kalimantan to look for work, resulting in the depletion of productive human resources from the island. The abundant fishery products are mostly sold in fresh form without processing, while the tourism activities that develop tend to be passive and rely only on natural beauty, without the support of local products that are able to create tourism experiences of economic value. As a result, tourist spending levels are low and the economic impact of tourism on local communities is very limited.

Karang Taruna as a youth institution has a strategic role in encouraging local economic dynamics. However, limited capacity in mastering fishery product processing technology, product innovation, packaging, and business management has caused coastal youth to not be able to develop competitive MSMEs. Limited production facilities and the lack of integration of youth MSMEs with the tourism ecosystem reinforce the gap between the potential and utilization of local resources. This condition shows that the main problem faced is not limited resources, but in the weak integration between the fisheries sector, youth MSMEs, and coastal tourism.

Table 1. Target Partner Profile

No.	Identity	Description
1	Partner name	Karampuang Village Youth Organization
2	Category mitra	Non-productive economic community groups
3	Partner's social status	Youth groups
4	Number of members	25 people
5	Partner education	Strata 1 and SMA equivalent
6	Partner work	Private employees, honorary employees, and students
7	Age range	17–32 years old
8	Location	Karampuang Village, Mamuju District, Mamuju Regency, West Sulawesi

Based on the agreement with partners, two priority problems were identified. First, the production aspect: the process of processing fishery products into value-added products has not been optimal. Although fish raw materials are available in relatively sufficient quantities, the production process is still carried out in a simple and traditional manner without the support of appropriate technology. Equipment limitations lead to very limited product variety, low production capacity, and inconsistent product quality. The lack of adequate implementation of sanitation and food safety standards also has an impact on product quality that is not guaranteed and the shelf life is relatively short. Second, the social aspect of society: the involvement of youth in productive economic activities that are integrated with the development of coastal tourism has not been optimal. Karang Taruna activities are still dominated by incidental social activities and have not developed into a forum for strengthening economic and entrepreneurial capacity. This condition has an impact on limited productive employment opportunities for coastal youth, which has the potential to cause low motivation, economic dependence on families, and lack of regeneration of local business actors.

Through innovation in processing fishery products, Karang Taruna can develop typical processed products based on local resources that not only function as an economic commodity, but also as a tourist attraction. Processed products that are packaged hygienically, innovatively, and with local characteristics have the potential to be part of the coastal culinary tourism experience of Karampuang Island, so that it can increase the length of stay and the level of spending of tourists. This service activity aims to: (1) improve the knowledge and skills of Karang Taruna in processing value-added fishery products in the form of shredded fish and fish sticks; (2) apply appropriate technology to improve production efficiency, quality consistency, and product shelf life; (3) assisting the formation of youth MSMEs along with digital-based marketing strategies; and (4) integrating processed fishery products with the coastal tourism ecosystem of Karampuang Island. This activity is in line with *Asta Cita*, especially in efforts to increase quality jobs, encourage entrepreneurship, and develop creative industries based on local potential.

IMPLEMENTATION AND METHODS

The implementation of the program is carried out through a participatory and applicative approach that actively involves Karang Taruna as the main partner. The activity lasted for six months in Karampuang Village, Mamuju District, Mamuju Regency, with eight field visits. The implementation method is designed in stages to be able to answer partner problems comprehensively and sustainably (Figure 1).



Figure 1. Execution Flow

Figure 1 shows the flow of activities that are designed in stages and continuously, where each stage is a prerequisite for the next stage. The series of activities began with the socialization of the program to equalize perceptions and explore the commitment of partners and local stakeholders, then continued with capacity building training to equip Karang Taruna with knowledge of processing techniques, sanitation and food safety, as well as the basics of product packaging and branding. The knowledge is then applied through the application of appropriate technology in the form of spinner machines, vacuum sealers, and blenders that function to improve production efficiency, maintain quality consistency, and extend product shelf life. The production and marketing assistance stage ensures that the technology and knowledge that has been provided are truly implemented, including quality control, calculation of cost of production, and strengthening digital-based marketing. The effectiveness of the entire series is then measured at the program evaluation stage through pre-test and post-test, product quality and quantity assessment, and economic impact analysis for youth MSMEs, the results of which are the basis for improvement and formulation of advanced strategies. The series was closed by strengthening the sustainability of the program through the institutionalization of MSMEs under Karang Taruna, the preparation of standard operating procedures, and the construction of a partnership network with village governments and coastal tourism actors. All stages are carried out for six months with a minimum of eight field visits, so that the assistance is intensive and the achievements of each stage can be monitored directly

Data Analysis Techniques

Increased knowledge was analyzed using the Normalized Gain (N-Gain) formula:

$$N-Gain = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

With the criteria of $N-Gain \geq 0.70$ (high); $0.30 \leq N-Gain < 0.70$ (moderate); and $N-Gain < 0.30$ (low). Business feasibility is analyzed using the Revenue Cost Ratio (R/C), which is a comparison of total revenue to total costs, with the business criteria declared feasible if the $R/C > 1$.

RESULTS AND DISCUSSION

Socialization Program

The socialization was carried out in Karampuang Village and was attended by members and administrators of Karang Taruna, village heads and apparatus, fishermen representatives, and tour boat service managers. The activity began with an explanation of the objectives, benefits, and stages of the program, followed by a discussion to explore the commitment of the parties. An important result of this stage is the growing understanding that the main problem is not the availability of raw materials, but the absence of added value and the untapped flow of tourists as a market. The resulting role agreements include: Karang Taruna as the manager of the production unit, local fishermen as a supplier of raw materials at an agreed price, the village government as a provider of production sites and licensing facilitators, and tourism service managers as marketing channel partners. Through participatory discussions, a mapping of the condition of partners as presented in Table 3 was obtained, which became the basis for determining shredded fish and fish sticks as developed products. Both products were chosen based on the availability of local fish raw materials, the ease of the MSME-scale production process, and the high level of market acceptance as culinary tourism products and coastal souvenirs.

Table 2. Results of the Analysis of Partner Conditions

Factor	Description
Kekuatan	Availability of fish raw materials throughout the year; an increased flow of tourists on weekends; adequate number of youth (25 people) with high school to S1 education level
Disadvantages	Limited mastery of processing technology; absence of production equipment; there is no legality of the business yet; No entrepreneurial experience yet
Opportunities	Local government support in the tourism sector; uncultivated souvenir markets; proximity to Mamuju City; Digital Marketing Access
Threats	Competition of similar products from outside the region; dependence on the season; Youth Migration Outside the Region

Sanitation and Food Safety

Before the production practice, participants were trained in the application of basic Good Manufacturing Practices: the use of personal protective equipment (aprons, head coverings, masks, gloves), hand washing procedures, separation of raw material and finished product areas, and equipment sanitation. This material is a prerequisite because the product is intended for tourist consumption and is directed to obtain legality of distribution.

Product Processing Techniques

a. Shredded fish

The process begins with boiling fresh fish to facilitate the separation of meat from bones and thorns. The meat is then twisted until smooth and even fiber is obtained. The cooking stage is carried out using a frying pan with the addition of standardized spices to maintain the consistency of the taste, followed by frying. The yield obtained is around 25%, meaning that 4 kg of fresh fish produces about 1 kg of shredded meat. The shredded meat processing process can be seen in figure 2.



Figure 2. Shredded Meat Processing Process

Fish Steak

The process begins with grinding fish meat until a fine dough is obtained, then mixed with supporting ingredients in the form of flour, spices, and binding agents. The shaping of the sticks is done with a simple printer so that the size and shape of the product are uniform, followed by frying at a controlled temperature to produce a crispy texture and attractive colors. The product is drained and cooled before packaging. The process of processing fish sticks can be seen in figure 3.



Figure 3. Fish Steak Processing Process

Increased Partner Knowledge

To evaluate the effectiveness of counseling activities, the level of knowledge of participants was measured before (pre-test) and after (post-test) the implementation of counseling. This evaluation aims to find out the extent to which the material presented can improve participants' understanding of fishery product processing technology, especially the process of making shredded tuna and fish meatballs. The instrument used was in the form of a questionnaire with questions that measured participants' understanding of the counseling material. The measurement results were then compared to see changes in knowledge levels after participating in the activity.

Table 3. Increased Partner Knowledge

Material indicators	Pre-test	Post-tests	Increase (%)
The concept of added value of fishery products	45,2	82,4	82,3
Sanitation and food safety	52,0	88,8	70,8
Shredded fish and fish stick processing techniques	41,6	83,2	100,0
Product packaging and branding	46,8	85,6	82,9
Entrepreneurship and digital marketing	57,4	81,0	41,1
Average	48,6	84,2	73,2

The overall N-Gain value of 0.69 belongs to the medium category close to high. The highest improvement occurred in the processing technique indicator (100%), which confirmed that the material was completely new knowledge for the participants. The lowest increase in the entrepreneurship and digital marketing indicators (41.1%) was due to a relatively higher initial score, participants were active users of social media, so the room for improvement was narrower.

Application of Appropriate Technology

The technology introduced was selected with the criteria of ease of operation, affordability, and according to the scale of MSMEs. The specifications and functions of the equipment handed over to the partners are presented in Table 4.

Table 4. Applied appropriate technology

Equipment	Quantity	Uses	Impact on the Process
Spinner machine (oil slicer)	1 unit	Reduces the level of shredded oil and fish sticks after frying	Texture is drier and crispier; the shelf life increases from 1–2 months to 4–6 months; The product does not go rancid quickly
Vacuum sealer	1 unit	Packaging products in airtight food-grade packaging	Quality is maintained, contamination is prevented, the attractiveness of products as souvenirs is increased
Blender/meat grinder	1 unit	Grinding fish meat into a fine dough for fish steaks	Shorter processing time; uniform texture of the dough; Consistent Shape of the Steak
Shredded plastic packaging and steaks	1 package	Product primer container	Products are ready to be marketed with MSME identity labels

The most prominent impact of the application of technology occurs in the aspects of shelf life and quality consistency. The use of spinners lowers the oil content of the product so as to slow down the coolness, while the vacuum sealer maintains the crispiness of the fish sticks during the distribution of the problem which was previously the main obstacle because the product had to cross the sea to the market in Mamuju City. The use of a blender replaces the manual crushing process which was previously time-consuming and produces a non-uniform texture of the dough. The improvement of partners' skills in operating the technology was measured through observation sheets on three production cycles (Table 5).

Table 5. Partner Upskilling

Skill aspect	Cycle I	Cycle II	Cycle III	Final category
Implementation of sanitation and hygiene	2,1	3,0	3,6	Excellent
Precision of seasoning formulation	2,3	3,1	3,5	Excellent
Frying process control	1,9	2,8	3,4	Good
Operation of spinners and blenders	1,8	2,9	3,5	Excellent
Packaging with vacuum sealer	2,0	3,2	3,7	Excellent
Production recording	1,7	2,6	3,2	Good
Average	1,97	2,93	3,48	Excellent

Description: scale 1–4 (1 = less; 2 = adequate; 3 = good; 4 = very good)

The average increase from 1.97 to 3.48 indicates the effectiveness of the repetitive practice method. The aspect of recording production received the lowest score, indicating the need to strengthen the culture of business administration in a sustainable manner.

Production and Packaging Capacity

Production assistance is carried out for three cycles with organoleptic tests at the end of each cycle. The formulation that is set is the third cycle formulation that obtains the highest preference score on taste, aroma, and texture attributes. Partners achieved a routine production capacity of 30 kg of products per month, consisting of 20 kg of shredded fish and 10 kg of fish sticks, exceeding the minimum target of 20 kg per month set in the program plan. The product is packaged in 100-gram food-grade packaging using a vacuum sealer, with a label containing the identity of Karang Taruna youth MSMEs, product information, and the characteristics of Karampuang Island as a coastal tourist destination. The inclusion of the island icon on the label makes the product serve a dual function: as an economic commodity as well as a promotional medium for the destination.

Analysis of Added Value and Business Feasibility

The calculation of production costs and monthly receipts for both products is presented in Table 6.

Table 6. Analysis of the Business of Shredded Fish and Fish Steak Per Month

Components	Shredded fish	Fish steak
Production volume	20 kg (200 packs 100 g)	10 kg (100 packs 100 g)
Raw material of fish	IDR 2,000,000 (80 kg × IDR 25,000)	IDR 75,000 (3 kg × IDR 25,000)
Flour and binders	—	IDR 105.000
Spices, oils, and supporting ingredients	IDR 900,000	IDR 350,000
Packaging and labels	IDR 600.000	IDR 300.000
Fuel and electricity	IDR 300.000	IDR 100.000
Equipment shrinkage	IDR 300.000	IDR 100.000
Total cost	IDR 4.100.000	IDR 1.030.000

Components	Shredded fish	Fish steak
Selling price per package	IDR 30.000	IDR 20.000
Total receipts	IDR 6.000.000	IDR 2.000.000
Advantages	IDR 1.900.000	IDR 970.000
R/C ratio	1,46	1,94

Overall, the total production cost of the two products is IDR 5,130,000 per month with a revenue of IDR 8,000,000 per month, resulting in a collective profit of IDR 2,870,000 per month and an R/C ratio of 1.56. An R/C value above 1 indicates that the business is suitable for development; Every Rp 1.00 in fees incurred results in a revenue of Rp 1.56. This achievement is within the target range of the collective income of youth MSMEs of Rp 2-4 million per month. The value-added analysis shows significant changes. Fresh fish sold directly is worth Rp 25,000 per kg. After processing, 4 kg of fresh fish (worth Rp 100,000) produces 1 kg of shredded fish which is equivalent to 10 100-gram packages with a selling value of Rp 300,000. Thus, there is an increase in selling value about three times compared to sales in fresh form, according to the program target. Youth involvement in productive economic activities also increased from the initial condition of no involvement to 12 people who were active in the production, packaging, and marketing process at the upper limit of 8-12 people.

Digital-Based Marketing

Partners are assisted in creating Instagram, TikTok, and WhatsApp Business accounts as promotional channels. The assistance includes product photography techniques using mobile phones, the preparation of product narratives that raise the stories of islands and fishermen, and the use of geotags for Karampuang Island tourist sites. The marketing strategy is structured on three channels: (a) direct sales at the piers and tourist visit points to reach tourists; (b) deposit at the souvenir center in Mamuju City; and (c) online sales for markets outside the region. Social media content is designed not only to sell products but also to promote destinations, so that MSME accounts play a dual role as a branding medium for coastal tourism on Karampuang Island.

Program Evaluation

The recapitulation of the program's achievements against the promised indicators is presented in Table 7.

Table 7. Program Achievement Recapitulation

Indicator	Initial conditions	Target	Achievements	Status
Partner knowledge (score)	48,6	Increase	84,2 (N-Gain 0,69)	Achieved
Partner skills (scale 1-4)	1,97	Increase	3,48	Achieved
Number of types	0 of	Minimum types	2 2 types (shredded and fish steak)	Achieved

Indicator	Initial conditions	Target	Achievements	Status
processed products				
Production capacity	0	20-30 kg/month	30 kg/month	Achieved
Youth involvement	0	8-12 people	12 people	Achieved
Increased selling value	—	3-4 times as much	± 3 times	Achieved
Collective income of MSMEs	Rp 0	IDR 2-4 million/month	IDR 2,870,000/month	Achieved
Technology and marketing proficiency	Not yet	Able to operate and digital	3 Active digital channels	Achieved

In terms of socio-economic impact, the formation of youth MSMEs provides alternative productive activities on the island that were previously unavailable. This is relevant to the problem of youth migration to Kalimantan: the availability of local business opportunities has the potential to restrain the pace of overseas migration while strengthening the regeneration of business actors on Karampuang Island. For supplier fishermen, the existence of buyers still provides better price certainty than the sales mechanism to collectors. The linkage of the program with the coastal tourism economy occurs through four mechanisms: (1) the extension of the tourist expenditure chain that previously only paid for boat transportation; (2) diversification of attractions through the development of production houses as educational tourist locations for marine product processing; (3) strengthening upstream-downstream linkages that improve fishermen's bargaining positions; and (4) the absorption of local youth labor. Based on the results of the evaluation, three further improvements were formulated: managing business legality (NIB and SPP-IRT) to expand formal market access, strengthening production and financial recording discipline, and developing fish stick flavor variants to expand the consumer segment.

The increase in partner knowledge from 48.6 to 84.2 (N-Gain 0.69) and skills from 1.97 to 3.48 confirmed that the combination of counseling with repetitive practice was more effective than the delivery of theoretical material alone, as reported in the training on processing shredded fish in West Lombok and Jember. The highest increase in the processing technique indicator shows that the material is completely new to coastal communities who have only known traditional processing, while the lowest increase in the digital marketing aspect reflects the social media literacy of youth that has been formed since the beginning. In terms of technology, the application of spinners reduces the level of residual oil so as to slow down the stability and extend the shelf life from 1-2 months to 4-6 months, in line with the results of the introduction of spinners in various MSMEs of fried and shredded fish products, while vacuum packaging

maintains the crispiness of fish sticks during cross-sea distribution to Mamuju City. This pattern reinforces the principle that control of oil and moisture content is the main determinant of the shelf life of the waste, and explains why the lowest score is precisely in production recording—a common symptom of beginner MSMEs whose administrative skills develop more slowly than technical skills.

Economically, the transformation of 4 kg of fresh fish worth IDR 100,000 into 1 kg of shredded fish equivalent to IDR 300,000 resulted in an increase in selling value of about three times, with a collective profit of IDR 2,870,000 per month and an R/C of 1.56 which shows that the business is worth developing; This achievement is consistent with similar activities that report that product diversification is able to multiply the value of the catch while reducing the risk of spoilage during abundant harvests [9,11,18]. The R/C difference between fish sticks (1.94) and shredded fish (1.46) comes from the shredded yield of only 25%, so that the efficiency of the yield and the supply partnership with fishermen are the leverage point of profitability. The peculiarity of this activity lies in the placement of products as part of the tourism value chain: the inclusion of Karampuang Island's identity on the label makes the product as well as a destination promotional medium, in line with the findings that tourism villages develop optimally when supported by MSME product innovations and youth-driven marketing networks, and complement the digital branding efforts of Karampuang Island that have been pioneered previously with the dimension of physical products with economic value. The formation of MSMEs with 12 active youths provides alternative productive activities that have the potential to restrain the pace of overseas migration to Kalimantan while improving the bargaining position of supplier fishermen, although its sustainability still requires assistance in managing legality (NIB and SPP-IRT), financial recording discipline, and product variant development.

CONCLUSIONS AND RECOMMENDATIONS

This service activity succeeded in empowering the Karampuang Village Youth Organization through the implementation of value-added fishery product processing innovations. Partner knowledge increased from a score of 48.6 to 84.2 with an N-Gain of 0.69 (medium category), while skills increased from 1.97 to 3.48 on a scale of 1–4. Mitra produces two types of processed products, namely shredded fish and fish sticks, with a production capacity of 30 kg per month and actively involving 12 youths. The application of appropriate technology in the form of spinners, vacuum sealers, and blenders improves quality consistency and extends product shelf life from 1–2 months to 4–6 months. From the economic side, the selling value increased about three times compared to the sale of fresh fish, with a collective profit of IDR 2,870,000 per month and an R/C ratio of 1.56 which shows that the business is worth developing. The formation of youth MSMEs based on Karang Taruna which is integrated with digital marketing and tourism narratives strengthens the coastal tourism economic ecosystem of Karampuang Island in a sustainable manner. It is suggested that there be further assistance in managing business legality, strengthening financial management, and developing product variants. This Karang Taruna-based empowerment

model is also recommended to be replicated on other small islands in West Sulawesi with similar characteristics.

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