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Fisher Boncalang Technology Implementation for Productivity Improvement and Product Diversification of Bettet Village MSMEs

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ABSTRACT

Background: This community service program was designed to address the challenges faced by the PKK Bettet MSME group, including low productivity, inconsistent product quality, inadequate packaging, and limited marketing capacity. The main objective was to enhance the competitiveness of local MSMEs through the integration of technological innovation, hygienic processing, improve packaging, and digital marketing.
Contribution: The program contributed to empowering rural women's groups through the introduction of the Fisher Boncalang fish shredder, improved packaging practices, product diversification, and digital marketing skills, thereby forming an integrated empowerment model
Method: The program was implemented in five stages: socialization, training, technology application, mentoring and evaluation, and sustainability planning.
Results: The results indicate a significant increase in production capacity, rising from 1 kg per 5 hours to 15–50 kg per hour. Product quality also improved through the implementation of standardized packaging, which extended the shelf life from 3–5 days to 1–2 months.
Conclusion: The program achieved its objectives by integrating technology, training, and marketing. These results show that MSME empowerment through innovation and digitalization can enhance productivity, product competitiveness, and sustainable rural entrepreneurship.

1. Introduction

The Micro, Small, and Medium Enterprises (MSMEs) have long been one of the main pillars driving poverty reduction and local economic development. In Indonesia, MSMEs account for nearly 99% of the total businesses and contribute more than 60% to the national GDP, according to data released by the Indonesian Ministry of Cooperatives and Small and Medium Enterprises [1]. One example of rural-based MSMEs is the PKK women's group in Bettet Village, Pamekasan, which has developed innovative products such as Jamela Keren (Jahe Merah Gula Aren) an herbal drink made from red ginger and palm sugar and Boncalang (Abon Cakalang) a type of skipjack tuna floss. These products are derived from local resources, including TOGA (family medicinal plants) cultivated through hydroponic farming, as well as marine fish sourced from nearby areas. The empowerment program implemented in PKK Bettet Village has supported the group's business growth through training and community-based innovation. However, despite this progress, the group still faces significant challenges in scaling up production and expanding market access [2].

Although the PKK Bettet Village MSME has successfully produced Boncalang, the production process remains highly constrained by manual methods. Shredding skipjack tuna into floss takes approximately 3-4 hours to produce only one kilogram, which significantly limits productivity, creates inconsistent quality, and exposes products to hygiene risks [3], [4]. This condition is exacerbated by unprofessional packaging, which relies on plastic containers without proper labels, reducing both product appeal and shelf-life [5], [6]. Moreover, the product portfolio remains limited, with diversification still focused on a few TOGA-based drinks, leaving other opportunities such as instant herbal powders or spiced fish floss underutilized [7]. Marketing is also dependent on traditional approaches, with 80% of sales coming from local markets and only limited promotion via WhatsApp and Facebook [8], [9].

These challenges indicate structural limitations in production efficiency and market competitiveness, highlighting the need for integrated technological and marketing interventions. Introducing a fish-shredding machine can significantly accelerate production, improve product hygiene, and standardize quality, enabling MSMEs to better meet rising market demand. Product innovation and digital transformation have been shown to significantly boost competitive advantage in fish-processing MSMEs [10]. Complementary to this, the adoption of Good Manufacturing Practices and vacuum packaging has been proven to enhance processed fish product quality and shelf life [11]. Moreover, the development of a shredded fish processing machine capable of producing up to 50 kg per hour demonstrates how technology can make fish-floss production both faster and cleaner [12]. These challenges highlight the need for an integrated solution that not only addresses production efficiency but also strengthens product quality and market competitiveness.

To address this issue, the proposed solution is the implementation of Fisher Boncalang (Fish Shredder Efficient Reusable Abon Cakalang), an innovative machine designed to enhance the efficiency of fish floss production. The machine is capable of increasing production capacity up to 15-50 kg per hour, which is significantly more efficient than manual methods

that produce only approximately 1 kg in 5 hours. In addition to improving productivity, Fisher Boncalang ensures hygienic processing, delivers consistent shredding results, reduces labor costs, and opens opportunities for diversifying floss products such as chicken or beef. The design of the tool and the production process of the Fisher Boncalang machine can be seen in Figure 1.

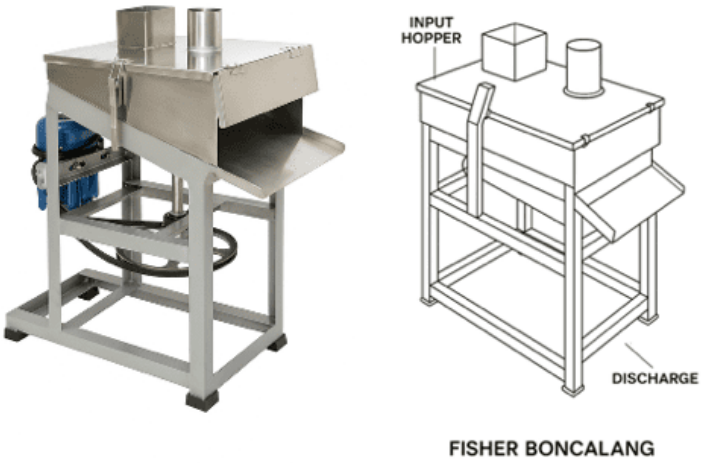

Figure 1. Prototype and Manufacturing Process of the Fisher Boncalang Machine

The design and manufacturing process of the Fisher Boncalang machine are illustrated in Figure 1, showing the key components and development stages of the technology used to improve production efficiency. Alongside this machine, complementary tools such as digital scales and continuous band sealers will be introduced to ensure standardized packaging and accurate product weight. Moreover, structured training in digital marketing and branding will enable the MSME group to leverage platforms such as Facebook, Instagram, TikTok Shop, Market Place, and WhatsApp Business to reach a wider audience, increase brand awareness, and build stronger customer loyalty.

While previous studies have explored MSME development through digitalization, food-processing technology, packaging improvement, and hygiene practices, most of them address these aspects separately and lack an integrated approach [13]–[15]. As a result, the combined impact of technological innovation, product diversification, and digital marketing on rural MSME empowerment remains insufficiently examined. This study addresses this gap by proposing an integrated empowerment model through the implementation of Fisher Boncalang technology, combined with standardized packaging, product diversification, and structured digital marketing training for rural women's groups. The novelty of this study lies in positioning the Fisher Boncalang machine not only as a production tool but also as a driver of business transformation. This study contributes theoretically by providing an integrated framework that combines appropriate technology, product diversification, and digital marketing in rural MSME empowerment. Practically, this study offers an evidence-based model that can be replicated to improve productivity, product quality, and market access in similar community-based enterprises.

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2. Method

This study employed a Participatory Action Research (PAR) approach, which emphasizes active collaboration between researchers and community members to solve practical problems while generating measurable outcomes [16]. The approach was chosen to ensure that the intervention was not only implemented but also adapted to the needs and conditions of the PKK Bettet MSME group. The program was carried out in five stages: (1) socialization, (2) training and implementation, (3) technology application, (4) mentoring and evaluation, and (5) program sustainability. Each stage was designed to systematically address identified problems while enabling continuous feedback and improvement.

The effectiveness of the program was evaluated using both qualitative and quantitative approaches. Quantitative indicators included production capacity (kg/hour), product shelf life (days/months), number of product variants, and the number of digital marketing platforms utilized. Qualitative data were collected through participant observations, interviews, and feedback discussions to assess changes in skills, knowledge, and confidence. Data were analyzed using a descriptive comparative approach to examine differences between pre-and post-intervention conditions across key performance indicators.

3. Results and Discussion

During this stage, the objectives and expected benefits of the program were explained, along with an introduction to Fisher Boncalang as an appropriate technology designed to enhance the productivity of skipjack tuna floss production. Additional information was also provided regarding the provision of complementary equipment, namely a continuous sealer and digital scales, which were utilized to improve packaging quality and ensure standardized product weight.

The socialization session was followed by discussions with PKK members and village officials to identify partners' needs, determine the sequence of activities, and plan the schedule for subsequent meetings. The results indicated that this activity served as an initial stage for socialization and the alignment of perceptions, during which partners expressed their expectations regarding increased production capacity and improved marketing strategies. It was further agreed that the subsequent meeting would focus on technical training on the use of the Fisher Boncalang machine, as well as strategies for diversifying fish-based products.

Figure 2. Socialization Activities with PKK Members

The socialization stage in this community service program served as a crucial foundation before moving into technical training and technology implementation. Through socialization, the implementing team not only conveyed the objectives and program plans but also ensured alignment of perceptions between the team and the partners. This is in line with the concept of community empowerment, where socialization is considered a critical initial phase to build commitment, increase understanding, and foster active community participation. As shown in Figure 2, the socialization activity involved active participation from PKK members and village officials, the activity successfully identified partner needs, structured appropriate program stages, and prepared the community to adopt the Fisher Boncalang innovation. This process demonstrated that socialization is not merely informative but also participatory, allowing partners to develop a sense of collective ownership of the program.

Previous studies emphasize that the socialization of appropriate technology plays a significant role in the success of empowerment programs, as it enables communities to understand the benefits of innovation while simultaneously fostering a sense of ownership toward the technology being introduced [17].

3.1. Training and Implementation

The second stage of this program was training and implementation, designed to strengthen the technical and managerial capacity of the PKK women's group in Bettet Village. The training included several key components: hygienic fish processing, to ensure product safety and quality; branding and packaging design, to improve product appeal and competitiveness; and digital marketing, to enhance promotional strategies and expand market reach.

Figure 3. Training on Hygienic Fish Processing and Digital Marketing

As illustrated in Figure 3, the training session focused on delivering practical knowledge on hygienic processing, branding, and digital marketing strategies. The training was delivered through practical workshops that emphasized hands-on learning, allowing participants to directly apply the knowledge gained during each session. For example, participants practiced hygienic preparation of raw materials, learned to design attractive labels and packaging, and were guided in creating social media content and promotional materials. By integrating both technical and marketing training, the program ensured that participants could immediately implement the acquired skills into their production and business processes.

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Figure 4. Participants practiced hygienic preparation of raw materials

As shown in Figure 4, participants were directly involved in hands-on activities, particularly in practicing hygienic preparation of raw materials to ensure product quality and safety. This systematic approach to training and implementation not only addressed the identified problems of low productivity, inconsistent quality, and limited marketing capacity but also prepared the community to adopt the subsequent stages of technology application, mentoring, and sustainability more effectively. These findings are consistent with previous research showing that practical training in hygienic food processing and packaging significantly improves product quality and safety, while digital marketing and branding workshops enhance MSME competitiveness and market access [18], [19].

The provision of training on hygienic fish processing, product branding, and packaging had a significant impact on improving the quality of products produced by the PKK Bettet MSME. Prior to the intervention, the skipjack tuna floss products were still packaged simply in plastic jars without adequate labeling, making them less attractive and failing to provide consumers with clear information. After receiving training and mentoring, the products began to use pouch packaging, which is more modern, practical, and informative, thereby strengthening their identity as Bettet's signature souvenirs.

Figure 5. Comparison of Product Packaging Before and After the Program

The improvement in packaging quality before and after the intervention can be clearly observed in Figure 5, highlighting the transition from simple plastic containers to standardized and more attractive packaging. The introduction of packaging technology using sealers also

contributed greatly to the shelf life of the products. With tight sealing techniques, fish floss and other processed variants became more durable, more hygienic, and better able to preserve their distinctive taste. The improvement in product quality and shelf life is closely related to the adoption of standardized packaging and sealing technology. Proper packaging reduces exposure to contamination and slows product degradation, thereby extending shelf life. This result aligns with previous research highlighting that packaging technology plays a critical role in ensuring food safety, maintaining product quality, and increasing consumer trust [20]–[22].

In addition to processing and packaging aspects the provision of digital marketing training also brought significant positive impacts for the PKK Bettet MSME group. Prior to the program, product marketing strategies were still very limited to conventional methods, such as direct sales in local markets or simple promotions through WhatsApp [23], [24]. After participating in the training, the PKK members' understanding of digital marketing increased substantially, particularly in the use of social media and e-commerce platforms as tools for product promotion and distribution [25].

This improvement was demonstrated through concrete actions, namely the establishment of online shop accounts across various digital platforms, including Facebook Shop, Instagram, TikTok Shop, and the popular marketplace Shopee [26]. Through these platforms, skipjack tuna floss products and other processed variants from the Bettet MSME group can now be promoted more widely, reaching not only local consumers but also potentially penetrating regional and national markets. The expansion of digital marketing platforms significantly contributed to increased market reach and product visibility. This shift reflects the growing importance of digital transformation in MSMEs, where online platforms enable broader customer engagement and more efficient promotion strategies.

Previous studies have shown that digital marketing adoption enhances MSME competitiveness by improving brand awareness and facilitating access to wider markets [27], [28]. This finding is further supported by research indicating that digital platforms play a crucial role in expanding market access and strengthening customer engagement in small-scale enterprises [29].

3.2. Technology Application

The third stage was technology application, which focused on the installation and utilization of the Fisher Boncalang fish shredder, continuous band sealer, and digital scales. This stage aimed to increase production capacity, standardize product weight, and improve packaging quality to meet market standards. Participants were trained to operate the Fisher Boncalang machine effectively, which enabled them to reduce processing time drastically from approximately 1 kg of fish floss in five hours using manual methods to between 15 and 50 kg per hour using the machine. The application of the continuous band sealer ensured airtight and professional packaging, while the use of digital scales guaranteed product weight consistency, thereby enhancing consumer trust and marketability.

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Figure 6. Implementation of The Fisher Boncalang Tool, and continuous band sealer

The implementation of the Fisher Boncalang machine and supporting equipment is presented in Figure 6, demonstrating how the technology was applied to improve production efficiency and packaging quality. In addition to machine operation, participants were also taught step by step how to use the equipment and how to maintain it properly, ensuring that the PKK group could not only operate but also preserve the longevity of the tools. This practical guidance helped strengthen the group's independence and reduced dependency on external assistance in the future. Furthermore, this stage emphasized hygienic production practices, routine maintenance of equipment, and the integration of technology into daily business operations. The adoption of these tools not only improved efficiency but also minimized hygiene risks associated with manual handling. By combining productivity improvement with better packaging standards, this stage provided a strong technological foundation for the sustainability of the MSME's business [30].

3.3. Mentoring and Evaluations

The fourth stage of the program was mentoring and evaluation, which played a crucial role in ensuring the effectiveness and sustainability of the interventions provided. This stage was carried out through structured mentoring sessions, periodic monitoring, and continuous feedback collection. The mentoring activities focused on assisting PKK members in operating the Fisher Boncalang machine correctly, maintaining hygienic production practices, applying professional packaging techniques, and managing online marketing accounts that had been newly created.

Evaluation was conducted using several approaches. First, monthly monitoring was performed to track production capacity, product quality, and sales performance. Second, feedback sessions were organized to identify challenges faced by participants, such as machine maintenance issues or difficulties in managing digital platforms. Third, sales data analysis was used to objectively assess the impact of the interventions on income growth and market expansion. These evaluations allowed the program team to provide timely solutions, such as additional technical guidance or marketing support.

The mentoring and evaluation stage also emphasized capacity building and independence, ensuring that the PKK women's group could sustain the program's outcomes even beyond the project period. This finding is consistent with previous research that highlights the importance of mentoring and continuous evaluation in improving MSME

performance, building long-term resilience, and strengthening entrepreneurial capacity [31]. During the mentoring stage, partners were actively involved in interactive sessions that allowed them to openly share the obstacles they encountered, including operational difficulties with the Fisher Boncalang machine and challenges in managing newly created online marketing platforms. These issues were directly followed up with on-site assistance and additional coaching, ensuring that problems could be solved quickly and effectively. This ongoing support contributed to a 25% increase in partner income, while also strengthening their confidence in running production and marketing activities independently.

The evaluation process applied multiple approaches, combining pre-test and post-test assessments to track the improvement of participants' knowledge and skills, with continuous monitoring of sales performance and product quality. This dual approach made it possible to measure both technical competency and market outcomes. The progress achieved by the PKK Bettet group as a result of the mentoring and evaluation activities is detailed in Table 1.

Table 1. Comparative Results Before and After Program Implementation

Indicator	Before Program	After Program	Improvement (%)
Production Capacity	1 kg/5 hours (manual)	15-50 kg/hours (using Fisher Boncalang)	400-900%
Product Quality & Hygiene	Inconsistent, risk of contamination	Standardized, hygienic, and uniform	Improved
Packaging	Plastic jars without labels	Modern pouch with labels & sealer	Improved
Shelf Life	3-5 days	1-2 months	200%
Digital Marketing Skills	Limited to WhatsApp	FB Shop, Instagram, TikTok Shop, Shopee	Expanded
Participant Confidence & Skills	Low	High (independent operation & marketing)	Significant

The results of the monitoring and evaluation, as presented in Table 1, demonstrate a significant improvement across all measured indicators. In terms of production capacity, the shift from manual shredding methods, which only produced approximately 1 kg of fish floss within five hours, to the utilization of the Fisher Boncalang machine resulted in an impressive increase to 15-50 kg per hour, The significant increase in production capacity (400-900%) can be attributed to the transition from manual, labor-intensive processes to mechanized production using the Fisher Boncalang machine. This shift reduced processing time, minimized human error, and ensured more consistent output.This finding is consistent with previous studies indicating that the adoption of appropriate technology in fish-processing MSMEs can substantially improve efficiency and productivity [32], [33]. Furthermore, the integration of technology and digital transformation has been recognized as a key factor in enhancing MSME competitiveness and operational performance [34].

The quality and hygiene of the products also improved substantially. Previously, the products were inconsistent and posed a risk of contamination due to manual processing. After the intervention, the products became more standardized, hygienic, and uniform, thus

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enhancing consumer trust. A similar trend was observed in the packaging system, which shifted from unlabeled plastic jars to modern pouches with labels and sealers, not only improving visual appeal but also providing better information and branding value. The shelf life of the products also experienced notable progress, increasing from only 3-5 days to 1-2 months after the adoption of proper packaging technology, such as continuous band sealers, which ensure airtight packaging. In addition, there was a remarkable transformation in digital marketing skills, where previously promotion was limited to WhatsApp, now expanding into multiple platforms such as Facebook Shop, Instagram, TikTok Shop, and Shopee. This expansion enabled a broader market reach and enhanced product visibility.

Finally, the evaluation showed that participants' confidence and technical skills improved significantly. Initially, the PKK members displayed low confidence in operating machines or managing online marketing, but after continuous mentoring, they became capable of running production processes and marketing activities independently. These results indicate that the program successfully combined technological, managerial, and marketing interventions, creating a holistic empowerment model for the PKK Bettet group.

3.4. Program Sustainability

The fifth stage of this community service program emphasized sustainability, aiming to ensure that the positive outcomes achieved would provide long-term benefits for the PKK Bettet group and the wider community. Sustainability measures were realized through the development of Standard Operating Procedures (SOPs) for hygienic fish processing, machine operation, and product packaging. These SOPs serve as practical guidelines to maintain consistency, efficiency, and product quality in daily operations [35]. In addition, sustainability was reinforced through the expansion of marketing networks, connecting PKK Bettet products not only with local markets and souvenir centers but also with digital platforms such as Facebook Shop, Instagram, TikTok Shop, and Shopee. By broadening both offline and online distribution channels, the MSME group is now better positioned to maintain sales growth and strengthen brand recognition. Product diversification strategies, including the development of new variants such as abon and herbal drinks, also helped reduce market risk and foster continuous innovation.

Another critical aspect of sustainability was capacity building and leadership empowerment among PKK members. Through structured mentoring and peer-to-peer learning, members gained the confidence and skills necessary to manage production independently, maintain equipment such as Fisher Boncalang and sealers, and oversee marketing activities. The involvement of younger generations and student volunteers further supported knowledge transfer, ensuring that the program's impact would endure over time. Table 2 demonstrates that the program generated significant outcomes across four key aspects. In terms of SOP development, the absence of written guidelines was transformed into established SOPs for hygienic processing, machine operation, and packaging, resulting in improved consistency and quality control.

Table 2. Achievements of Mentoring and Sustainability Efforts

Aspect	Before Program	After Program	Achievement/Impact
SOP Development	No written guidelines for production or hygiene	SOPs established for hygienic processing, machine operation, and packaging	Consistency and quality control improved
Product Diversification	Only original Abon Cakalang and TOGA drinks	New variants (Spicy, herbal drinks with collagen.)	Reduced market risk, higher innovation
Team Management & Capacity	Low confidence, dependent on manual work	Independent in machine operation, packaging, and online sales	Stronger leadership, long-term self-reliance
Community Involvement	Limited to PKK core members	Inclusion of younger members & student volunteers	Knowledge transfer ensured sustainability

For product diversification, the business expanded from producing only original skipjack tuna floss and TOGA drinks to introducing new variants such as spicy floss and herbal drinks with collagen, thereby reducing market risks and fostering greater innovation. Regarding team management and capacity, members who were previously less confident and dependent on manual work became independent in operating machines, packaging, and managing online sales, indicating stronger leadership and long-term self-reliance. In community involvement, participation expanded beyond the PKK core members to include younger members and student volunteers, ensuring knowledge transfer and supporting program sustainability.

4. Conclusion

This community service program successfully addressed the key challenges faced by the PKK Bettet MSME group, namely low productivity, inconsistent quality, and limited marketing capacity. In line with the objectives outlined in the introduction, the implementation of the Fisher Boncalang machine, complemented by modern packaging equipment and structured digital marketing training, resulted in significant improvements in production capacity, product hygiene, packaging standards, and market expansion, as evidenced in the results and discussion. The development of Standard Operating Procedures (SOPs), product diversification strategies, and strengthened team capacity further ensured sustainability; while mentoring and evaluation activities confirmed a measurable increase in confidence, skills, and income among participants. These outcomes demonstrate that integrating technological innovation with branding, packaging, and digital marketing can effectively empower rural women's groups and enhance MSME competitiveness.

Looking forward, the prospects of this program include scaling up the Fisher Boncalang innovation for other fish-based MSMEs, extending product diversification to meet the growing demand for functional foods, and strengthening digital ecosystems to access broader regional and international markets. Future studies can also explore the integration of halal certification, advanced preservation technologies, and e-commerce analytics to further improve quality assurance and market reach. Thus, this research not only provides practical contributions to

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the empowerment of MSMEs in Bettet Village but also offers theoretical insights into sustainable rural entrepreneurship.

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