Management and Appropriate Technology Catfish Cultivation and Food Processing at the Groups of Elok Mekar Sari SME's Surabaya

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Abstract.
This Community Service (PKM) activity aims to increase productivity, business efficiency, and economic added value at the Elok Mekar Sari Surabaya MSME through the application of Appropriate Technology (TTG) and innovation in catfish-based products. The main problems faced by partners include limitations in water quality management, high fish mortality rates, and low product diversification and business management. The method used in this activity is a participatory approach through the stages of preparation, implementation, mentoring, and monitoring and evaluation. The implementation of technology includes the use of a 1200-liter water tank, water pumps, filtration systems, aerators, and the application of a biofloc system to maintain water quality. In addition, innovations in processing catfish products into shredded fish and nuggets were carried out to increase added value. The results of the activity showed an increase in more stable water quality, a decrease in fish mortality rates, and an increase in cultivation productivity. Furthermore, there was an increase in the partners' business management capacity through more structured financial records, business planning, and cost analysis. Product diversification also provides opportunities for increasing income and expanding the market. Overall, this PKM activity has a positive impact on economic and social aspects, and encourages the sustainability of businesses based on local potential.

Keywords: *Appropriate Technology, catfish cultivation, MSMEs, product innovation and community service.*

I. INTRODUCTION

Indonesia's economic growth is driven by the significant growth of micro, small, and medium enterprises (MSMEs), particularly as these MSMEs use local materials to produce goods, thus avoiding the impact of rising imports, which are often driven by the rising dollar, a recurring issue. According to Bank Indonesia Governor Agus Martowardojo, as quoted on www.kabarbisnis.com, MSMEs in Indonesia have contributed up to 99% to Indonesia's economic development [1]. MSMEs are one sector that has been able to survive the current global economic downturn. Furthermore, MSMEs are an integral part of the national business world and hold a crucial and strategic position, potential, and role in achieving national economic development goals. Therefore, economic development through small business development is one way to address unemployment and improve the welfare of the people of East Java Province. Thus, the MSME development program needs to be developed because this activity is able to expand employment opportunities and provide broad economic services to the community. This also plays a role in the process of equalizing and increasing community income, as well as encouraging economic growth and realizing national stability in general and economic stability in particular. Small industries as business units are often carried out by housewives, their operations are supported by local sources of materials with marketing targets that are generally within a limited domestic scope. The availability of local raw materials for small and medium industries is a distinct advantage that allows them to operate efficiently.

The majority of MSMEs in Indonesia are home-based businesses that absorb a significant workforce. According to data from the Ministry of Cooperatives and SMEs, there will be 65.4 million MSMEs in Indonesia by 2023. This 65.4 million business units can employ 123,300 workers [2]. This demonstrates the significant impact and contribution of MSMEs in reducing unemployment in Indonesia [3] (Ministry of Cooperatives, 2023). Increasing workforce involvement in MSMEs, which helps reduce unemployment and create new jobs, can boost economic growth.

One MSME that is developing in the heart of Surabaya through urban farming is the Elok Mekar Sari MSME, located in Semolowaru, Surabaya. This MSME is a micro-enterprise operating in the agriculture and fisheries sectors, including catfish cultivation and fishery product processing. This business has significant potential to support local food security and improve the community's economy.

Catfish is a commodity that is a favorite of consumers in Indonesia, its savory taste and easy processing are one of the reasons. In addition, this fish is also easy to get, of course because its maintenance is quite easy, according to [4] Mutiara Santi et al (2019) Catfish cultivation can increase income and improve community welfare, this is also supported by the results of research [5] Dewi Anna Sari Harahap et al (2023) that catfish cultivation production plays a very important role in improving the economic income of the community, this shows that catfish cultivation can bring more prosperity to the community because they get increased income from catfish cultivation.

In fact, catfish are easy to maintain, market demand is also very stable, making catfish cultivation have quite high economic potential [6] (Sustian Alfina, et al. 2025). However, in practice, there are still various obstacles that hinder the optimization of catfish businesses experienced by the Elo Semolowaru Surabaya MSME Group, where catfish maintenance techniques are still carried out conventionally with limitations in water quality management, feed, and monitoring systems. This has an impact on productivity that is not optimal and the risk of fish mortality is relatively high. According to [7] Fuadi et al., (2020) an important aspect in catfish cultivation is to maintain water quality, namely dissolved oxygen (DO) levels, which play a role in the metabolic processes of fish and microorganisms in the pond ecosystem. Lack of dissolved oxygen can cause fish to experience stress, lose appetite, and slow growth, even in extreme conditions can cause mass mortality [8] (T. Policar at all 2024). For this reason, the use of appropriate technology in catfish cultivation by improving water quality, namely implementing the use of a biofloc system or a simple water quality control tool and a water pump is very necessary.

Furthermore, catfish farming will have greater selling value if it is further processed into food after harvest. Furthermore, catfish food also benefits the community's nutrition. This is evidenced by research by [9] Chusnul Khotimah Galatea (2025) which states that increasing innovation in healthy food with catfish can improve understanding for teachers and parents, in addition to increasing children's interest in understanding things. Thus, consuming catfish can help achieve balanced nutrition and optimal growth. This means that providing catfish to children can inspire schools to adopt the habit of eating fish from an early age. This is also supported by research by [10] Nurul Fatmawati (2024) who attempted to explore the content of processed catfish on nutritional status. The results of a review of five journals showed that processed catfish contains protein, calories, fat and carbohydrates, water, and minerals that play an important role in nutritional status. Thus, it can be said that catfish is very beneficial for the quality of public health.

The challenges faced by the Elok Mekar Sari Surabaya MSME, in addition to technological challenges in catfish cultivation and processing into value-added food products, also lie in business management. They also face challenges in production management, financial record keeping, and marketing strategies. The variety of processed catfish products they produce is limited and lacks strong market differentiation. Product packaging and branding are also not yet professionally implemented, resulting in low product competitiveness compared to similar products on the market.

Based on these conditions, a community service program (PKM) is needed that integrates management and appropriate technology in catfish cultivation and processing into value-added food products. This program is expected to increase productivity, business efficiency, and competitiveness of MSMEs, while also providing a sustainable economic impact for entrepreneurs.

II. METHODS

The implementation of this Community Service Program (PKM) activity uses a participatory, educational, and applicative approach, where partners are actively involved in all stages of the activity. This method is designed to ensure that each solution provided is understandable, applicable, and sustainable.

1. Preparation Phase

This phase aims to ensure program readiness and the suitability of solutions to partner needs. Activities include:

a) Initial survey and needs identification to more specifically map problems in production, management, and marketing aspects

b) Coordination with partners regarding the schedule, location, and format of activities

c) Preparation of training modules covering catfish cultivation, product processing, business management, and digital marketing

d) Preparation of tools and materials for the implementation of appropriate technology

2. Implementation Phase

This phase is the core of the Community Service Program (PKM) activity and consists of several integrated sub-activities:

a. Cultivation Training and Mentoring

b. Business Management Training

c. Product Diversification Training

3. Monitoring and Evaluation Phase

This phase is conducted to ensure the effectiveness and sustainability of the program:

III. RESULT AND DISCUSSION

The implementation of Community Service Program (PKM) activities at the Elok Mekar Sari MSME has yielded significant results in increasing production capacity, business management, and product innovation. The results of this activity can be seen in the following aspects:

Technology and Innovation Products (Hard and Soft)

The technology product provided to the community was a 1200 ml water tank. This 1200-liter water tank is one of the Appropriate Technology (TTG) facilities used to support the catfish cultivation system, particularly at the Elok Mekar Sari MSME in Semolowaru, Surabaya. The second technology is the Shimizu PS 130 BIT water pump, an electric water pump widely used for clean water distribution needs, including in small businesses such as catfish farming. It serves as a tool for draining dirty water and refilling fish ponds to ensure the water clarity required by the fish. In addition, the Filter Housing 10 is a tube-shaped water filter designed to accommodate a 10-inch filter cartridge. This tool is used to filter out dirt, particles, odors, and certain substances in water, resulting in cleaner, more usable water. The innovation of this PKM activity is the production of shredded catfish, starting from the raw material preparation stage to the finished shredded fish. Besides preparing shredded catfish, it also turns catfish into nuggets, a popular food among children and adults alike.

Implementation of Appropriate Technology (TTG) and Innovation in the Community.

The implementation of Appropriate Technology (TTG) in this Community Service Program (PKM) activity aims to improve production efficiency, yield quality, and the sustainability of catfish farming businesses. The technology implemented is tailored to the conditions of the target community, is easy to operate, and relatively affordable. Some forms of Appropriate Technology (TTG) and innovations implemented in this activity include a catfish cultivation system in a limited container using a water tank, which allows the community to cultivate in small areas with high stocking densities. The biofloc system plays a role in maintaining water quality by utilizing microorganisms that decompose organic waste. Furthermore, aerators and a simple water circulation system are used to increase dissolved oxygen levels, thereby reducing the risk of fish mortality while maintaining a stable cultivation environment. The use of water pumps such as the Shimizu PS 130 BIT also facilitates more efficient water distribution, supported by the installation of a filtration system using 10 filter housings to filter impurities and maintain optimal water quality. On the other hand, the use of alternative feed based on fermented organic waste is an important innovation in reducing production costs while increasing fish growth, so that the overall application of this technology is able to increase the efficiency, productivity, and sustainability of cultivation businesses.

Innovation in catfish product processing developed in this PKM activity focuses on increasing economic

added value through product diversification, where in addition to cultivation, catfish are processed into products such as catfish nuggets and catfish floss which have wider market appeal; catfish nuggets are a product that is favored by various groups, especially children because of its taste, while catfish floss has the advantage of longer shelf life and can be marketed widely as a practical product or souvenir. The application of this innovation combined with Appropriate Technology (TTG) has been proven to be able to increase cultivation efficiency as well as the economic value of production results, where there is an increase in the quality of clearer and more stable pond water, a more efficient and controlled water circulation system, a decrease in fish mortality rates, and an increase in more optimal harvest productivity, thus supporting a more modern and sustainable cultivation system. In addition, this activity also has an impact on increasing business management capacity, where through training and mentoring partners have been able to carry out simple financial records, compile more structured business plans, and understand cost and profit analysis, so that business management becomes more organized, transparent, and measurable. The development of processed product innovations also results in product diversification with higher added value, better taste and hygiene quality, and opens up opportunities for increased income from these processed products. Overall, the implementation of PKM has had positive economic and social impacts, including increased MSME income, improved skills and knowledge of business actors, the opening of small-scale employment opportunities, and contributions to local food security, so that this program is able to encourage the independence and sustainability of businesses based on local potential. This supports the activities carried out by Dewi Sutjahyani et al. (2025) by providing assistance in Management and Appropriate Technology, which has provided solutions in the form of financial management training, natural dyeing techniques, digital marketing strategies, and the procurement of appropriate technology (TTG). The results of the activities show that partners have increased their capacity to produce batik efficiently, manage their businesses professionally, and market their products to a wider market, both offline and online. The real impact of this program is seen in the increased enthusiasm of housewives in entrepreneurship and the growing awareness of the importance of protecting the environment. This activity not only strengthens the position of MSMEs in the local economy.

Catfish cultivation by the Elok Mekar Sari MSME group in Semolowaru, Surabaya, is carried out using drums. Catfish cultivation in drums is a method of raising fish in a limited environment (household/MSME scale) using plastic drums as mini ponds. This system is suitable for small spaces, is cost-effective, and easy to implement in urban areas (urban farming). This method of catfish cultivation requires maintaining clean and odor-free water. Partial water changes (approximately 10–30%) are performed every 1–2 weeks. If the water becomes too cloudy or smells, replace it immediately. Aeration (supplementary oxygen) can be used to improve water quality. Therefore, water pumps and water filters are required to maintain water quality. Therefore, this activity provides assistance to MSMEs with the following technologies:

1. A water pump to drain dirty water and refill the fish pond to ensure the water clarity required by the fish. The image and description show the Shimizu PS 130 BIT, an electric water pump widely used for clean water distribution, including in small businesses such as catfish farming. This pump is designed with automatic technology for more practical and efficient operation. General Specifications

- Power: ±125 watts
- Voltage: 220V / 50 Hz
- Maximum suction power: ±9 meters
- Head: up to ±33 meters
- Water flow capacity: ±28 liters/minute
- Automatic system: uses a pressure switch (automatic on/off)

Fig. 1: Shimizu PS 130 BIT Water Pump

2. 10-inch Filter Housing

The 10-inch Filter Housing is a tube-shaped water filter designed to accommodate a 10-inch filter cartridge. This device is used to filter out dirt, particles, odors, and certain substances in water, resulting in cleaner water quality suitable for use in businesses such as fish farming.

Fig. 2: Water Filter 10 Filter Housing

This 10-piece Filter Housing serves as both a pre-treatment and advanced filtration system to improve water quality by filtering out solid particles, certain chemicals, and even odor and color. This filter housing operates on the principle of pressurized water flowing through the filter media in the cartridge. The quality of the filtration results depends heavily on the type of cartridge used, making this device flexible and can be used to filter clear, odorless water for healthy catfish. General Specifications

- Cartridge size: 10 inches (universal standard)
- Material: food-grade plastic (polypropylene) or pressure-resistant material
- Working pressure: ±60–100 psi
- Working temperature: up to ±45°C
- Pipe connection: ½ inch or ¾ inch
- Type: single housing (can be installed in series for multiple filtration)

2. Water Tank 122

A 1200-liter water tank is one of the Appropriate Technology (TTG) facilities used to support catfish cultivation systems, particularly at the Elok Mekar Sari Semolowaru, Surabaya MSME. This water tank is very effective in limited space and simplifies water quality management.

The main uses of a 1200-liter water tank in Community Service (PKM) activities are as follows:

1. Medium for Limited-Scale Catfish Cultivation

The water tank is used as a container for raising catfish with a controlled stocking density system. This allows communities to cultivate even with limited land.

2. Maintaining More Stable Water Quality

With a large water volume (1200 liters), the physical and chemical conditions of the water are more stable than in smaller containers, thus supporting optimal fish growth.

3. Supporting the Biofloc System

The water tank can be integrated with a biofloc system, where microorganisms play a role in decomposing organic waste and maintaining good water quality.

4. Efficient Water Use

This system allows for more efficient water use because it eliminates the need for frequent total water changes.

5. Ease of Monitoring and Maintenance

The shape and design of the water tank make it easy to monitor fish conditions, feed them, and clean the tank.

6. Supports Circulation and Aeration Systems

The water tank can be combined with a water pump like the Shimizu PS 130 BIT and a filtration system like the 10 Filter Housing to maintain dissolved oxygen levels and water cleanliness.

1200 Liter Water Tank Specifications

The specifications for water tanks generally used in PKM activities are as follows:

- Capacity: 1200 liters
- Material: High-quality polyethylene (PE) (UV-resistant and leak-proof)
- Shape: Vertical cylinder
- Diameter: ± 100–120 cm
- Height: ± 140–160 cm
- Wall thickness: ± 8–12 mm
- Color: Blue/orange (reduces excessive light penetration)

Fig. 3: Image of a Tank for Catfish Cultivation

3. Processing Catfish into Shredded Fish

The process of making shredded catfish begins with the raw material preparation stage. Fresh, high-quality catfish are selected and then cleaned of dirt, guts, and mucus. Afterward, the fish is steamed or boiled until cooked through to facilitate separation of the meat from the bones. The cooked catfish is then shredded until smooth.

The next stage is mixing the spices. The shredded catfish is mixed with ground spices such as shallots, garlic, coriander, salt, sugar, and coconut milk to impart a distinctive flavor. This mixture is then cooked again, stirring constantly until the spices are absorbed and the water content is reduced.

The next important process is frying or roasting. The meat and spice mixture is cooked over low heat until dry, browned, and has a light texture similar to shredded fish fibers. This stage requires precision to prevent burning and to achieve the right level of dryness.

Once cooked, the shredded fish is cooled before draining the oil (if fried), and then packaged in airtight containers for long-lasting and hygienic storage. The resulting catfish floss product has a longer shelf life than fresh fish and can be marketed as an MSME product with high economic value..

Fig. 4: Making Shredded Catfish

4. Q QFQaProcessing Catfish into Nuggets

The activity of processing catfish into nuggets is a process of processing fishery products that aims to increase added value, durability, and consumer appeal, which begins with the preparation stage of ingredients and tools, where the main ingredients used include fresh catfish, flour (wheat or tapioca), eggs, garlic, shallots, salt, pepper, and additional spices according to taste, while the tools used include knives, cutting boards, blenders or food processors, dough containers, baking sheets, and steamers. Next is the process of cleaning and filleting the fish, washed thoroughly before separating the meat from the bones and skin. The catfish meat that has been obtained is then mashed using a blender or chopped until it has a soft texture, then mixed with flour, eggs, and ground spices such as garlic, shallots, salt, and pepper to form a homogeneous dough. The dough is then molded into a baking sheet that has been greased to prevent sticking and flattened to achieve uniform thickness, then steamed for approximately 20–30 minutes until cooked to bind the nugget structure. After the steaming process, the dough is cooled first before being cut into the desired shape such as squares or sticks, then the coating process is carried out by dipping the nugget pieces into beaten egg and coating them with breadcrumbs to produce a crispy texture when fried. The next stage is frying in hot oil until the nuggets are golden brown, although another alternative is to store them in the freezer as frozen food. The final stage is packaging, where the finished nuggets are packed in plastic or airtight containers to maintain quality and extend the product's shelf life.

Fig. 5: Food Processed from Catfish

IV. CONCLUSION

Community Service (PKM) activities at the Elok Mekar Sari Surabaya MSME have succeeded in increasing the effectiveness of catfish cultivation through the application of Appropriate Technology (TTG) in the form of water tanks, biofloc systems, aerators, water pumps, and filtration, which have resulted in improved water quality, reduced fish mortality rates, and increased harvest yields.

Furthermore, product processing innovations such as catfish nuggets and catfish floss have been able to provide added economic value and expand the market, supported by increased management capacity of partner businesses through more structured financial records, business planning, and cost analysis so that business management becomes more professional. While overall, this activity also provides economic and social impacts in the form of increased income, skills, and business opportunities for the community.

Therefore, it is recommended that partners can continue to develop and maintain the consistency of the application of the technology that has been provided, increase product innovation to be more varied and competitive in the market, and strengthen marketing strategies and business management to support the sustainability and development of the business in the future. In the future, further efforts are needed in the form of ongoing mentoring and periodic evaluations to ensure that all technologies and innovations that have been implemented can be utilized optimally. In addition, the development of marketing networks both offline and digital is also important to expand the market reach of processed catfish products.

Support from various parties such as the government, academics, and the private sector is expected to strengthen the business ecosystem so that MSMEs are able to grow more independently, adaptively, and highly competitive in the long term.

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