



# Application of Fish Waste Processing for Sustainable Livestock Feed Production A Community Engagement Study in Garut Regency

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## Abstract

This community engagement study aimed to develop an application for processing fish waste into animal feed based in an incubator system in Garut Regency. The program was conducted from May to November 2023 with the primary objective of transferring technology in waste processing and animal feed production to partner groups. Methods included socialization, technical and non-technical training, and direct mentoring in animal feed pellet production. Results showed a significant improvement in the knowledge and skills of the groups in producing fish waste pellets, reducing feed production costs, and enhancing the sustainability of local livestock businesses. Challenges encountered included initial production limitations and consumer trust in new products. With in-depth scientific approaches and sustained support, the program successfully created positive impacts on the environment and community economic welfare.

*Keywords:* Community engagement, fish waste, animal feed, incubator, business sustainability

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## 1. Introduction

Waste has become a serious problem in Indonesia, a phenomenon recognized by Mo, et al., (2018). Waste not only causes the environment to be unhealthy and uncomfortable, but also has the potential to become a disaster for the ecosystem if not addressed seriously. Waste is often found in public places such as markets, reflecting the suboptimal waste management practices currently in place. In many areas, including Palu City, waste management still relies on conventional systems consisting of collection, transportation to Temporary Disposal Sites (TPS), and disposal at Final Disposal Sites (TPA). This system is heavily dependent on waste transport fleets and requires substantial operational costs, covering collection, transportation, and processing of waste at TPA.

Although waste management should ideally be a shared responsibility between the government and the community, in reality, the community often acts merely as a recipient of services. They feel that paying waste collection fees is sufficient, considering subsequent handling as the government's responsibility. However, there is a more efficient and modern waste management system known as the zero waste concept. This concept emphasizes integrated waste management, reducing waste volume at its source through recycling and composting. According to Saleh, et al., (2022), the zero waste concept should be implemented to address Indonesia's waste problems. Effective and efficient waste management requires cooperation between the government and the community, as well as the application of appropriate technologies and methods. By doing so, it is hoped that waste management in Indonesia can become better and more sustainable (Al Abdullah et al., 2020).

Currently, South Garut Regency is facing a serious waste problem caused by vegetable and fish vendors, especially in markets, restaurants, and food processing units. The community tends to clean fish at the point of purchase, particularly types like stonefish, rappo-rappo fish, tilapia, and milkfish. The waste from cleaning, which includes gills, scales, and fish guts, begins to emit a strong, unpleasant odor within six hours, disrupting the environment. This issue is exacerbated by the disposal of fish waste mixed with vegetable and food scraps, as the majority of fish vendors in South Garut and its surroundings also sell vegetables, fruits, tofu, tempeh, and household spices. The impact of this waste significantly contributes to extreme waste levels in South Garut, not only in terms of volume but also qualitatively, as it produces foul odors that combine with plastic bags, leading to air pollution that affects respiratory

health. Additionally, the leachate from fish waste can cause corrosion of waste transport fleets, shortening their lifespan.

Therefore, it is necessary to adjust the waste burden by shifting part of it to early waste processing. One viable solution is processing fish waste into fish meal as animal feed. Fish meal has high economic value, containing beneficial proteins and calcium. This process not only serves as an exchange cost but also provides significant benefit cost, alleviating burdens on both the community and the government. Observations indicate that the highest added value can be achieved by processing fish waste into fish meal. The market price of fish meal ranges from Rp 5,000 to Rp 9,000 per kilogram, depending on its protein content. Fish meal is used as a nutritious component in animal feed, with recommended percentages for layers and broilers being 5-10%, for ducks 12%, and for quails 10% (Jayathilakan, et al., 2012). Implementing fish waste processing into fish meal is expected to reduce the negative impacts of waste, extend the lifespan of waste transport fleets, and provide economic benefits to the local community.

This program involves training and counseling to establish small industries as incubators for fish waste processing. The benefits of processing fish waste include improving the quality of fish waste into high-value products, thus utilizing the waste effectively rather than discarding it uselessly. Currently, the utilization of fish waste in the community is minimal, presenting an opportunity to create new jobs for local residents. Given the previously described conditions, the prospect of fish meal production is highly promising. The target of this Community Service Program (PKM) is catfish farming groups. With the implementation of this PKM program, it is expected to increase the income of partner catfish farming groups by enhancing the value of their products. There are two partner groups involved in this PKM program: the MOMI group with 8 members and the PETOBO group with 7 members, totaling 15 members. Each group can employ 8 members from the surrounding community as part of the PKM training initiative. The partner groups are eager to add value to the fish waste that is often discarded but face challenges, such as insufficient knowledge about processing fish waste into valuable products.

The effort to turn fishery waste into economically valuable products will be carried out by the partner catfish farming groups, reducing initial investment costs as there is no need to rent a facility. Therefore, the location is quite supportive of the fish waste processing business to produce fish meal with higher economic value. The raw materials for fish waste processing in this activity are sourced from fish vendors at Masomba Market, Inpres Market, and Tua Market, purchased at Rp. 500 per kg and transported to the processing location. The waste potential from these market vendors reaches 1 ton per day. To increase production capacity, waste can also be collected from restaurants and households in the surrounding area. Thus, with cooperation from fish vendors in these three markets and others, the availability of raw materials will not be an issue.

The primary market currently comprises broiler and layer chicken farmers in South Garut and surrounding areas, who need tens of tons of fish meal daily for their feed. Additionally, fish farmers require fish meal for pellet production. Given the ready market for fish meal, marketing the product is not a significant obstacle, provided that quality, quantity, and continuity of fish meal production are maintained. By processing fish waste into fish meal, the pollution caused by the accumulation of fish waste can be reduced. This initiative indirectly assists the government in addressing city waste management issues in South Garut. From the perspective of job opportunities for local residents, this activity will provide employment for people around the partner locations. Therefore, the negative impacts of this activity can be minimized, resulting in more positive outcomes.

## 2. Materials and Methods

The PKM program in South Garut Regency addresses significant waste management challenges posed by vegetable and fish vendors, particularly in markets, eateries, and food processing units. Waste materials such as fish gills, scales, and entrails often lead to environmental issues, including pervasive foul odors that affect local air quality. The initiative focuses on transforming these waste products, especially from fish cleaning activities, into high-value fish meal. This approach not only reduces the volume of waste that would otherwise end up in landfills but also enhances its economic potential.

During the implementation phase, the program employed a multifaceted educational and training strategy. Technical workshops were pivotal, providing hands-on demonstrations of fish waste processing techniques using specialized equipment like fish grinders and ovens. Concurrently, educational seminars were conducted to educate community members about the environmental benefits of proper waste management and the economic advantages of producing fish meal. These sessions aimed to instill practical skills and knowledge necessary for sustainable waste processing practices among participants.

The technical training component focused extensively on the intricacies of fish waste handling and processing. Participants learned the entire process, from collection and cleaning to grinding and drying, ensuring the production of high-quality fish meal. Non-technical training sessions complemented this by equipping community groups with essential entrepreneurial skills. Topics covered included market analysis, product marketing strategies, and basic financial management tailored to the needs of small-scale operations.

To ensure the longevity and effectiveness of the program, a "Learning by Doing" approach was adopted post-training. This involved ongoing mentoring and support for community groups, facilitating continuous improvement in their waste processing capabilities and business acumen. Regular group sessions provided platforms for shared

learning and problem-solving, while targeted market access support helped participants navigate product placement and sales. Monitoring and evaluation mechanisms were also integral, allowing stakeholders to track progress, address challenges promptly, and measure the program's overall impact on waste reduction and community empowerment.

### 3. Results and Discussion

The implementation of the Community Service Program (PKM) titled "Application of Waste Processing for Livelihood and Environmental-Friendly Livestock Feed Incubator-Based" from May to November 2023 achieved significant milestones. The program aimed to transfer technology and knowledge to address challenges encountered by community partners in Garut, West Java, specifically focusing on enhancing their capabilities in livestock feed processing using locally available resources. Throughout the duration, all planned activities were completed successfully, with comprehensive engagement through regular mentoring sessions and face-to-face interactions.

During the initial phase, meticulous preparation was crucial. Administrative materials were meticulously prepared to facilitate smooth socialization sessions. Coordination with community partners was established to gauge their readiness and ensure alignment with the scheduled activities (Wilson, et al., 2016). This preparatory phase also involved setting up a structured socialization timetable that accommodated the partners' availability and needs. Additionally, the team assigned specific roles to ensure the effective delivery of training content tailored to the partners' competencies. The execution phase involved a series of structured activities aimed at empowering the community partners with practical skills and knowledge. Socialization sessions were conducted to familiarize the partners with the concept of transforming fish waste into viable livestock feed ingredients. These sessions were complemented by focused discussions aimed at deepening the participants' understanding and skills in waste management and entrepreneurship. Practical training sessions were pivotal, providing hands-on experience in producing feed pellets from locally sourced materials such as rice bran, tofu pulp, and fish meal derived from fish waste.

One of the primary challenges addressed was the effective management of fish waste, prevalent in local markets and eateries, which posed environmental and economic concerns. By training the partners in converting this waste into valuable feed ingredients, the program aimed to reduce environmental pollution while creating economic opportunities through cost-effective feed production for livestock, particularly catfish. The high cost of commercial feed pellets, which consumed a significant portion of production expenses, prompted the initiative to produce pellets independently at a lower cost of Rp. 9000 per kg, thereby reducing production costs by Rp. 2,000 per kg compared to commercial alternatives.

Throughout the training sessions, which spanned several months, the participants demonstrated a keen interest and active participation. The theoretical and practical training modules were structured to equip them with the necessary skills to produce high-quality feed pellets (Van der Poel, et al., 2020). Practical sessions, facilitated by experienced trainers and practitioners in organic pellet production, focused on optimizing the use of local resources and ensuring the pellets met nutritional standards suitable for catfish farming. The provision of pellet-making and grinding equipment further facilitated the participants in mastering the pellet production process, ensuring they could independently sustain their feed supply needs.

One of the significant challenges encountered during the implementation of the community service program was the initial inability of the community groups to scale their production to meet market demand. This limitation stemmed from the need for in-depth scientific studies to validate the nutritional content and safety of the livestock feed produced from fish waste. Convincing consumers to adopt these products also posed a hurdle, as there was initial skepticism and hesitation towards accepting feed derived from unconventional sources. Addressing these challenges required rigorous scientific validation and consumer education. Scientific studies were crucial to demonstrate the nutritional value and safety of the feed pellets made from fish waste, ensuring they met regulatory standards and were suitable for livestock consumption. This process involved conducting laboratory tests to analyze the protein and calcium content, as well as assessing any potential contaminants that could affect livestock health.

Furthermore, consumer acceptance played a pivotal role in the success of the program. Efforts were made to educate potential consumers, including local farmers and livestock breeders, about the benefits of using locally produced feed pellets. Information campaigns highlighted the environmental benefits of reducing fish waste in landfills and providing an affordable alternative to commercial feed pellets. Demonstrations and field trials were conducted to showcase the effectiveness of the feed pellets in enhancing livestock growth and health (Murray, et al., 2016). Overcoming these challenges required a multi-faceted approach that combined scientific research, community engagement, and market outreach. By addressing these hurdles, the program aimed to foster sustainable practices in livestock feed production while promoting economic opportunities for the community partners involved. Ongoing efforts focused on refining production processes, expanding market access, and building trust among consumers, ensuring the long-term viability and impact of the community service initiative.

## 4. Conclusion

Based on the comprehensive implementation and outcomes of the community service program titled "PKM Application of Waste Processing to Enhance Environmentally Friendly Livelihoods Based on Livestock Feed Incubators," several key conclusions can be drawn:

- (a) **Achievement of Program Objectives:** The program successfully achieved its primary objectives of transferring technology and knowledge to address community challenges related to livestock feed production. Through structured activities including training sessions, practical demonstrations, and ongoing support, significant progress was made in enhancing the skills and capabilities of community members.
- (b) **Impact on Community Welfare:** The program had a positive impact on community welfare by introducing sustainable practices in waste management and livestock feed production. By utilizing fish waste to produce nutritious feed pellets, the program not only reduced environmental pollution but also provided a cost-effective solution for local livestock farmers, thereby improving their economic resilience.
- (c) **Scientific Validation and Innovation:** A critical aspect of the program's success was the rigorous scientific validation of the feed pellets. Through scientific studies and laboratory tests, the nutritional content and safety of the feed were verified, ensuring compliance with regulatory standards and enhancing consumer confidence.
- (d) **Challenges and Mitigation Strategies:** The program encountered challenges such as initial production limitations and consumer skepticism. These challenges were addressed through in-depth scientific research, consumer education campaigns, and practical demonstrations to build trust and acceptance among stakeholders.
- (e) **Sustainability and Future Directions:** To ensure the sustainability of the initiative, ongoing efforts are needed to refine production processes, expand market reach, and strengthen institutional support. Long-term success hinges on continuous engagement with community partners, monitoring of outcomes, and adaptation to evolving market demands.

In conclusion, the community service program exemplifies a successful model of collaborative efforts between academia, community members, and stakeholders to promote sustainable development. By integrating scientific research with practical applications, the program not only addressed local challenges but also contributed to broader environmental and economic goals. Future endeavors should focus on scaling up initiatives, fostering innovation, and empowering communities to achieve lasting impact and resilience.

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