

## Enhancing the Capacity of Kumis Jaya Fish Farmer Group through Circular Economy-Based Alternative Feed Training and Demonstration for Catfish Farming

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### Abstract

**Background:** Catfish farming plays an important role in food security and community income. However, high feed costs (60-80% of production costs) and limited knowledge of feed formulation remain major constraints for fish farmer groups.

**Contribution:** This community service activity aimed to improve the knowledge and technical understanding of the Kumis Jaya Fish Farmer Group (POKDAKAN) regarding the utilization of locally available waste materials as alternative feed ingredients based on circular economy principles.

**Method:** The activity was conducted using an educational, participatory, and applicative approach involving 10 members of POKDAKAN Kumis Jaya in Ujong Tanjong Village, Meureubo District, West Aceh Regency. The program consisted of pre-test activities, lectures, discussions, demonstrations of feed formulation using the Pearson Square Method, and post-test evaluation. The assessment instrument consisted of 10 questions related to feed nutrition, circular economy concepts, and feed formulation.

**Results:** Participants' average understanding increased markedly from 24.5% in the pre-test to 80.6% in the post-test, with an average improvement of 56.1%. Participants were able to identify local materials such as water hyacinth, poultry slaughter by-products, and agricultural waste as potential ingredients for alternative catfish feed. In addition, participants gained practical understanding of simple feed formulation targeting 30% protein content using the Pearson Square Method.

**Conclusion:** The training activity improved participants' short-term knowledge and technical understanding regarding alternative feed formulation and the application of circular economy principles in catfish farming. The program also demonstrated the potential utilization of local waste resources as alternative feed ingredients for sustainable aquaculture development.

**Keyword:** Circular Economy, Alternative Feed, Catfish, POKDAKAN, Community Service

### INTRODUCTION

Catfish (*Clarias* sp.) farming plays a significant role in supporting food security and generating income for local communities in Indonesia. Catfish culture is widely practiced due to its rapid growth rate, adaptability to diverse aquaculture systems, and consistently high market demand (Susilawati et al., 2022). One of the active fish farmer groups in West Aceh Regency is

the Kumis Jaya Fish Farmer Group (POKDAKAN), located in Ujong Tanjong Village, Meureubo District.

POKDAKAN Kumis Jaya consists of 10 active members engaged in small-scale catfish aquaculture production. Preliminary field observations and interviews revealed that the group relied predominantly on commercial feed for daily farming operations. Feed expenditure constituted the largest operational cost component in catfish production, while limited knowledge regarding feed formulation and nutrient requirements constrained farmers' capacity to utilize locally available resources.

Feed cost has been widely recognized as a major challenge in aquaculture production systems. Dependence on commercial feed may reduce production efficiency and increase farmers' vulnerability to feed price fluctuations. Therefore, the development of alternative feed derived from locally available resources is considered a strategic approach to support more economically and environmentally sustainable aquaculture practices. The implementation of circular economy principles offers opportunities to convert agricultural and organic waste into valuable aquaculture inputs. Several locally available materials in the study area, including water hyacinth, poultry slaughter by-products, and agricultural residues, possess potential as alternative feed ingredients following appropriate processing procedures. Poultry slaughter by-products, for instance, were processed through cleaning, boiling, drying, and grinding stages prior to their inclusion in feed formulations to enhance safety and storage quality.

Although previous community service activities related to feed-formulation training had been conducted within the same partner group, the present activity was designed as a follow-up program emphasizing circular economy-based feed utilization, participant knowledge assessment, and the introduction of locally derived waste materials as potential alternative feed resources. In addition, the activity incorporated practical demonstrations and pre-test/post-test evaluations to assess participants' short-term understanding of feed formulation concepts. Nevertheless, knowledge regarding feed formulation techniques and the application of circular economy principles among fish farmers remained limited. Therefore, this community service activity aimed to enhance the knowledge and technical understanding of POKDAKAN Kumis Jaya through training and demonstration activities on alternative feed formulation using local resources and the Pearson Square Method.

## **METHOD**

This community service activity was conducted on August 25, 2025, in Ujong Tanjong Village, Meureubo District, West Aceh Regency, Aceh, Indonesia. The activity involved 10 active members of POKDAKAN Kumis Jaya who were directly engaged in catfish farming activities. The program used an educational, participatory, and applicative approach. Participants were selected based on their active involvement in pond management and willingness to participate throughout the training session. The implementation stages consisted of:

### **1. Pre-test Evaluation**

Participants completed a pre-test consisting of 10 multiple-choice questions related to circular economy concepts, alternative feed ingredients, feed nutrition, and feed formulation.

### **2. Training and Discussion Session**

The training materials included: (1) introduction to circular economy principles in aquaculture; (2) nutritional requirements of catfish feed; (3) identification of local feed ingredients; and (4) feed formulation using the Pearson Square Method.

### 3. Practical Demonstration

Participants observed and practiced simple feed preparation procedures using locally available materials, including water hyacinth meal, poultry slaughter by-product flour, rice bran, and agricultural by-products. The demonstration included ingredient preparation, drying, grinding, mixing, and pellet formation processes.

### 4. Post-test Evaluation

The same set of questions used in the pre-test was administered after the training session to evaluate participants' short-term knowledge improvement.

Quantitative data were analyzed descriptively using percentage comparisons between pre-test and post-test scores. Qualitative information was obtained from field observations, participant discussions, and direct feedback during the training activities.

## RESULTS AND DISCUSSION

### 1. Participation and Engagement

All 10 invited members of POKDAKAN Kumis Jaya attended the activity, indicating strong participant involvement throughout the training session. Participants actively engaged in discussions, asked questions related to feed costs and raw material availability, and participated directly in feed formulation demonstrations. The training activity focused not only on theoretical understanding but also on practical application. Participants showed interest in the use of local materials such as water hyacinth and poultry slaughter by-products because these materials were relatively accessible in the surrounding environment.

### 2. Improvement of Knowledge and Skills

The effectiveness of the training activity was evaluated using pre-test and post-test assessments. The results indicated an increase in participants' understanding after the intervention. The average percentage of correct answers increased from 24.5% during the pre-test to 80.6% during the post-test, representing an average improvement of 56.1%. These findings suggest that the training activity contributed positively to participants' short-term understanding of alternative feed formulation and circular economy concepts. The highest item-level improvement (75%) was observed in questions related to alternative feed formulation, while the lowest increase (42%) occurred in questions regarding the integration of alternative and commercial feed.

**Table 1. Pre-test and Post-test Assessment Results**

No	Question	Percentage of Correct Answers Pretest (%)	Percentage of Correct Answers Posttest (%)	Increase (%)
1	What is meant by circular economy in the context of catfish farming?	15	85	70
2	What are the advantages of using alternative feed compared to commercial feed?	25	80	55
3	How does agricultural or household waste work in making catfish feed?	35	85	50
4	What is the optimal composition of alternative feed formulation for the growth and development of catfish?	10	85	75
5	Why is the implementation of a circular economy important in the production of alternative feed for catfish?	30	85	55
6	When is the best time to give alternative feed to catfish?	28	78	50

No	Question	Percentage of Correct Answers Pretest (%)	Percentage of Correct Answers Posttest (%)	Increase (%)
7	Can alternative feed be combined with commercial feed?	23	65	42
8	What types of local raw materials can be used to make alternative catfish feed?	25	70	45
9	What is the impact of using alternative feed on the environment?	26	81	55
10	Is the use of alternative feed for catfish safe for human health and the environment?	28	92	64
Average		24.5	80.6	56.1

The percentages presented in Table 1 were calculated based on the total number of correct responses across all question items and participants.

### 3. Implementation of Circular Economy

The implementation of circular economy principles in this activity was demonstrated through participants' ability to identify locally available resources that have potential as alternative feed ingredients. Based on discussion sessions and practical demonstrations, participants recognized water hyacinth, poultry slaughter by-products, rice bran, and agricultural residues as potential materials for catfish feed formulation. During the practical session, participants also observed and practiced simple processing stages, including drying, grinding, and mixing feed ingredients using the Pearson Square Method. However, the activity was limited to training and demonstration stages, and long-term utilization in daily farming practices requires further monitoring and evaluation.

This outcome reflects an improvement in participants' understanding of alternative feed formulation and the potential utilization of local resources in catfish farming. Through training sessions and practical demonstrations, participants were introduced to circular economy concepts by learning how locally available agricultural and organic waste may be used as potential feed ingredients. However, the present activity only evaluated short-term knowledge improvement through post-test assessment, and further follow-up observation is still required to determine the long-term adoption of these practices in daily farming activities.

**Table 2. Example of Alternative Feed Formulation Using the Pearson Square Method**

Ingredient	Crude Protein (%)	Proportion (%)
Poultry slaughter by-product flour	55	41
Rice bran	12	59
Expected crude protein	30	100

The formulation was calculated using the Pearson Square Method to obtain a target crude protein level of 30% for catfish feed. Poultry slaughter by-product flour was used as the high-protein source, while rice bran functioned as an energy and carbohydrate source. Participants practiced the calculation process during the demonstration session to improve their understanding of simple feed formulation techniques. The use of locally available materials as alternative feed ingredients has the potential to reduce feed expenditure, particularly by partially substituting commercial feed components. However, the present activity did not evaluate production costs or profitability changes quantitatively. Further economic analysis is required to determine the actual financial impact of alternative feed utilization.

#### **4. Impact on Community and Sustainability**

The utilization of locally available materials as alternative feed ingredients has the potential to reduce dependence on commercial feed and support more efficient resource utilization in small-scale aquaculture systems (Saba et al., 2023). Feed is recognized as the largest operational cost component in aquaculture production; therefore, the use of alternative local feed resources may potentially contribute to reducing production expenses and improving production efficiency in small-scale catfish farming (Hertika, 2024). Nevertheless, the present community service activity did not quantitatively assess feed replacement ratios, production costs, or profitability throughout a production cycle. Consequently, the economic impact of alternative feed application still requires further evaluation through long-term monitoring and financial analysis. Improved technical understanding was demonstrated through participants' ability to identify potential feed ingredients, recognize their nutritional functions, and perform simple feed formulation calculations using the Pearson Square Method. During the practical demonstration, participants practiced formulating feed with a target crude protein content of 30% by combining poultry slaughter by-product flour and rice bran, referring to the recommended protein requirements for grower-stage catfish feed reported in previous studies (Kapulaf and Tjiputev, 2024; FAO, 2024). The ability to utilize locally available resources may also help small-scale fish farmers reduce their dependence on commercial feed suppliers and improve resource accessibility under fluctuating market conditions (Efendi and Fahrudin, 2025). This training activity further introduced circular economy principles through the potential utilization of agricultural and organic waste as alternative feed resources in aquaculture systems.

#### **CONCLUSION**

The community service activity improved participants' short-term knowledge and technical understanding of alternative feed formulation and circular economy principles in catfish farming. Participants' average understanding increased from 24.5% in the pre-test to 80.6% in the post-test, with an average improvement of 56.1%. Participants were able to identify locally available feed ingredients and practice simple feed formulation using the Pearson Square Method with a target crude protein content of 30%. This activity also introduced the potential utilization of agricultural and organic waste as alternative feed resources in aquaculture systems. Further monitoring and evaluation are needed to examine the long-term adoption and economic impact of alternative feed utilization in catfish farming businesses.

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