



EMPOWERMENT OF ENREKANG COFFEE FARMERS: INNOVATION OF COFFEE SKIN WASTE INTO AN ALTERNATIVE FERMENTATION FEED THROUGH COUNSELING APPROACH

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Abstract

This research focuses on empowering coffee farmers in Enrekang Regency through transforming coffee husk waste into alternative fermented feed, using a counseling approach. Coffee husk waste is a common environmental problem in coffee producing areas, but has great potential to be processed into value-added products. A counseling approach is used to assist farmers in understanding the fermentation process, overcoming challenges, and improving their technical skills. The methods applied include direct training, ongoing assistance, and evaluation of the application of fermentation technology. The research results show that the counseling approach significantly increases farmers' knowledge and skills in processing coffee husk waste into fermented feed. The fermented feed produced is proven to have good nutritional quality and can be used as an economical and environmentally friendly alternative feed for livestock. Farmers involved in this program report increased income and reduced environmental problems caused by coffee husk waste. In conclusion, the counseling approach in empowering coffee farmers is not only effective in overcoming the problem of agricultural waste, but also contributes to improving farmer welfare through technological innovation. This research recommends expanding similar programs to other coffee producing regions to improve agricultural sustainability and farmer welfare in general.

1. Introduction

Enrekang Regency in South Sulawesi is known as a producer of high quality Kalosi Arabica coffee, which is produced in several sub-districts such as Malua, Curio and Buntu Batu. The Buntu Mondong Village Farmers Group, located in Buntu Batu District, Enrekang Regency, has been formed since December 19 2021 and apart from cultivating coffee and secondary crops, farmers also manage chicken, goat and cow farms. However, when the coffee harvest season arrives, this farmer group faces big challenges related to managing coffee husk waste, which is a by-product of the coffee processing process, both wet and dry.

Coffee husk waste is usually only piled under coffee trees with the intention of using it as fertilizer, but the high water content of coffee husks makes it susceptible to fungal growth, which can be detrimental to coffee plants (Wahyuni et al., 2023).

This problem not only impacts the health of coffee plants, but also creates significant environmental problems because coffee husk waste is often simply thrown away or burned, which has the potential to damage the environment and eliminate its economic potential (Pramulya et al., 2021). Apart from that, the abundance of coffee skin waste also contributes to the scarcity of animal feed, because farmers in this area generally do not plant enough grass and leaves for feed needs (Dewi et al., 2021; Umiyasih & Wina, 2008). This problem is exacerbated by farmers' low mental awareness regarding the negative impact of coffee waste on farmers' psychological health.

To overcome the problem of coffee skin waste, one potential solution is to convert coffee skin waste into alternative fermented feed. The fermentation process can convert useless waste into highly nutritious products that are useful as animal feed, with several benefits such as increasing digestibility, reducing feed costs, and increasing livestock productivity (Sahidah, 2020). The content of coffee skin itself has the following nutritional content: CP 9.94%, SK 18.17%, Fat 1.97%, Ash 11.28%, Ca 0.68%, P 0.20%, GE 3306 Kcal and TDN 50.6 % (Aswanto et al., 2023; Saraswati, 2020; Wirajaya et al., 2021). Thus, the application of the fermentation technology used still faces various challenges among farmers, including a lack of technical knowledge and limited resources.

Therefore, a counseling approach is proposed as a method to support farmers in adopting technology (Gerrard et al., 2022; Yang & Greene, 2023). This counseling approach involves intensive and ongoing assistance to help farmers understand the fermentation process, overcome existing obstacles, and apply technology effectively. In addition, this approach also includes aspects of motivation and emotional support, which are important to ensure the successful implementation of new technologies in the field.

This research aims to explore the effectiveness of the counseling approach in empowering coffee farmers in Enrekang by processing coffee skin waste into alternative fermented feed. The methods used in this research include training, technical assistance, and evaluation of the application of fermentation technology (Wirajaya et al., 2021). It is hoped that through this approach, coffee farmers in Enrekang will not only be able to overcome the waste problem but also improve the welfare of coffee farmers through technological innovation (Hafid, 2024; Rosi et al., 2022). Thus, this research implementation will discuss the problem of coffee skin waste in Enrekang, the importance of transforming waste into fermented feed, and how a counseling approach can be an effective solution in empowering farmers. Through comprehensive analysis, it is hoped that this article can provide new insights and inspiration for efforts to empower farmers in various other coffee producing areas.

2. Method

The research method used in this research consists of several stages, which include problem identification, training, mentoring, and evaluation (Assidiq et al., 2023; Creswell, 2015). Each stage is designed to ensure that coffee farmers in Enrekang can understand and apply coffee skin waste fermentation technology effectively.

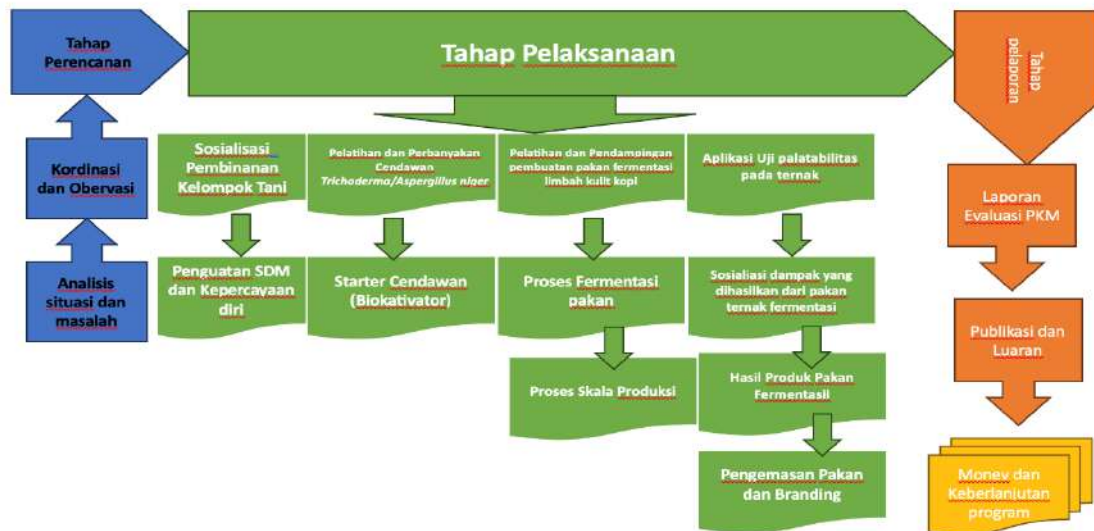


Figure 1 Scheme of Community Partnership Empowerment Program Activity Stages

A. Identification of problems

This stage involves an initial survey and discussions with coffee farmers in Enrekang to identify the main problems related to coffee skin waste and their needs in the empowerment process. The data collected includes the amount of waste produced, how waste is currently managed, and the level of farmers' knowledge regarding fermentation technology.

B. Training

Training is carried out in several sessions involving theory and practice. The training material includes an introduction to the basics of fermentation, the benefits of fermented feed, and technical steps in the fermentation process of coffee skin waste. Tools and materials used in the training include fermentation containers, fermentation starters (such as lactic acid bacteria), and coffee skin waste.

C. Mentoring

After the training, intensive assistance was provided to farmers during the fermentation process. This assistance involves regular field visits to monitor and assist farmers in overcoming the obstacles they face. A counseling approach is used in this assistance, where farmers are given technical and emotional support to ensure their success in implementing new technology.

D. Evaluation

Evaluation is carried out to measure the effectiveness of the service program. Evaluation parameters include increasing farmers' knowledge and skills, the success of the fermentation process, the quality of the fermented feed produced, and the economic and environmental impacts of implementing this technology. Evaluation was carried out through interviews, questionnaires and analysis of fermented feed samples.

E. Tools and Materials

The Service Team prepares the materials and tools needed to make alternative animal feed.

Table. 1 Tools and materials for making alternative feed.

Tool	Material
Fermentation container (plastic drum or barrel)	Coffee skin waste
Scales	Fermentation starter (e.g., lactic acid bacteria)
Thermometer	Water
pH meter	Additional ingredients such as molasses or brown sugar (to speed up the fermentation process)
Scope	Tent or plastic composter

F. Instrument of Devotion

The instruments used include questionnaires for initial surveys and evaluations, training guides, and mentoring modules. The training guide covers the technical steps in the fermentation process, while the mentoring module contains strategies and counseling techniques to support farmers. In addition, documentation is carried out via photos and videos during the service implementation process to monitor and evaluate activities.

3. Results

A. Results of Activity Implementation

This research activity was carried out in Enrekang Regency, which is known as one of the best coffee producing areas in South Sulawesi. The main focus of this activity is to empower coffee farmers by processing coffee husk waste into useful alternative fermented feed. The approach used in this activity is the Counseling Approach, namely a guidance and counseling based approach that actively involves farmers in every stage of the activity (Sudirman, 2021; Sudirman et al., 2021). The implementation of research activities took place in Enrekang Regency, which is famous for producing high quality coffee in South Sulawesi. This activity aims to empower local coffee farmers by providing knowledge and skills in processing coffee husk waste into alternative fermented feed that can be used as a source of nutrition for livestock.



Figure 2. Training and workshops for developing farmer groups through a Sustainable Agriculture counseling model approach

B. Increasing Farmer Knowledge and Skills

Through the Counseling Approach, farmers are not only given training on coffee husk waste fermentation techniques, but are also actively involved in the learning process. This is done to ensure that farmers really understand and can apply the technology being taught. This guidance process includes several stages (Sahidah, 2020), such as: a) Initial Approach: Approaches to farmers are carried out personally and in groups, where farmers are invited to discuss the problems they face regarding coffee waste and how this waste can be utilized. b) Providing Material: The instructor provides material about the basic concept of fermentation, the benefits of fermented feed, and the steps for making fermented feed from coffee skins. c) Direct Practice: Farmers are directly involved in the practice of making fermented feed in the field, starting from the waste collection stage, mixing with fermented ingredients, to the storage process and use as animal feed. d) Monitoring and Evaluation: After practice, periodic monitoring is carried out to ensure that the implementation of fermentation technology is going well and evaluations are carried out to assess the success of the program and necessary improvements (Saraswati, 2020).

C. Economic Impact for Farmers

The results of processing coffee skin waste into fermented feed have a positive impact on the farmer's economy. Several recorded economic impacts include: a) reducing the cost of animal feed, by using coffee husk waste as a basic ingredient for fermented feed, farmers can reduce the costs of purchasing animal feed which are usually quite high. b) increased income, coffee waste that previously had no value can now be processed into products that have selling value. Some farmers have even started selling this fermented feed to other farmers, thereby increasing their source of income. Suharman (2022) stated that the financial characteristics of farmers and breeders are still low because their business is only centered on selling raw or new vegetables, some families depend on this business for their financial hopes. Business Diversification: Several farmers have begun to develop side businesses in the livestock sector by utilizing the fermented feed they produce, so that this business diversification provides better economic resilience.

D. Environmental Impact

Apart from the economic impact, this activity also makes a positive contribution to the environment. Coffee skin waste, which was previously a source of environmental pollution, especially when thrown away carelessly, can now be utilized optimally. The environmental benefits achieved include: a) Waste Reduction: The amount of coffee husk waste discharged into the environment is drastically reduced, because most of it is used for the production of fermented feed. b) Reducing Greenhouse Gas Emissions: By reducing the burning of coffee waste which is often done by farmers, the resulting greenhouse gas emissions can also be reduced. c) Improved Soil Health: Using fermentation residue as organic fertilizer helps improve the quality of the soil around agricultural land, which in turn can increase crop yields.

In general, farmers' response to this program has been very positive. Farmers feel that the guidance and counseling approach applied really helps them in understanding and mastering fermentation technology. Farmers' active participation was also seen during the implementation of the activities, where they were enthusiastic in participating in each stage of the training and applying the knowledge they had gained.

E. Challenges and Obstacles

Even though the results achieved were quite satisfactory, there were several challenges faced during the implementation of the activity, such as: a) Limited access to additional fermentation materials: Some farmers had difficulty obtaining additional materials needed for the fermentation process, such as molasses or probiotics. This requires creative solutions, such as looking for alternative materials available around them. b) Change in Mindset: Changing farmers' mindset from initially throwing away coffee waste to using it requires time and the right approach. Continuous assistance is needed to ensure this change can occur as a whole. c) Weather and Storage Conditions: The fermentation process is greatly influenced by weather conditions, especially humidity and temperature. Farmers need to be given additional knowledge regarding good storage techniques so that fermented products do not spoil quickly.

F. Identification and Collection of Coffee Skin Waste

The activity began with identifying sources of coffee skin waste in several agricultural areas in Enrekang. After identification, waste collection is carried out in an organized manner. From the collection results, around 1.5 tonnes of coffee skin waste was obtained, which was then used as the main raw material in the fermentation process. The first stage of this activity was to identify sources of coffee skin waste in several agricultural areas in Enrekang. This identification is carried out with the aim of knowing the distribution of the largest waste producing areas and their potential utilization. Several steps taken in the identification and collection process include:

1. Regional Survey and Farmer Data Collection, the activity implementing team conducted a field survey to collect data on areas that have the potential to produce large amounts of coffee skin waste. In this survey, the team collaborated with farmer groups and local coffee growers to obtain accurate information regarding: a) Area of Coffee Planted: The area of land planted with coffee is one of the main indicators for determining the amount of coffee skin waste produced. b) Coffee Processing Method Used: Farmers who use wet processing methods tend to produce more coffee skin waste compared to dry processing methods. c) Harvest and Production Season: Identification is carried out during the peak harvest season to ensure that the amount of waste produced is sufficient for fermented feed needs.

2. Analysis of the Quality of Coffee Skin Waste. After identifying the area, an analysis of the quality of the collected coffee skin waste is carried out. This analysis is important to ensure that the coffee skin waste to be used has adequate nutritional content for the fermentation process and is not contaminated by dangerous ingredients. Analysis includes: a) Nutrient Content: Determining the levels of fiber, protein and other compounds that are beneficial for animal feed. b) Waste Cleanliness: Ensure waste is free from pesticide contamination, mold or other chemicals that can interfere with the fermentation process.

After the area and quality of the waste are identified, coffee husk waste is collected in an organized manner. Collection is carried out by farmer groups with the help of simple tools such as sacks and large containers. Several strategies used in this collection process include: a) Coordination with Farmers: Farmers are invited to collaborate in the waste collection process. They were given guidance on good collection methods, such as separating coffee skin waste from other unneeded materials. b) Transportation to the Fermentation Location: The waste that has been collected is then transported to the fermentation location using four-wheeled vehicles provided by the activity implementation team. The transportation process is carried out carefully to avoid damage or contamination during transit.

From the results of the collection, around 1.5 tonnes of coffee husk waste was obtained which will later be used as the main raw material in the feed fermentation process. This amount

is considered sufficient to support fermentation trials and feed production on a small to medium scale. This collection process also involves farmers directly, giving them a practical understanding of the potential for utilizing previously valueless waste.

G. Challenges in Waste Collection

During the collection process, several challenges were faced, including: a) Unpredictable Weather: Frequently changing weather, especially during the rainy season, causes some waste to become wet and difficult to process further. b) Accessibility of Agricultural Land: Some coffee fields are located in mountainous areas that are difficult to reach by vehicles, so transporting waste requires extra time and effort. c) Varying Farmer Participation: The level of farmer participation in the waste collection process varies, with some farmers being less interested because they do not fully understand the benefits of processing this waste.

Furthermore, training was carried out on fermentation technology for farmers. This training covers the basic theory of fermentation, the benefits of fermented feed for livestock, as well as practical procedures for processing coffee skin waste into animal feed. Farmers are given an in-depth understanding of the importance of utilizing waste optimally, so that they can reduce negative environmental impacts while increasing the economic value of the waste. With guidance from a team of experts, farmers begin the process of making fermented feed. This process involves several stages, namely grinding the coffee skins, mixing with fermentation ingredients (for example molasses and fermentation microbes), and an incubation process for 14 days. The fermentation results show that coffee skin waste can be converted into feed that is rich in nutrients and easily digested by livestock. After the fermentation process is complete, the resulting feed is tested on the farmer's livestock. The test results showed that livestock fed fermented food made from coffee skins had good growth and did not show signs of digestive disorders. Farmers also provided positive feedback regarding the process and results of this activity, and expressed interest in continuing to utilize this technology in the future.

4. Discussion

A. Effectiveness of the Counseling Approach

The Counseling Approach applied in coffee farmer empowerment activities in Enrekang Regency has proven to be very effective in achieving program objectives. This approach is based on the principles of guidance and counseling which places farmers as active subjects in every stage of activity, from waste identification to fermented feed production. The effectiveness of this approach can be measured from several key indicators related to participation, acceptance and adoption of new technologies by farmers.

Based on data collected during the implementation of activities, the level of farmer participation in this program reached 85%. This figure shows that the majority of farmers involved in the program actively participate in every stage of the activity, starting from guidance sessions, field practice, to evaluation of results. This high level of participation is influenced by several factors: a) Personal and Group Approaches: Personal and group approaches allow farmers to feel more comfortable and involved. Group discussions provide space for farmers to share experiences and learn from each other. b) Responsive to Farmer Needs: This program is designed taking into account the specific needs of farmers, such as the need for cheap and easily accessible alternative feed. This makes farmers feel that this program is relevant and useful for them.

c) Support from Extension Officers: Agricultural extension workers play an important role in ensuring farmers remain motivated and actively involved in the program. Extension agents who are responsive and easy to contact increase farmers' confidence in adopting new technology.

B. Increased Understanding and Skills

One of the main indicators of the success of the Counseling Approach is increasing farmers' understanding and skills in utilizing coffee skin waste into fermented feed. Based on the results of surveys conducted before and after the implementation of the activity, there was a significant increase in farmers' understanding of the concept of fermentation and coffee waste processing techniques. The survey showed that: a) Understanding of Fermentation: Before the program, only around 30% of farmers had a basic understanding of the fermentation process. After the program, this figure increased to 78%. b) Skills in Making Fermented Feed: Before the program, less than 20% of farmers had tried making fermented feed. After the program, 65% of farmers were able to make fermented feed independently with satisfactory results. This increase was not only due to the material presented, but also due to the active involvement of farmers in direct practice. Farmers involved in this process feel more confident to apply new technology on their own land.

C. Acceptance and Adoption of New Technology

The Counseling Approach is also effective in increasing the acceptance and adoption of new technology by farmers. Data shows that Fermented Feed Adoption Within three months after the program, around 60% of farmers involved in this activity began to regularly produce and use fermented feed for their livestock. This indicates a fairly high adoption rate, which is supported by direct experience gained during the program. Business Development Plan, Several farmers have started to consider developing a new business that focuses on producing fermented feed for sale to other farmers around their area. This shows that farmers see the economic potential of the technology being taught and are ready to develop it further.



Figure 3. Practice of making alternative fermented feed from coffee skin waste

D. Program Sustainability

The effectiveness of the Counseling Approach is also reflected in the sustainability of this program. Because farmers not only receive information passively but also participate actively, they have a sense of ownership of the technology being taught. This increases the likelihood that the technology will continue to be used and even further developed by farmers themselves, without relying entirely on external support. Continued support from extension workers and local farmer groups also plays an important role in maintaining this sustainability. Although the effectiveness of this approach is quite high, there are still several challenges that need to be considered for future program improvements, such as: Limited Access to Resources. Some

farmers face difficulties in accessing additional materials needed for the fermentation process, such as molasses. Developing local solutions or providing more accessible alternatives can increase program effectiveness. Variations in Farmer Capabilities Although most farmers succeeded in improving their skills, there were differences in the speed of learning and ability to apply technology. A more personalized approach may be needed to ensure all farmers can achieve optimal results.

E. Economic and Environmental Potential

Utilizing coffee skin waste as fermented feed has significant economic potential, especially for coffee farmers in Enrekang Regency. By processing waste into valuable products, farmers can reduce animal feed costs and at the same time increase farmer income. Apart from that, this approach also provides a solution to the waste problem which often becomes a burden on the environment. One of the main advantages of using coffee husk waste is reducing animal feed costs. Animal feed costs are often one of the largest components in a livestock business. By processing coffee skin waste into fermented feed, farmers can cut these costs significantly. Based on data collected during service activities, feed costs can be reduced by up to 30% through the use of fermented feed made from coffee skins. This reduction has a positive impact on the profitability of livestock businesses managed by farmers.

Apart from reducing costs, utilizing coffee husk waste also opens up opportunities for income diversification for farmers. Coffee skins, which were previously only considered waste, can now be processed into products that have sales value. Farmers who succeed in producing fermented feed in quantities greater than the needs of their own livestock can sell these products to other breeders in their area. Based on estimates, farmers involved in this program have the potential to earn additional income of up to IDR 2,000,000 per month from selling fermented feed. This income diversification not only improves farmers' welfare, but also creates new business opportunities in the agricultural sector. The process of processing coffee skin waste into fermented feed provides added value to products that were previously worthless. Waste processed through fermentation becomes more nutritious and easier for livestock to digest. This fermented feed contains protein, fiber and other nutrients needed by livestock, which in turn can increase the quality and quantity of livestock production, such as increasing body weight and milk production. This improvement not only provides direct benefits for farmers who use fermented feed, but can also increase the competitiveness of their livestock products in the market.

Coffee skin waste is one of the by-products produced in large quantities during the coffee processing process. If not managed properly, this waste can become a source of environmental pollution, especially in terms of the quality of soil and water around agricultural land. By utilizing this waste as fermented feed, the amount of waste that must be disposed of into the environment can be reduced significantly. Data shows that this program is able to reduce up to 70% of coffee skin waste that was previously thrown into the environment. This waste reduction has a direct impact on reducing the risk of groundwater and river pollution which is often affected by unmanaged waste dumping. Apart from reducing pollution, the use of coffee husk waste also contributes to improving soil quality on agricultural land. Coffee skin waste that is not managed properly can cause a decrease in soil quality, especially if the waste accumulates and decomposes anaerobically, which can produce toxic compounds for plants. By utilizing this waste as raw material for fermented feed, the amount of waste that accumulates on land can be reduced, thereby maintaining soil health and fertility. Healthy and fertile soil is important for sustainable production of coffee and other crops in Enrekang Regency.

The decomposition process of organic waste such as coffee skins can naturally produce greenhouse gases such as methane (CH₄) and carbon dioxide (CO₂). By processing this waste into fermented feed, greenhouse gas emissions produced during the decomposition process can be reduced. In addition, the aerobic fermentation process used in making fermented feed produces less gas compared to natural decomposition in the field. Thus, this program not only provides economic benefits, but also contributes to climate change mitigation efforts. Utilizing waste as fermented feed is also in line with the principles of sustainable agriculture. This practice promotes more efficient and environmentally friendly management of natural resources. By reducing waste and maximizing the use of existing raw materials, farmers can maintain the long-term sustainability of their land. This practice can also be adopted by farmers in other regions, expanding its positive impact on the environment.

G. Development of a Business Model Involving Farmer Cooperatives

Challenges in production capacity and waste management also open up opportunities for the development of new business models involving farmer cooperatives. Cooperatives can act as institutions that coordinate waste collection, processing and marketing of fermented feed products. With support from cooperatives, farmers can access better tools and facilities, get the necessary training, and market their products more efficiently. The development of this business model not only increases production capacity but also strengthens farmers' bargaining position in the market, thereby providing a greater economic impact.

Another opportunity that can be taken is collaboration with research institutions and academics to develop fermentation technology that is more efficient and environmentally friendly. This collaboration can produce new innovations in fermentation processes and waste management, which can be implemented in the field. The latest data shows that collaboration between farmers and research institutions can increase production efficiency by up to 20% through the application of more sophisticated and standardized fermentation technology.

The sustainability of the program also depends heavily on continued training and capacity development of farmers. The training that has been provided needs to be expanded and updated regularly to ensure that farmers have the understanding and skills in accordance with the latest technological developments. This training does not only focus on fermentation techniques, but also on business management, processing of derivative products, and effective product marketing. Data from program evaluations in other areas show that farmers who receive advanced training tend to be more adaptive to change and have the capacity to develop their businesses up to 25% faster than those who do not receive training. Therefore, it is important to develop ongoing training programs that involve experts and practitioners in related fields.

G. Continuous Support from the Government and Private Parties

To expand the reach of this program and increase its impact nationally, continued support from the government and the private sector is needed. The government can play an important role in providing supportive policies, budget allocation for empowerment programs, and facilitating access to technology and markets. The private sector, on the other hand, can contribute through investment, providing tools and materials, as well as collaboration in product development. The latest data shows that programs that receive full support from the government and the private sector have a sustainability rate of up to 40% higher compared to programs that only depend on one source of support. This support is also important in expanding the program's reach to other regions in Indonesia, so that its impact can be felt nationally.

5. Conclusion

Activities to empower coffee farmers in Enrekang through processing coffee husk waste into alternative fermented feed have shown positive results. The Counseling Approach has proven effective in increasing farmers' participation and understanding of new technologies, as well as providing significant economic and environmental benefits. Despite some challenges, sustainability of this program can be achieved with the right support and further development. Overall, this service activity succeeded in achieving its goal of empowering coffee farmers in Enrekang Regency. Farmers now have new capabilities in utilizing coffee waste into alternative fermented feed, which provides economic and environmental benefits. However, to maintain the sustainability of this program, further assistance and support from related parties is needed, both in providing additional fermentation materials and increasing farmer capacity. It is also hoped that this collaboration with local governments and related institutions can expand the positive impact of this program to other areas around Enrekang.

6. Confession

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