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Developing Farmers' Business in Utilizing Coffee Skin Waste In Turekisa Village Through Biochar Production, Implementation, And Marketing for Sustainable Value Added Increase

Igniosa Taus [1, a)], Victoria Ayu Puspita [2], Umbu Awang Hamakonda [1], Antonius Dolu [1], SR. Anastasia Bela Bili. PIJ [2]

[1]Agrotechnology Study Program, Flores Bajawa Agricultural College, NTT
[2]Agribusiness Animal Husbandry Study Programs, Flores Bajawa Agricultural College, NTT

[a)]Corresponding author: igitaus3@gmail.com

ABSTRACT

One of the specialty coffees produced in Indonesia is Flores Bajawa Arabica coffee, known as Flores coffee. Coffee, as the main commodity produced by farmers in Turekisa Village, has a low production level compared to other regions. The purpose of this activity is to implement GAP in plantation cultivation and technology for processing coffee skin agricultural waste into biochar as an effective and efficient program development activity in reducing poverty, providing direct benefits to farmer group partners, and opening up job opportunities for small and medium groups. This community service activity uses the Participatory Learning and Action (PLA) method, consisting of several stages of activities. namely the preparation stage of activities and coordination with partners, literature studies for the preparation of socialization materials, training and dissemination, the implementation stage of PKM activities (production, management, science and technology), the method of approach and application of technology and innovation (Analysis and design, socialization and training as well as the implementation and supervision stage). This program has succeeded in increasing the knowledge and technical skills of farmers in implementing organic coffee cultivation SOPs through the application of GAP and environmentally friendly Biochart processing by utilizing agricultural waste through the pyrolysis process. This program has also succeeded in developing the marketing capacity of the More Masi Group by equipping farmers with branding skills, attractive packaging design, and digital marketing strategies to expand market reach.

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INTRODUCTION

Coffee is one of the plantation commodities that plays a significant role in economic activities in Indonesia. Ngada Regency is one of the largest producers of Arabica coffee in East Nusa Tenggara. Recorded, Arabica coffee production in Ngada in 2019 was 2,230.8 tons with a productivity of 0.66 tons/ha, below the national average of 0.78 (BPS Ngada Regency, 2023). The location of the assisted partner (More Masi Group) is in Turekisa Village, which has most of the commodities cultivated, including secondary crops, vegetables, and plantation commodities. Generally, these agricultural activities have not utilized harvest waste in the form of organic products resulting from appropriate technology (biochar and bokashi). The More Masi Farmer Group is one of the farmer groups in Turekisa Village, as a fostered farmer group whose members are farmers in the Village. This farmer group is a partner that has been assisted previously in the 2024 community service activities, which focused on utilizing the potential of local coffee skin waste as an organic fertilizer. The problems experienced by farmers are that there are still many limitations including in the field of marketing the products produced such as determining the type of commodity cultivated, determining the market, determining business partners, determining commodity prices resulting in the quality of the formed farmer groups not being able to play a role as participatory village community assets, their development has not been significant in increasing the capacity of the community itself so that assistance is needed to become an independent group in an effort to improve the welfare of farmers. The purpose of this activity is in line with SDG'S 1: no poverty and SDG 8: decent work and economic growth. In addition, this program supports Key Performance Indicators (IKU) 1 and 2 and supports the 6th Asta Cita program. This program supports Key Performance Indicators (IKU) 1 and 2, where community service activities also involve students as technical assistants who will have learning experiences outside the campus, and can implement the knowledge learned on campus in the social field. This program supports the 6th Asta Cita program, where this activity is able to optimize local potential, namely sustainable coffee cultivation, enabling villages to become centers of community economic growth. Through the development and innovation provided, it can make independent villages able to reduce poverty significantly and realize prosperity. Farmer group partners and coffee skin waste that is thrown away on the land can be seen in Figure 1.

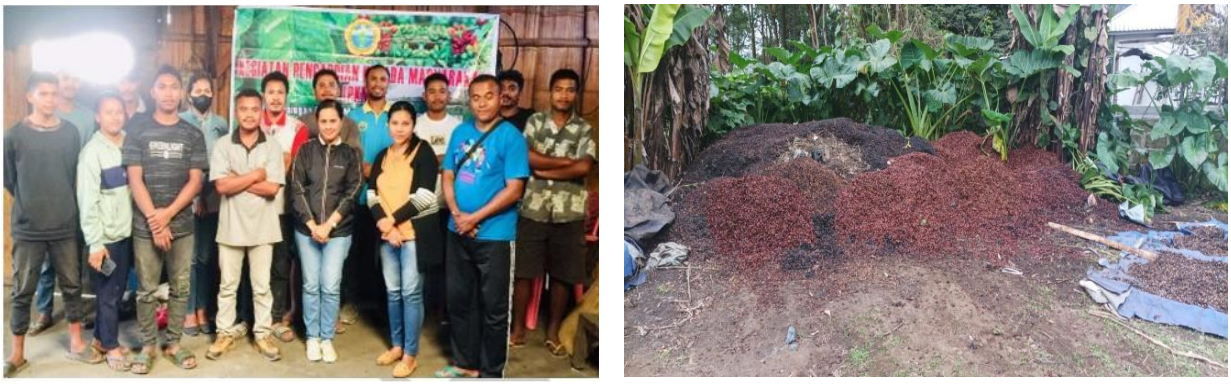

FIGURE 1. Farmer Group Partners

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PROBLEMS AND SOLUTIONS

Problems in the Production Sector

The problems of partners in the production sector are 1) not yet implementing GAP so that the production process has not been carried out in an environmentally friendly and sustainable manner by not utilizing the resulting biomass waste, including coffee skin, 2) The resulting coffee skin waste piles up on coffee plantations and in post-harvest processing areas. The solution to the problems experienced by farmer groups is the creation and assistance of farmers in implementing SOPs for organic coffee cultivation through the application of GAP, which has been arranged in the form of modules, as well as assistance in biochar production and implementation on plantation land.

Problems in the Field Of Science And Technology

The problems faced by partners in the field of science and technology are: 1) there is no dissemination of technology in the cultivation process and post-harvest handling, as well as the processing of coffee skin waste produced, and 2) minimal training and assistance in the application of science and technology by farmers. The solution to the problems experienced by farmer groups in the field of science and technology is the dissemination of technology to farmers, as well as training and assistance in the application of science and technology by farmers.

Problems in the Product Field

A key issue facing partners in the product sector is that coffee husk waste has not been properly managed to produce useful, value-added products. The solution to this problem is assistance in the production and marketing of biochar from coffee husk waste.

Problems in the HR Field

Partners' problems in this area include: 1) manual bookkeeping, sometimes incomplete, and 2) traditional partner group management with limited managerial skills and motivation. The solution to the problems faced by farmer groups is the creation of management standard operating procedures (SOPs) and guidance on improving the management capabilities of the Work Plan and Budget (RKA).

Problems in the Financial Sector

The problem faced by partners in the science and technology sector is that financial management and record-keeping are not yet optimal. The solution to this problem faced by farmer groups is assistance with financial administration using applications.

Problems in the Marketing Field

Partners' marketing challenges include: 1) the lack of commercialization of biochar produced from coffee husk waste; 2) marketing techniques not yet utilizing technologies available in today's modern markets. The solutions to the problems faced by farmer groups include marketing plan assistance, participation in local festivals, and the creation of business accounts on social media and an official website.

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METHOD

Community service activities using the Participatory Learning and Action (PLA) method emphasize the learning process, on the basis of community participation starting from planning, implementation, and evaluation, which is closely related to the community empowerment process (Dadan et al, 2020).

Stages Of Activity Preparation and Coordination with Partners

To analyze the situation in the field, discussions and FGDs are carried out, problem analysis, identification of potential according to the needs of partners and the community, and formulating solutions that will be included in the community service program, which includes targets and objectives, roles and responsibilities of the community service team and partners.

Literature Study for the Preparation of Socialization, Training, And Dissemination Materials.

The purpose of this stage is to gather information about research on biochar and coffee cultivation practices that comply with Good Agricultural Practices (GAP) to find the right technology and science to solve partner problems, as well as product and marketing innovations. A "training module" will be produced as a reference for various outreach and training activities in each activity that will be carried out within the community service program.

The Implementation Stage of PKM Activities Refers to Partner Problems, Namely:

Implementation In the Production Sector

- Preparation and assistance in the implementation of SOP for organic coffee cultivation referring to the Regulation of the Minister of Agriculture Number 49/Permentan/OT.140/4/2014 of 2014 concerning Technical Guidelines for Good Coffee Cultivation (Good Agriculture Practices/GAP on Coffee 2) providing pyrolysis equipment that produces biochar and packaging equipment, 3) socialization and assistance in biochar production and packaging 4) socialization and assistance in the implementation of biochar in accordance with the Indonesian national product standards (SNI) on farmer plantations.
- Implementation in the field of management
- Creation of SOPs and training on management implementation, 2) training to improve work plan and budget management capabilities.

Implementation In the Field of Science and Technology

Training in precision agricultural technology using a series of digital and portable measuring equipment to determine soil fertility parameters, drainage management in the field, and the implementation of biochar and organic fertilizer in the field. 2) Socialization and assistance in post-harvest handling of coffee using fermentation technology, drying using drying racks, and sorting using perforated plates.

Implementation of the Marketing Field

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Marketing plan training, 2) creation and assistance in managing social media business accounts, 4) creation of an official website and assistance in managing it.

Methods Of Approach and Application of Technology and Innovation

Analysis And Design

- SOP analysis and design consists of 1) production SOP, 2) SOP for production process, 3) SOP for implementing management. Management is carried out by the service team through SOP theories based on the Indonesian National Work Competency Standards (SKKNI).
- Market and network analysis using the FGD method.
- Analysis of marketing application systems available on the market was carried out by the service team in accounting records and recording in the application system.

Socialization, Training, And Mentoring

- Socialization is a process where a person internalizes concepts, values, ideas, or concepts from other people in a group or social institution so that participation (participation) in the group (Elias et al, 2020) is carried out directly through face-to-face meetings with farmers related to post-harvest handling of coffee using fermentation, drying, and sorting technology.
- Training is a systematic process to change the work behavior of an employee/group of employees in an effort to improve organizational performance (vinesh, 2014) carried out directly by the community service team, namely precision agricultural technology training using a series of digital and portable measuring equipment to determine soil fertility parameters, drainage management on land, implementation of biochar and organic fertilizer on land.
- Mentoring as a dynamic interaction between groups to face various challenges such as designing programs to improve economic life, solving social problems, establishing cooperation with other parties in accordance with the context of community empowerment (Vinesh, 2014) related to biochar production and packaging, mentoring to improve management capabilities for work plans and budgets, technical mentoring for marketing plans and operating official applications and websites.

Implementation And Supervision

Implementation and supervision are carried out by the community service team for all aspects of production, application of science and technology, management, and marketing to minimize technical obstacles offline with farmer partners.

Evaluation Of Program Implementation.

The evaluation was conducted so that the PKM team and partners could identify any obstacles encountered during the activity and identify possible solutions. Monitoring and implementation of the activity were conducted through questions and answers, discussions, and the distribution of questionnaires to partners (farmer groups) before and after the activity.

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RESULTS AND DISCUSSION

Turekisa Village is one of the coffee-producing centers located in West Golewa District, with a smallholder plantation area of 1,970.63 hectares and a total production of 676.37 tons (BPS Ngada Regency, 2025). Coffee is a major commodity in this village still has a low production level compared to other areas. Several factors contributing to the decline in coffee production include inadequate coffee plantation management and the lack of optimal cultivation techniques, including Good Agricultural Practices (GAP). Research by Sarvina (2020) states that coffee, as a commodity, has seen declining production due to several factors, including a lack of farmer attention to coffee plants, inadequate care for them, and the consequent inability to produce optimally.

Efforts to improve soil fertility through fertilization, soil conditioner application, and the use of superior varieties are crucial to support sustainable coffee production (Evrizal et al., 2020). Dependence on chemical fertilizers will have a negative impact in the future, leading to a decline in soil quality, both in terms of chemical, physical, and biological properties, which can reduce soil productivity (Prasetyo & Evrizal, 2021). Coffee husk waste, abundantly available in Turekisa village, is an alternative raw material for biochar production, which can improve soil fertility and address soil toxicity, stemming from exchangeable aluminum in acidic soils (Lehmann, 2019 & Joseph, 2009).

The community service activities carried out were in the form of socialization, training, and mentoring to assist farmer groups based on priority problems experienced by partners and conditions in the field that had been discussed through initial FGDs with partners involving community participation. Andreeyan & Rizal (2014) revealed that community participation is an activity of the community to be involved in the process of identifying problems and potentials that exist in the community, selecting and making decisions about solution options to address problems, implementing, and involving the community in the evaluation process. The implementation of this community service program shows a significant increase in biochart production capacity in the More Masi Farmers Group in Turekisa village. After participating in intensive training, farmers understand better coffee skin burning techniques and can choose the right raw materials before being processed using the pyrolysis method.

Initial planning activities through discussions with partners are shown in Figure 2.

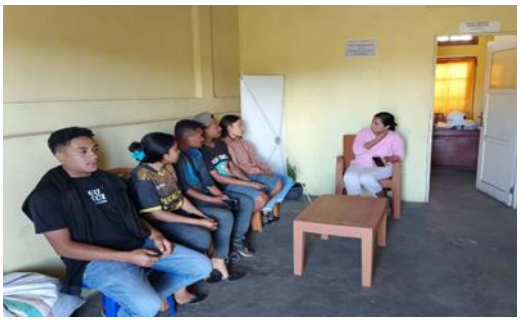

FIGURE 2. Joint Activity Planning Stage with Farmer Group Partners and PkM Activity Team

Stages of Activity Implementation

Socialization Activities

Community service activities are carried out through interactive discussions that open up perspectives and are able to provide more insight to farmer groups. Post-harvest coffee handling

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assistance is shown in Figure 3.

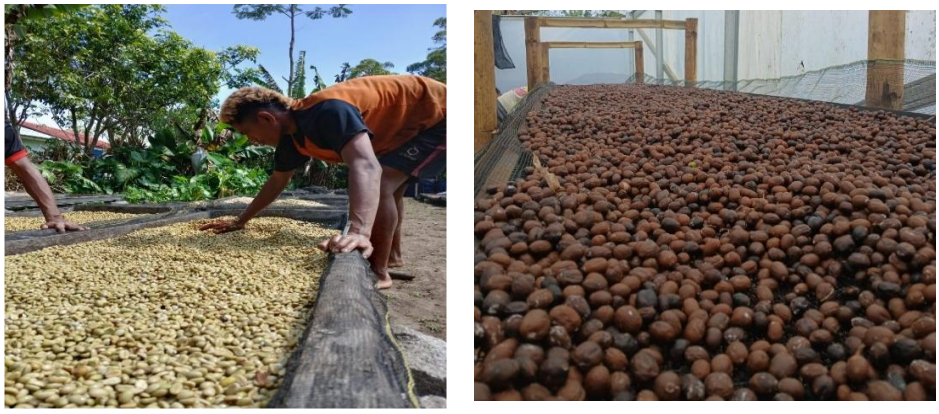

FIGURE 3. Post-Harvest Handling (Drying Coffee Using a Drying Rack)

Training Activities

Training activities conducted during the Community Service Program (PKM) included precision agricultural technology training using a series of digital and portable measuring instruments to determine soil fertility parameters, manage drainage on the land, and implement biochar and organic fertilizer on the land. Some of the activities carried out are shown in Figure 4.

Measurement of soil fertility parameters

Applying Biochart coffee skin to coffee plants

Application of liquid organic fertilizer to coffee plants

Making rorak around coffee plants

FIGURE 4. Training on the Application of Precision Agricultural Technology

Mentoring Activities

Some of the activities carried out include:

- Groups received assistance in improving their work plan and budget management skills, as well

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as technical assistance in marketing plans. Farmer group members gained new insights into developing effective work plans and detailed budgets, thereby enhancing their financial management and operational implementation capabilities, encompassing planning, organization, and control. Effective financial management, transaction recording, budget planning, and cash management strategies are crucial for Micro, Small, and Medium Enterprises (Prasetyo et al., 2020). The training resulted in farmer groups having the understanding and skills to effectively manage marketing and manage their business finances. Business owners were also able to monitor business development through systematic bookkeeping. This finding aligns with research by Taus et al (2024). which states that financial planning and management are control tools that can remind people to do what is best for their businesses. Work plan and budget management training is shown in Figure 5.

Delivery of material on work plan and budget management capabilities

Delivery of material on coffee cultivation practices in accordance with Good Agricultural Practices (GAP) and precision farming

Games to test the cohesiveness of partner group teams

Participants (partners) and Community Service Activity Team

FIGURE 5. Socialization of GAP, Precision Agriculture, and RKA

- The mentoring activity involved assisting in the production of biochart from coffee husk waste using a simple pyrolysis process, with the main product being biochart and a byproduct being liquid smoke. The resulting biochart was returned to the coffee farmers' fields. Biochar is an alternative soil conditioner that can absorb pollutants, increase nutrient content, and help balance soil pH. Meanwhile, the liquid smoke produced through the pyrolysis process has the potential to act as a biopesticide. effective in pest control (Ton et al, 2020) and as a sustainable and efficient solution in pest control, which is in line with the principles of sustainable agriculture (Erdiansyah et al, 2024). Assistance in biochar production can be seen in Figure 6.

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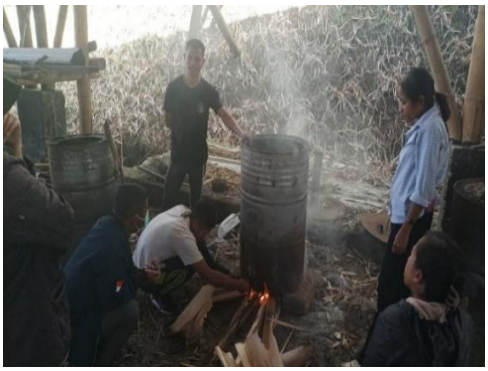
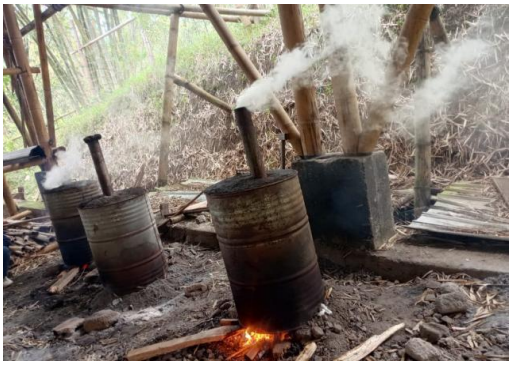
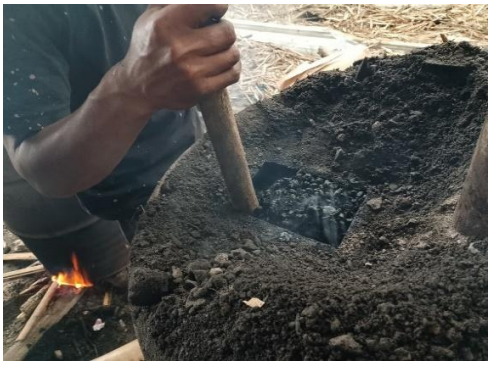
Initial presentation of biochart production materials



Technical assistance biochart combustion



Coffee skin roasting process



The result of burning coffee skin, which has become biochart

FIGURE 6. Biochart Production Assistance

Community service activities also involve students as technical assistants for the Agrotechnology and Agribusiness study programs, providing them with off-campus learning experiences and the opportunity to apply the knowledge they gain on campus in social and community settings. These PKM activities can serve as a competency-based approach to the students' expertise, thus providing them with a competitive advantage in securing decent employment. In addition to production aspects, this program also successfully developed the marketing capacity of the More Masi group by equipping farmers with branding skills, attractive packaging design, and digital marketing strategies to expand market reach. Overall, this program provides a strong foundation for the long-term sustainability and independence of farmer groups. The participation of farmer groups in every stage of the program ensures the implementation of relevant technology and innovation. It improves their skills and readiness to manage their businesses more professionally. With continued support from various parties, this program has great potential to become a model for empowering rural communities that is innovative, sustainable, and impactful. Mentoring in branding skills, attractive packaging design, and digital marketing strategies is shown in Figure 7.

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FIGURE 7. Mentoring branding skills, attractive packaging design, and digital marketing strategies

The program's success indicators were measured by the community service team, along with members of the farmer groups and village officials, directly at the PKM activity locations. Following the learning process with the farmers, the community service team monitored and evaluated conditions before and after the program's implementation.

CONCLUSION

This program has successfully improved farmers' technical knowledge and skills in implementing SOP for organic coffee cultivation through the application of GAP and environmentally friendly Biochart processing by utilizing agricultural waste through the pyrolysis process. This program has shown a significant positive impact on the efficiency of the production process and the quality of the resulting biochart. Improvements in both affective (knowledge), cognitive (attitude) and skills in utilizing harvest waste as a soil conditioner to increase crop production. This program has also succeeded in developing the marketing capacity of the More Masi Group by equipping farmers with branding skills, attractive packaging design, and digital marketing strategies to expand market reach.

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- PKM Activity Partner Farmer Group.

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