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Household Waste Management into Organic Fertilizer in Tangkas Village, Klungkung

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ABSTRACT

Tangkas Village, located in Klungkung District, Bali, holds significant potential for organic waste utilization through the activities of the Satwa Winangun Livestock Farmer Group. This group processes cow manure and household waste into organic fertilizer. Despite contributing to waste management and sustainable agriculture, several challenges remain, including suboptimal fertilizer quality, limited application of appropriate technologies, and issues related to packaging, marketing, and product certification. This study aims to (1) improve the quality of organic fertilizer derived from household waste and cow manure through technology transfer and the use of local materials, and (2) enhance the product's added value through business management assistance, marketing strategies, packaging improvements, and certification facilitation. The research outcomes are expected to contribute to increased agricultural productivity, more efficient waste management, and improved competitiveness of organic fertilizer products at both local and regional levels.

Contribution to Sustainable Development Goals (SDGs)
SDG 2 (Zero Hunger)
SDG 8 (Decent Work and Economic Growth)
SDG 12 (Responsible Consumption and Production)
SDG 13 (Climate Action).

1. INTRODUCTION

1.1. Background

Tangkas Village in Klungkung District, Bali, possesses substantial potential in agriculture and livestock, particularly through the activities of the Satwa Winangun Livestock Farmer Group, which focuses on breeding Bali cattle and producing organic fertilizers. The group utilises cow manure—amounting to thousands of kilograms daily—and organic household waste to produce organic fertiliser. These efforts align with the local government's waste management program based on the Local Waste Processing Site initiative.

The group's main product is a certified organic fertilizer branded "Lemeksari," formulated from a mixture of household waste, cow manure, cocopeat, biochar, dolomite, and microbial activators. This fertilizer has proven effective in improving soil quality and supporting sustainable agriculture. However, several obstacles persist, such as suboptimal fertilizer quality, inefficient waste management, limited raw materials, and minimal application of appropriate technologies. On the downstream side, challenges include unattractive packaging, limited marketing strategies, narrow market access, and insufficient understanding of licensing and product certification.

Organic waste management is a global challenge, as most solid waste originates from human activities (2, 3). When properly managed, organic waste can provide significant environmental and agricultural benefits (4, 5) and even contribute to increased crop yields (6). Trends indicate a growing use of organic fertilizers, while dependence on chemical fertilizers is declining due to their adverse effects on soil ecosystems (7). Organic fertilisers have been shown to enhance the physical, chemical, and biological properties of soil (10–14), whereas excessive use of chemical fertilisers can lead to nutrient imbalances and soil degradation (15, 16).

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Amid the rising volume of household waste (17), the conversion of organic waste into fertilizer has expanded across various regions (18, 19), demonstrating its ability to enhance soil fertility and quality (20, 21). Nevertheless, integrating organic waste management into sustainable agriculture still faces technical and managerial challenges, necessitating further research and cross-sector collaboration (22).

Based on these conditions, the research problems can be formulated as follows: (1) how to improve the quality of organic fertilizer derived from household waste using appropriate technology, and (2) how to strengthen the added value and marketing of organic fertilizer products to enhance competitiveness.

1.2. Objective

The objectives of this study are: (1) to conduct technology transfer aimed at improving the quality of organic fertilizer based on household waste and cow manure through the use of local materials and appropriate technologies, and (2) to assist in business management and marketing strategies, including packaging improvements, product certification, and market access expansion.

2. Methodology

The Community Service Program (PkM) was conducted in the Satwa Winangun Livestock Farmer Group, located in Tangkas Village, Klungkung District, Bali. The method employed was systematic and participatory, leveraging local potential and emphasizing community needs (23). The process spanned from proposal approval to final evaluation, involving active participation from all group members.

The initial stage involved socialization through group meetings to identify partner needs, understand issues related to household and ceremonial organic waste management, and build mutual understanding and commitment. This was followed by technical and managerial training. Technical training focused on organic fertilizer production using appropriate technologies based on local materials—biochar, cocopeat, and EM4 microbial activators—alongside field practice (24, 25). Managerial training covered packaging design for the "Lemeksari" product, digital marketing strategies, and licensing and certification processes (26, 27).

During the implementation phase, a solid composting technology using modified plastic drums was applied to accelerate decomposition and improve fertilizer quality. This approach was selected for its simplicity and suitability to the partner group's capacity (28). The implementation team provided intensive mentoring to ensure participants could master the skills independently. Monitoring and evaluation were conducted periodically, using indicators such as production volume, fertilizer quality, and group participation (29, 30).

To ensure sustainability, a business development strategy was designed, encompassing capacity building, marketing network expansion, and partnerships with government agencies, NGOs, and the private sector. The activity agenda was divided into three main areas—production, business management, and marketing—with the implementation team assigned according to their respective expertise to ensure effective and sustainable execution (22, 23).

3. RESULT AND DISCUSSION

The Community Service Program (PkM) in the Satwa Winangun Livestock Farmer Group, Tangkas Village, was carried out in stages—from socialization and training to technology implementation and evaluation. The process was designed using a participatory approach to align with local needs and village resource potential. Socialization began with identifying partner needs and key challenges, particularly the management of household and ceremonial organic waste. A needs-based approach has proven more effective in fostering shared commitment between the implementation team and community partners (30).

All of these stages are visualized in a flowchart shown in Figure 1, making it easier for participants to understand the program's sequence. The diagram illustrates the systematic relationship between the stages of socialization, training, technology implementation, mentoring, and strategies for program sustainability.

Figure 1. PKM Flowchart

Training was divided into technical and managerial components. Technical training included organic fertiliser production using appropriate technologies and local raw materials (Figure 2), such as biochar from burned rice husks, cocopeat from coconut coir dust, and EM4 microbial activators. A simple composting method using plastic drums was employed due to its compatibility with the group's capacity and its proven effectiveness in improving fertilizer quality (31).

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Figure 2. Organic Fertilizer Raw Materials

Figure 3. Organic Fertilizer Production Process

This activity not only enhanced the community's technical skills but also strengthened environmental awareness and opened new economic opportunities through eco-friendly products. Figures 3 and 4 show participants enthusiastically engaging in training and hands-on organic fertilizer production using waste materials.

Figure 4. Organic Fertilizer Training Session

Meanwhile, managerial training focused on developing packaging design for the "Lemeksari" product, digital marketing strategies, and product licensing procedures. This combined approach to production and business management aligns with findings by Sari & Handayani (32), who emphasize the importance of packaging innovation and digital marketing in enhancing the competitiveness of local products.

In the technology implementation and evaluation phase, the solid composting system was chosen over vermicomposting or anaerobic processing due to its adaptability and ease of application for the group. Intensive mentoring ensured skill improvement among participants, while monitoring assessed program effectiveness through indicators such as production volume, fertiliser quality, and active participation rates. The mentoring outcomes showed an increase in group capacity for managing organic waste and producing value-added fertiliser. This aligns with research by Iqbal et al. (33), which confirms that combining local organic materials with simple composting techniques can sustainably improve soil fertility.

The sustainability strategy was developed by promoting strategic partnerships with government agencies, NGOs, and the private sector, as recommended by Chaudhry & Malik (34) in their study on sustainable waste management in developing countries.

The community service activity entitled "Managing Household Waste into Organic Fertilizer in Tangkas Village, Klungkung" provides a strategic contribution to the achievement of the Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption and Production), SDG 2 (Zero Hunger), and SDG 11 (Sustainable Cities and Communities). By prioritizing the use of appropriate technology in managing household organic waste, the program promotes more responsible consumption and production patterns at the community level. The resulting organic fertilizer supports sustainable agricultural practices, enhances soil fertility, and contributes to local food security. Furthermore, the active involvement of community members in training and technical assistance strengthens local capacity in environmental management, aligning with the principles of inclusive and resilient settlement development. This initiative showcases the synergy between local innovation, ecological education, and participatory empowerment, providing a replicable model for village-based development that is rooted in local resources and community engagement.

4. CONCLUSION

The Community Service Program (PkM) in Tangkas Village successfully integrated simple composting technology with a participatory approach, resulting in a locally driven innovation with economic value in organic fertilizer production. The program's success was supported by the synergy of appropriate technology, educational media, and digital marketing strategies tailored to community needs. To ensure sustainability, continued technical assistance, product diversification utilizing household waste, livestock manure, biochar, and cocopit, along with institutional support for certification and market expansion, are essential. Strategically, this initiative contributes to achieving the Sustainable Development Goals (SDGs), particularly SDG 12 by promoting waste reduction and resource efficiency, SDG 2 through enhanced soil fertility and sustainable agricultural practices, and SDG 11 by strengthening community capacity in environmental management. The model demonstrates strong potential for replication in other rural contexts, offering an adaptive and inclusive approach to community empowerment through science and technology.

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